



MANDALONG SOUTHERN EXTENSION PROJECT

RESPONSE TO RTS SUBMISSIONS

JULY 2014



Centennial Coal

Mandalong Southern Extension Project

Response to RTS Report

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ABBREVIATIONS

BSAL	Biophysical Strategic Agricultural Land
DGRs	Director General's Requirements
DgS	Ditton Geotechnical Services Pty Ltd
DP&I	Department of Planning and Infrastructure
EC	Electrical Conductivity
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EL	Exploration Licence
EPA	Environment Protection Authority
EP&A Act	NSW Environmental Planning & Assessment Act 1979
GDE	Groundwater Dependent Ecosystem
LGA	Local Government Area
LMCC	Lake Macquarie City Council
MMAS	Mandalong Mine Access Site
MSSS	Mandalong South Surface Site
NOW	NSW Office of Water
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
OASFS	NSW Office of Agricultural Sustainability and Food Security
P&E	NSW Planning & Environment
POEO Act	NSW Protection of the Environment Operations Act 1997
Project, the	Mandalong Southern Extension Project
ROM	Run of Mine
RTS	Response to Submissions
TARP	Trigger Action Response Plan
WSC	Wyong Shire Council

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1.0 INTRODUCTION

Mandalong Mine is an existing underground coal mine operation located in the Lake Macquarie Local Government Area (LGA) approximately 130 kilometres north of Sydney and 35 kilometres south-west of Newcastle near Morisset in New South Wales (NSW).

The currently approved Mandalong Mine comprises the underground workings and surface infrastructure of the:

- Mandalong Mine, including the Mandalong Mine Access Site (MMAS), encompassing the underground workings and associated surface infrastructure near Morisset; and
- Cooranbong Entry Site encompassing a coal delivery system and surface infrastructure (coal handling and processing) near Dora Creek.

Underground longwall mining operations commenced at Mandalong Mine in January 2005. Since this time, Centennial Mandalong has extracted up to 6 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal from the West Wallarah Seam utilising a combination of longwall and continuous mining methods.

In September 2013, an Environmental Impact Statement (EIS) was submitted to the NSW Department of Planning and Infrastructure (DP&I) (now NSW Planning and Environment (P&E)) for the Mandalong Southern Extension Project. The Mandalong Southern Extension Project proposes to extend Mandalong Mine's existing underground mining operations into the area within EL 6317 in order to access, develop and extract additional coal reserves. The objectives of the Project include:

- Developing the on-going underground mining operations with a focus on maximising resource recovery and maintaining continuity of coal production beyond the currently projected life of mine;
- Maximising the use of existing underground and surface infrastructure and equipment;
- Securing increased employment and socio-economic flow-on benefits; and
- Continuing to conduct mining at Mandalong Mine in an environmentally responsible manner to ensure the potential for impact is minimised.

In March 2014, a Response to Submission (RTS) report was submitted to DP&I responding to issues raised in submissions received from various community individuals, special interest groups and government agencies following the public exhibition of the EIS.

1.1 Scope

This report considers the matters raised in submissions received by P&E following the distribution of the RTS report to various government agencies. This report builds on information presented in the EIS and RTS report and is to be read in conjunction with those documents.

2.0 SUBMISSIONS

Following the distribution of the RTS to various government agencies, nine submissions were received. Of the nine submissions received:

- Seven agencies raised concerns or proposed recommendations for the Mandalong Southern Extension Project.
- Two agencies had no further issues regarding the Mandalong Southern Extension Project.

As a result of the submissions received, additional commitments have been made by Centennial Mandalong and included in a revised Statement of Commitments provided in **Section 5.0** of this Response to RTS report.

2.1 Summary of Submissions

A summary of the issues raised by the government agencies is provided in **Table 1**. Detailed responses to each of the issues raised are provided in **Section 3.0**.

Table 1 - Summary of Government Agency Submissions

Raised By	Summary of Issue
Office of Environment and Heritage (OEH)	Given that floristic data provided by the proponent supports at least some patches as being River Flat Eucalypt Forest on Coastal Floodplains EEC then OEH recommends monitoring of vegetation condition before and after mining and, if required offsetting if mine operations cause harm to this EEC.
	OEH recommend the proponent must monitor the floristic composition and structure (as per Siversten, 2010) of at least five (5) mapped occurrences of 'Tall Alluvial Moist Forest' from Bell and Driscoll (2010) above longwall panels 25, 26, 27, 40, 41, 42, 43, 55, 56, 57, 59, 60 and 64 at least on an annual basis starting at least two years before undermining by longwall mining and continuing at least five years after active longwall mining within 200 metres has passed. OEH considers this mapped vegetation to be River Flat Eucalypt Forest on Coastal Floodplains EEC.
	OEH still has concerns about the risk of threatened amphibian habitat and ground water dependent (GDE) EEC vegetation from mine subsidence associated with the project and recommends that the proponent implement an appropriate monitoring programme in sensitive environments before, during and after longwall mining, and that any harm to threatened biodiversity caused by mine subsidence is appropriately offset.
	OEH is still not satisfied with the quality of subsidence monitoring data provided for the existing Mandalong Mine, and is aware of a number of mine subsidence impacts. OEH also has concerns that seemingly small surface cracks may have large impacts in draining groundwater tables in overlying alluvium that supports GDE EECs, and that such cracks are both difficult to detect and almost impossible to remediate.

Raised By	Summary of Issue
Office of Environment and Heritage (OEH)	OEH recommends that the proponent monitors groundwater levels before, during and after mining in all areas that support GDE EECs. Where levels of groundwater drop with the passage of mining the proponent must apply adaptive management to ensure that no harm occurs to threatened biodiversity. In the event that such harm does occur then it must be offset in accordance with OEH biodiversity offset policy (OEH, 2014).
	The proponent must adequately monitor groundwater levels in areas that support groundwater dependent ecosystems before, during and after undermining by longwall panels at least on an annual basis.
	The faulting issue and its potential interaction with subsidence over the Southern Extension remains unresolved because of the lack of detailed discussion on faults contained in the EIS (or RTS). OEH would appreciate more explanation on 'seam rolls'. OEH recommends that the proponent establishes a robust network of regular subsidence monitoring that will feed into adaptive management, particularly where GDE EEC vegetation is undermined.
	OEH is not reassured by the HydroAlgorithms (2014) review concerning the adequacy of the groundwater model for assessing potential impacts to or recovery of groundwater aquifers.
	OEH continues to have concerns with the use of the un-calibrated and un-validated hydrodynamic model to assess mining impacts to stream flow. OEH recommends that the proponent collects robust and quantifiable stream flow data from third order and larger streams above the mine project ahead of mining in order to assess whether the mine indeed has had a negligible impact on local streams and alluvial aquifers in the Study Area.
	OEH recommends that mine make water is appropriately treated to meet ANZECC (2000) guidelines before release into the Muddy Creek catchment and that the proponent effectively monitor water quality and local biodiversity in this catchment.
	The proponent must monitor the floristic composition and structure (as per Siversten, 2010) of at least five (5) sites in the Muddy Lake catchment that must sample Swamp Oak Sedge Forest, Coastal Saltmarsh and coastal freshwater wetlands downstream of LDP001. Such monitoring must be done on an annual basis.
	Current mine water fish toxicity testing appears inadequate in scale and timeframe.
	The RTS does not appropriately discuss the recent studies on the toxicity of bicarbonate to aquatic fauna.
	OEH notes that Nickel is not currently included in the EPL for LDP001 and so the Proponent is actually not licensed to discharge

Raised By	Summary of Issue
Office of Environment and Heritage (OEH)	Nickel concentrations of the magnitude recorded in the effluent.
	That the proponent must freely provide its monitoring data collected on its webpage or, upon a written request on a CD, within six (6) months of the data being collected.
	With an increased discharge to 7.1 ML/day this represents an increased load of contaminants (salt, sulphate, nitrogen, phosphorus, boron, iron and barium) to the receiving environment. OEH believes that some form of treatment is required to reduce the salt and contaminant load to the receiving environment.
	OEH notes that the RTS states that the peak groundwater inflows into the Cooranbong and Mandalong workings may reach up to 5.9 ML/day. However, OEH also notes that models 1 and 10 (Figure 3 GHD (2014)) suggests that under these scenarios groundwater inflows could go as high as 7-10 ML/day. Therefore greater volumes of mine water may be discharged from LDP001 than were considered by the proponent.
	Inadequate explanation of subsidence levels over longwal1 panel 5 of the current mine in relation to subsidence predictions and scant details on the borehole extensometer results in the middle of Mandalong Mine's LW5 to monitor heights of sub-surface fracturing due to the caving or goafing process during mining.
	OEH recommend that the proponent must continue to consult with and involve all the registered local Aboriginal representatives for the project, in the ongoing management of the Aboriginal cultural heritage values. Evidence of this consultation must be collated and provided to the consent authority upon request.
	In the event that ground disturbance identifies a new Aboriginal objects within the project area, all works must halt in the in the immediate area to prevent any further impacts to the object(s). A suitably qualified cultural heritage specialist and representatives of the local Aboriginal community must be contacted to determine the nature, extent, scale and significance of the finds. The site is to be registered in the Aboriginal Heritage Information Management System (AHIMS) (managed by OEH) and the management outcome for the site included in the information provided to the AHIMS. The proponent will consult with representatives of the local Aboriginal community, and the cultural specialist to develop and implement and appropriate management strategies for all objects/sites. Any management strategy development must also comply with the appropriate legislative provisions.
	If human remains are located in the event that surface disturbance occurs, all works must halt in the immediate area to prevent any further impacts to the remains. The NSW Police are to be contacted immediately. No action is to be undertaken until the NSW Police provide written notification to the proponent. If the skeletal remains are identified as Aboriginal, the proponent must contact OEH's Environment Line on 131 555 and representatives of the

Raised By	Summary of Issue
Office of Environment and Heritage (OEH)	local Aboriginal community. No works are to continue until OEH provides written notification to the proponent. An Aboriginal Cultural Heritage Education Induction Program must be developed as a component of the Land Disturbance Protocol for the induction of all personnel and contractors involved in the construction activities on site. Records are to be kept of which staff/contractors were inducted and when for the duration of the project. The program should be developed and implemented in collaboration with the registered Aboriginal parties.
Lake Macquarie City Council (LMCC)	Lake Macquarie City Council (LMCC) recommend that the Stakeholder Engagement Strategy is updated prior to the project receiving approval, and endorsed as part of the approval process, in order to provide certainty as to how this ongoing consultation with the community will occur. The planning agreement should be developed prior to development consent and included in the SoC, in order to provide certainty regarding what will be provided by the proponent for the local communities. Given that the proponent is aware that sensitive receptors will likely be exposed to PM2.5 pollution (as modelled), greater than the advisory goal/ health risk assessment level, Council considers that the proponent should address and resolve this exceedance prior to the granting of Project Approval.
NSW Office of Water (NOW)	Appendix C of the exhibited EIS Groundwater Impact Assessment has presented a significant number of bores with either widely ranging EC values (varies from very fresh to 20,000 $\mu\text{S}/\text{cm}$) or long term rising EC trends (rises from 100 $\mu\text{S}/\text{cm}$ in 1997 to around 2,000 - 5,000 $\mu\text{S}/\text{cm}$ in 2012). These are the changes noted over the period of development consent DA 97/800 for the Mandalong Mine. The proponent simplifying their response to 'natural variation' is considered inadequate. It is recommended the proponent provides a supplementary report prior to commencement of activities to review the drivers for groundwater quality trends being observed in the monitoring bore network. The report is to assess whether such trends pose a risk of exceeding the Aquifer Interference Policy Level 1 impact for a "water quality change of 1% per activity in long-term average salinity in a highly connected surface water source at the nearest point to the activity". To improve the understanding for the rising trends and fluctuating salinity observations, the report should include discussion on field techniques, quality assurance, instrument calibration and bore design.

Raised By	Summary of Issue
Office of Agricultural Sustainability & Food Security (OASFS)	The proponent has stated that a soil survey scale of 1:100 000 is adequate despite being requested to provide a 1 :25 000 soil survey on two soil landscapes (Doyalson and Yarramalong) totalling 157 ha of land at the adequacy stage. The proponent has stated that the 1:25 000 soil survey requirements are only required for Biophysical Strategic Agricultural Land (BSAL) verification which is not being asked for here. However, the Agricultural Impact Statement Technical Notes (available at http://www.dp.nsw.gov.au/data/assets/pdf/0010/463789/AgriculturalImpactStatement-technical-notes.pdf) clearly state "the project disturbance area should be sampled at a minimum scale of 1:25000." NSW DPI maintains that there is still insufficient soil information to make a decision, particularly in the light of a small amount of mapped BSAL being present on the disturbance area. OAS&FS was not able to assess the Proponent's 'review of property prices in the area' as no details were provided. OAS&FS recommends that a consent condition includes a report on the land values within 5km of the Project boundary to be updated every 5 years.
Wyong Shire Council	It is Council's view that the subsidence impacts on the leachate collection and gas management systems have not been adequately addressed. It appears that no allowance has been made for surface loadings from the landfill estimated at 12 million cubic metres. It would be appreciated if greater certainty could be provided to Council that the Buttonderry Waste Management Facility, Council's only operating landfill facility, will not be impacted upon by the proposed project and that the proposed future surface loads to be generated by the facility are incorporated into any assessments.
Office of the NSW Small Business Commissioner	Found the RTS unhelpful and reiterate the concerns of the office for the environmentally sensitive business that may be seriously affected.

3.0 RESPONSE TO RTS REPORT

3.1 Office of Environment and Heritage

Given that floristic data provided by the proponent supports at least some patches as being 'River Flat Eucalypt Forest on Coastal Floodplains EEC' then OEH recommends monitoring of vegetation condition before and after mining and, if required offsetting if mine operations cause harm to this EEC.

OEH recommend the proponent must monitor the floristic composition and structure (as per Siversten, 2010) of at least five (5) mapped occurrences of 'Tall Alluvial Moist Forest' from Bell and Driscoll (2010) above longwall panels 25, 26, 27, 40, 41, 42, 43, 55, 56, 57, 59, 60 and 64 at least on an annual basis starting at least two years before undermining by longwall mining and continuing at least five years after active longwall mining within 200 metres has passed. OEH considers this mapped vegetation to be 'River Flat Eucalypt Forest on Coastal Floodplains EEC'.

Centennial Mandalong will implement a vegetation condition monitoring programme before and after mining in sensitive environments (which will include floodplains and groundwater dependant ecosystems). This commitment has been included in the revised Statement of Commitments contained in Section 5.0 of the RTS Report.

Vegetation condition monitoring will be undertaken with a combination of remote sensing data collection and ground truthing. Ground truthing will be undertaken to confirm any potential impacts identified in the remote sensing stage. This has the added benefit of minimising the creation of tracks for monitoring purposes that are then used by 4WD and motorbike enthusiasts.

Vegetation monitoring over a particular longwall panel will continue for a period of two years before and two years after completion of mining of the subsequent longwall panel.

Centennial Mandalong will develop the Flora and Fauna Management Plan including TARPs in consultation with OEH.

Strategies for monitoring vegetation condition will be detailed in the Flora and Fauna Management Plan.

Should impacts above those identified in the EIS be identified, appropriate management actions will be implemented in consultation with landowners and relevant government agencies.

OEH still has concerns about the risk of threatened amphibian habitat and ground water dependent (GDE) EEC vegetation from mine subsidence associated with the project and recommends that the proponent implement an appropriate monitoring programme in sensitive environments before, during and after longwall mining, and that any harm to threatened biodiversity caused by mine subsidence is appropriately offset.

Centennial Mandalong has committed to developing a Flora and Fauna Management Plan that will incorporate the existing Wetland Management Plan. This commitment has been included in the Statement of Commitments provided in Section 5.0 of the RTS Report. The existing Wetland Management Plan includes amphibian fauna habitat.

Mandalong Mine currently monitors eight wetlands, three control sites outside of potential subsidence impact, and five within the subsidence zone. Monitoring at each wetland consists of collecting floristic content and abundance along a single transect that starts on dry ground and extends out into the wetland proper. Also, at each monitoring occasion, water samples are collected and analysed for levels

of nutrients, suspended solids, salinity, pH and dissolved oxygen. The latest monitoring report has been attached in **Appendix 1**.

Centennial Mandalong will install additional groundwater monitoring bores within areas of groundwater dependant ecosystems. This commitment has been included in the Statement of Commitments provided in Section 5.0 of the RTS Report.

Groundwater monitoring will be undertaken 2 years prior to, during and for 2 years following completion of mining in the adjacent longwall panel.

Should impacts above those identified in the EIS be identified, appropriate management actions included in a TARP will be implemented in consultation with landowners and relevant government agencies.

OEH is still not satisfied with the quality of subsidence monitoring data provided for the existing Mandalong Mine, and is aware of a number of mine subsidence impacts at Mandalong, Awaba and Newstan collieries (i.e. ponding; fractures in roads and rock dams; plug failure; declines in groundwater aquifers). OEH also has concerns that seemingly small surface cracks may have large impacts in draining groundwater tables in overlying alluvium that supports GDE EECs, and that such cracks are both difficult to detect and almost impossible to remediate.

OEH recommends that the proponent monitors groundwater levels before, during and after mining in all areas that support GDE EECs. Where levels of groundwater drop with the passage of mining the proponent must apply adaptive management to ensure that no harm occurs to threatened biodiversity. In the event that such harm does occur then it must be offset in accordance with OEH biodiversity offset policy (OEH, 2014).

The proponent must adequately monitor groundwater levels in areas that support groundwater dependent ecosystems before, during and after undermining by longwall panels at least on an annual basis.

Each year Centennial Mandalong provides a copy of the Annual Environmental Management Report to the OEH. These reports detail subsidence, groundwater and ecology monitoring and results.

Longwall mining at Mandalong Mine from January 2005 to date has demonstrated that mining can be carried out with no impacts to alluvial groundwater aquifers. The longwall widths at the start of the mine have been minimised to reduce surface impacts as described in section 3.5.2 of the EIS. The current groundwater monitoring network consists of 45 bores; 20 alluvial bores, 23 overburden bores and two coal seam bores (see Figure 19 of the EIS). The bores consist of 12 nests of two or three bores monitoring strata at increasing depth at the same site, and 13 single bore sites. The bores are monitored every month for water level, EC and pH.

Australasian Groundwater & Environmental Consultants Pty Ltd (AGE) undertook a review for the Annual Environmental Management Report. The latest AGE report can be found in **Appendix 2**. The report concludes that there has been no adverse long-term impact on the alluvial aquifers or shallow overburden from longwall mining of panels LW1 to LW14.

Centennial Mandalong will install additional groundwater monitoring bores within areas of groundwater dependant ecosystems. This commitment has been included in the Statement of Commitments provided in Section 5.0.

Surface cracking has been detailed in Table 8 of the RTS report. Cracks have not caused any alluvial water loss as shown on the groundwater monitoring bore network. Creek line mapping which is undertaken on an annual basis has not detected any cracking of alluvial creek beds. Section 9.5.1 of the EIS states that surface cracking of the creek beds is considered “unlikely” to occur where the cover

depth is greater than 180m. The only longwalls in the Southern Extension Area that have depths less than 180m are the ends of longwalls 55, 56 and 64. Areas of MU5 Alluvial Tall Moist Forest and MU42 Riparian Melaleuca Swamp Woodland have been mapped in these areas and will be monitored as per the commitment above.

For the 3rd order streams the mine design has limited the longwall width to further reduce the risk of cracking in the creek beds. Section 9.5.1 of the EIS states that for third and fourth order streams, surface cracking of the creek beds is considered “highly unlikely” and will be limited by the longwall geometries and the “strain absorbing” properties of the surface alluvium.

In addition to the groundwater monitoring bore network noted above, Mandalong Mine has 56 kilometres of active surface subsidence monitoring lines which consist of 4700 monitoring points. This provides a comprehensive set of monitoring data. The subsidence monitoring is undertaken by two full-time staff and is independently verified using laser scanning techniques. Due to the amount of data that Mandalong Mine produces, it is one of the pilot mines for the Department of Resources & Energy's new uploading software for all subsidence data across the state. Centennial Mandalong has received two awards from the NSW Awards for Excellence in Surveying and Spatial Information in 2008 and 2009 for subsidence real time monitoring and the use of airborne laser scanning data.

As detailed in Section 5.1.3 of the EIS, the mine layout has been designed to consider the environmental constraints which include the creeks, groundwater aquifers and GDEs. Section 9.7 of the EIS states that Centennial Mandalong will implement an adaptive management approach to subsidence, which will involve monitoring, remediation and periodic evaluation of the consequences of mining, with possible adjustment of the mining layout through the Extraction Plan process to achieve the required measure of performance, which will be to stay within the Level 1 Minimal Impact Considerations for Aquifer Interference Activities as per the NSW Aquifer Interference Policy.

The revised Statement of Commitments contained in Section 5.0 of the Response to Submissions includes a groundwater monitoring plan which will detail groundwater monitoring strategies and frequencies.

The faulting issue and its potential interaction with subsidence over the Southern Extension remains unresolved because of the lack of detailed discussion on faults contained in the EIS (or RTS). OEH would appreciate more explanation on ‘seam rolls’. OEH recommends that the proponent establishes a robust network of regular subsidence monitoring that will feed into adaptive management, particularly where GDE EEC vegetation is undermined.

This issue was discussed at a meeting held between Centennial representatives and OEH representatives on the 28th March 2014.

Faulting was addressed in Section 3.1.14 of the RTS report and Appendix 9 of that report. Appendix 9 details the likely ranges of tilt, curvature and strain if faulting was to occur in the Southern Extension Area.

The Review of Mandalong South Subsidence Predictions by Seedsman Geotechnics Pty Ltd (Appendix 3 of the RTS report) commented on faulting as follows:

“It is the nature of coal exploration that the presence and nature of faults is not known or even knowable at the EIS stage. There is a major failure by the regulators in accepting this as inevitable. As the knowledge of the deposit geology advances through planning and operations, adaptive management is used to avoid the large faults (as they are not compatible with economic longwall extraction). Adaptive management can also be used to decide if the mining through smaller faults could lead to adverse and unacceptable impacts in the overburden. Adaptive management in this case can be complicated by the knowledge that fault surfaces are rarely planar so their location at the surface cannot be predicted from a knowledge of their location at seam level.”

Regarding seam rolls, this is a term used in coal mining to describe a localised steepening of the coal seam which is also referred to in geological terms as a monocline. The name monocline is given to a flexure that has two parallel gently dipping (or horizontal) limbs with a steeper middle part between them; it is in effect a local steepening of the dip in the same direction. (p145, A Geology for Engineers, Blyth and de Freitas, 1984).

As detailed within the Statement of Commitments contained in Section 5.0 of the Response to Submissions Report, as part of the development of each Extraction Plan, Centennial Mandalong will update the subsidence monitoring program, including surface and sub-surface monitoring activities, as recommended by DGS (2013) and specified in the EIS.

OEH is not reassured by the HydroAlgorithms (2014) review concerning the adequacy of the groundwater model for assessing potential impacts to or recovery of groundwater aquifers.

Dr Noel Merrick is a groundwater modeller, hydrogeologist and geophysicist with 40 years professional experience in groundwater issues and policies. As a consultant, he has undertaken many model-based environmental impact studies for major infrastructure, resource and mining projects. Dr Merrick is a modelling advisor to the Commonwealth government and four state governments. The HydroAlgorithms (2014) review of the groundwater model has been undertaken in a systematic way and OEH should be reassured with its findings. Note that in conclusion the review states that *'Although more work could have been done to narrow property ranges through transient calibration, the model is considered sufficiently fit for purpose, as required by the Aquifer Interference Policy, on the strength of the corresponding cause-and-effect analysis of effects observed during prior and current mining.'*

GHD's hydrogeology group has extensive experience in data collection and interpretation in the fields of groundwater resource development, aquifer management, construction and mine dewatering, environmental impact assessment and contamination remediation. Models are developed through collaborative efforts and input from the hydrogeological team.

OEH continues to have concerns with the use of the un-calibrated and un-validated hydrodynamic model to assess mining impacts to stream flow. OEH recommends that the proponent collects robust and quantifiable stream flow data from third order and larger streams above the mine project ahead of mining in order to assess whether the mine indeed has had a negligible impact on local streams and alluvial aquifers in the Study Area.

Centennial Mandalong will collect quantifiable stream flow data from Morans Creek, Wyee Creek and Mannering Creek 2 years prior to mining and for 2 years after the completion of mining the adjacent longwall panel. This information will be used in the hydrodynamic model. This commitment has been added to the revised Statement of Commitments in **Section 5.0** of this report.

OEH recommends that mine make water is appropriately treated to meet ANZECC (2000) guidelines before release into the Muddy Creek catchment and that the proponent effectively monitor water quality and local biodiversity in this catchment.

In the RTS report (pages 114 and 115) the treatment of mine discharge water involves increased retention time either in the underground voids or the surface Borehole Dam and the introduction of a flocculent. Macroinvertebrate testing is discussed in this section of the RTS report and six monthly testing has commenced.

The proponent must monitor the floristic composition and structure (as per Siversten, 2010) of at least five (5) sites in the Muddy Lake catchment that must sample Swamp Oak Sedge Forest, Coastal Saltmarsh and coastal freshwater wetlands downstream of LDP001. Such monitoring must be done on an annual basis.

Surface water and ecological monitoring will be detailed in the respective management plans to be developed within 6 months following development consent as committed to in the Revised Statement of Commitments contained in Section 5.0 of the Response to Submissions Report.

Centennial Mandalong will continue to undertake aquatic ecology monitoring of bio indicator species. The toxicity assessment identified that there is no acute toxicity as a result of the mine water discharge and that discharges will only gradually increase over the life of the Project. No further treatment beyond what is proposed is considered necessary.

Current mine water fish toxicity testing appears inadequate in scale and timeframe.

This issue was discussed in section 3.1.20 of the Response to Submissions report.

The RTS does not appropriately discuss the recent studies on the toxicity of bicarbonate to aquatic fauna.

This issue was discussed in section 3.1.20 of the Response to Submissions report.

OEH notes that Nickel is not currently included in the EPL for LDP001 and so the Proponent is actually not licensed to discharge Nickel concentrations of the magnitude recorded in the effluent.

The Environmental Protection Licence is administered by the Environmental Protection Authority (EPA) and Centennial Mandalong has undertaken a Pollution Reduction Program (PRP) study as per Section 8 of EPL 365 investigating 32 metals including nickel and conductivity. A PRP, by its nature, allows for pollution to occur whilst reduction programs are investigated. The PRP was for an ANZECC water quality assessment designed to identify the potential elements of mine water discharge that may impact on the environment. Centennial Mandalong completed this PRP in 2013. This information has been forwarded to the EPA for consideration.

That the proponent must freely provide its monitoring data collected on its webpage or, upon a written request on a CD, within six (6) months of the data being collected.

The Protection of the Environment Operations Act 1997 and conditions of consent will require reporting EPL monitoring data on a monthly basis and this will be made available on Centennial Coal's website.

With an increased discharge to 7.1 ML/day this represents an increased load of contaminants (salt, sulphate, nitrogen, phosphorus, boron, iron and barium) to the receiving environment. OEH believes that some form of treatment is required to reduce the salt and contaminant load to the receiving environment.

This was addressed in the RTS report (pages 114 and 115), where the treatment of mine discharge water involves increased retention time either in the underground voids or the surface Borehole Dam and the introduction of a flocculent. The increase in discharge to 7.1 ML/day occurs at the end of the mine life in 2036 as detailed in Section 6.4.2 of the Water Management Impact Assessment (Appendix P of the EIS).

OEH notes that the RTS states that the peak groundwater inflows into the Cooranbong and Mandalong workings may reach up to 5.9 ML/day. However, OEH also notes that models 1 and 10 (Figure 3 GHD (2014)) suggests that under these scenarios groundwater inflows could go as high as 7-10 ML/day. Therefore greater volumes of mine water may be discharged from LDP001 than were considered by the proponent.

The Mandalong Southern Extension project is seeking approval to extract and discharge up to 8 ML/day and it is not requesting approval to extract any more than what has been assessed and applied for.

Inadequate explanation of subsidence levels over longwall panel 5 of the current mine in relation to subsidence predictions and scant details on the borehole extensometer results in the middle of Mandalong Mine's LW5 to monitor heights of sub-surface fracturing due to the caving or goafing process during mining.

This issue was addressed in Section 10.11.2 of the EIS subsidence assessment (Appendix M). The issue was further addressed in RTS report and Appendices 3 and 9. The borehole extensometer plots for displacement and strain are shown in Figures 1a and 1b of Appendix 9.

OEH recommend that the proponent must continue to consult with and involve all the registered local Aboriginal representatives for the project, in the ongoing management of the Aboriginal cultural heritage values. Evidence of this consultation must be collated and provided to the consent authority upon request.

Centennial Coal has developed an Aboriginal Cultural Heritage Management Plan (ACHMP) encompassing all of Centennials Northern Operations. This ACHMP identifies a consistent approach to consultation with Aboriginal groups and a consistent approach to the identification, monitoring and management of Aboriginal heritage sites. The ACHMP was developed in consultation with the Registered Aboriginal Parties and OEH and has been approved by NSW P&E

As included in the Statement of Commitments contained in Section 5.0 of the Response to Submissions, within six months following development consent, Centennial Mandalong will update the Centennial Northern Holding's ACHMP (in consultation with the relevant government agencies and registered Aboriginal parties) to take into consideration the commitments made in this EIS and any relevant consent conditions.

In the event that ground disturbance identifies a new Aboriginal objects within the project area, all works must halt in the in the immediate area to prevent any further impacts to the object(s). A suitably qualified cultural heritage specialist and representatives of the local Aboriginal community must be contacted to determine the nature, extent, scale and significance of the finds. The site is to be registered in the Aboriginal Heritage Information Management System (AHIMS) (managed by OEH) and the management outcome for the site included in the information provided to the AHIMS. The proponent will consult with representatives of the local Aboriginal community, and the cultural specialist to develop and implement and appropriate

management strategies for all objects/sites. Any management strategy development must also comply with the appropriate legislative provisions.

Noted.

If human remains are located in the event that surface disturbance occurs, all works must halt in the immediate area to prevent any further impacts to the remains. The NSW Police are to be contacted immediately. No action is to be undertaken until the NSW Police provide written notification to the proponent. If the skeletal remains are identified as Aboriginal, the proponent must contact OEH's Environment Line on 131 555 and representatives of the local Aboriginal community. No works are to continue until OEH provides written notification to the proponent.

Noted.

An Aboriginal Cultural Heritage Education Induction Program must be developed as a component of the Land Disturbance Protocol for the induction of all personnel and contractors involved in the construction activities on site. Records are to be kept of which staff/contractors were inducted and when for the duration of the project. The program should be developed and implemented in collaboration with the registered Aboriginal parties.

Centennial will develop an induction for all contractors on site involved in the construction activities on site which will include cultural heritage awareness. All induction records are currently, and will continue to be kept.

Centennial Mandalong will develop a cultural heritage awareness component of the induction for contractors involved in the construction activities in consultation with the Aboriginal community. This has been included in the revised Statement of Commitments contained in Section 5.0.

3.2 Lake Macquarie City Council

Lake Macquarie City Council (LMCC) recommend that the Stakeholder Engagement Strategy is updated prior to the project receiving approval, and endorsed as part of the approval process, in order to provide certainty as to how this ongoing consultation with the community will occur.

As included in the Statement of Commitments provided in Section 5.0 of the Response to Submissions, within six months following development consent, Centennial Mandalong will update the existing Stakeholder Engagement Strategy to provide a consistent management framework for the identification and consultation with stakeholders that have an interest in the mine.

The planning agreement should be developed prior to development consent and included in the SoC, in order to provide certainty regarding what will be provided by the proponent for the local communities.

Centennial Mandalong will contribute to improving local amenities and services in the Mandalong and Morisset communities. This will be achieved and agreed through ongoing consultation with LMCC. This has been included in the revised Statement of Commitments provided in Section 5.0 of the Response to Submissions.

Given that the proponent is aware that sensitive receptors will likely be exposed to PM2.5 pollution (as modelled), greater than the advisory goal/ health risk assessment level, Council considers that the proponent should address and resolve this exceedance prior to the granting of Project Approval.

In the Air Quality section of the Statement of Commitments, Centennial Mandalong committed to undertake a study to determine the nature of the particulate matter exiting the main fan evasée at the existing Mandalong Mine Access Site (MMAS). This study has been completed (see **Appendix 3**) and has estimated that 15% of the particulate matter exiting the evasée has come from other sources and has entered the mine as 'fresh air'. The additional data has been used in re-visiting the dispersion modelling in the AQIA for the Project. It concluded that the impacts to the residences on the eastern side of the M1 Motorway have been over estimated by up to 3.6 times. Adjusted predictions for the three affected residences have been reduced to below 10 µg/m3. The details of this report can be found in **Appendix 4**.

3.3 NSW Office of Water

Appendix C of the exhibited EIS Groundwater Impact Assessment has presented a significant number of bores with either widely ranging EC values (varies from very fresh to 20,000 µS/cm) or long term rising EC trends (rises from 100 µS/cm in 1997 to around 2,000 - 5,000 µS/cm in 2012). These are the changes noted over the period of development consent DA 97/800 for the Mandalong Mine. The proponent simplifying their response to 'natural variation' is considered inadequate. It is recommended the proponent provides a supplementary report prior to commencement of activities to review the drivers for groundwater quality trends being observed in the monitoring bore network. The report is to assess whether such trends pose a risk of exceeding the Aquifer Interference Policy Level 1 impact for a "water quality change of 1% per activity in long-term average salinity in a highly connected surface water source at the nearest point to the activity". To improve the understanding for the rising trends and fluctuating salinity observations, the report should include discussion on field techniques, quality assurance, instrument calibration and bore design.

As part of Centennial Mandalong's Annual Environmental Management Report a groundwater monitoring review is undertaken annually. The latest review by Australasian Groundwater & Environmental Consultants Pty Ltd (AGE) was undertaken in January 2014. AGE reviewed the water levels and the water quality data from the network of groundwater monitoring bores. This report has been provided to NOW and is included in this report as **Appendix 2**. In order to meet NOW's recommendation noted above, AGE have been engaged to provide the supplementary report. As this work has not been completed yet it is not included as an appendix to this report. However, through correspondence with NOW, Centennial Mandalong has committed to provide the report as soon as it is available which is expected in September 2014.

3.4 Office of Agricultural Sustainability & Food Security

The proponent has stated that a soil survey scale of 1:100 000 is adequate despite being requested to provide a 1:25 000 soil survey on two soil landscapes (Doyalson and Yarramalong) totalling 157 ha of land at the adequacy stage. The proponent has stated that the 1:25 000 soil survey requirements are only required for Biophysical Strategic Agricultural Land (BSAL) verification which is not being asked for here. However, the Agricultural Impact Statement Technical Notes clearly state "the project disturbance area should be sampled at a minimum scale of 1:25 000." NSW DPI maintains that there is still insufficient soil information to make a decision, particularly in the light of a small amount of mapped BSAL being present on the disturbance area.

Notwithstanding the OASFS's comments, draft amendments to the Environmental Planning & Assessment Regulation and Mining SEPP (on exhibition until 16/7/14) provide clarity on the circumstances under which BSAL verification is required. Centennial Mandalong received its DGRs for the Mandalong Southern Extension Project in March 2012 and the date the Strategic Agricultural Land map was gazetted (28/1/14).

A field survey at a mapping scale of 1:100,000 was undertaken by GSSE field staff in May 2012 in line with the existing guidelines at that time. The activity of underground mining to BSAL is low risk. As such, a low risk is commensurate with the 1:100,000 survey scale that has been applied to the Project for the mapping of soil resources.

Centennial Mandalong will undertake 1:25,000 mapping over the area adjacent to Morans Creek where the proposed access road and bridge construction will require soil disturbance. The wet weather over the past several months has delayed this assessment but it will be completed as soon as practicable.

OAS&FS was not able to assess the Proponent's 'review of property prices in the area' as no details were provided. OAS&FS recommends that a consent condition includes a report on the land values within 5km of the Project boundary to be updated every 5 years.

The review of property prices in the area between 1998 and 2008 referred to in Section 3.1.1 of the RTS report, is supplied in **Appendix 5**.

The suggested consent condition to report on land values within 5km of the project boundary involves 46,000 individual land parcels. Centennial Mandalong does not believe that this proposed condition offers any benefit to the community. As detailed in the property price review property prices are subject to many external factors.

3.5 Wyong Shire Council (WSC)

It is Council's view that the subsidence impacts on the leachate collection and gas management systems have not been adequately addressed. It appears that no allowance has been made for surface loadings from the landfill estimated at 12 million cubic metres. It would be appreciated if greater certainty could be provided to Council that the Buttonderry Waste Management Facility, Council's only operating landfill facility, will not be impacted upon by the proposed project and that the proposed future surface loads to be generated by the facility are incorporated into any assessments.

Wyong Shire Council provided plans and design reports (GHD 2012a, 2012b) of their existing and proposed leachate and gas management systems. DgS has provided additional subsidence predictions for these infrastructure items and these predictions are detailed and discussed in **Appendix 6**.

In summary the northernmost part of cell 4.3 and the proposed Area 5 are within the angle of draw for LW54 but the levels of subsidence are well within the design criteria stipulated by the Mine Subsidence Board as summarised in **Table 2**.

LW54 is unlikely to cause any damage to the lining of the cells. However, monitoring of cross-lines from the preceding longwall panels will help to confirm the predictions prior to the extraction of LW54. It is proposed that this monitoring commences when the longwall extraction is 600 m from the northern limit of the cells.

Table 2 – Comparison between design and predicted levels of subsidence for the Buttonderry Waste Management Facility

Criterion	Design levels required by the Mines Subsidence Board	95% UL prediction levels
Vertical subsidence	1700 mm	150 mm
Tilt	17 mm/m	2 mm/m
Strain	+/- 5 mm/m	1 mm/m
Curvature	-	0.05 /km
Horizontal displacement	-	50 mm

DgS has assessed the additional loading from 12 million cubic metres of landfill and concludes that the base of the cell will settle up to 200mm. The maximum settlement effects are not likely to superimpose with the maximum subsidence of LW54. The overall impact to the surface and subsurface drains will therefore still be <0.2% for both the scenarios if they occur simultaneously.

3.6 Office of the NSW Small Business Commissioner

Found the RTS unhelpful and reiterate the concerns of the office for the environmentally sensitive business that may be seriously affected.

All issues raised by the Office of the NSW Small Business Commissioner were addressed in the RTS report.

4.0 CONSULTATION

Since the submission of the RTS report, Centennial Mandalong has continued to undertake consultation with various stakeholders regarding the Project. A summary of the consultation undertaken since the submission of the RTS is detailed below.

4.1.1 Office of Environment and Heritage

OEH has been contacted to arrange a meeting to discuss Centennial Mandalong's response to their letter. This meeting is scheduled for 7 August 2014.

4.1.2 Wyong Shire Council

The Project team and Steve Ditton (DgS) met with Wyong Shire Council (WSC) representatives on 25 June 2014 to discuss Council's outstanding issue concerning subsidence impacts to the leachate collection system and the gas management system at the Buttonderry Waste Management Facility.

4.1.3 NSW Office of Water

The groundwater monitoring review for the Annual Environmental Management Report undertaken by Australasian Groundwater & Environmental Consultants Pty Ltd (AGE) was provided to NOW on 2 July 2014. The commitment to complete the supplementary report as per their recommendation was also made on that date.

4.1.4 Community Consultation

The Mandalong Mailbox newsletter was circulated to all residents in the Mandalong and Mandalong South areas where a Project update was provided.

An update of the Project and the approval process was provided to the Mandalong Mine Community Consultative Committee, which includes the Mandalong Community Association, at the meeting held on 24 June 2014.

5.0 REVISED STATEMENT OF COMMITMENTS

Desired Outcome	Commitment/Action
	Construction Management
Minimise impacts from construction activities from the Mandalong South Surface Site on the environment and sensitive receivers.	Six months prior to the commencement of construction activities at the Mandalong South Surface Site, Centennial Mandalong will develop a Construction Environmental Management Plan for the construction phase of the Mandalong South Surface Site and access road. The Construction Management Plan will ensure: • That vegetation to be removed is clearly marked using temporary fencing (flagging tape or similar) to delineate boundaries and minimise the potential for equipment to accidentally enter areas to be retained. • That vegetation adjacent to the disturbance footprint of the proposed Mandalong South Surface Site and access road is fenced (fauna friendly fencing) prior to construction activities to reduce damage from uncontrolled or accidental access. • That material stockpiles are established within already disturbed areas and not within areas of retained vegetation. • Appropriate topsoil management including: – Topsoil will be maintained in a slightly moist condition during stripping, and material will not be stripped in either an excessively dry or wet condition. – Stripping will be timed to take place in unison with any vegetation clearing activity. If planning to mix groundcover/grass with the soil (i.e. not removing groundcover prior to soil stripping), a weed assessment will be undertaken prior to stripping. – Where possible, grading or pushing soil into windrows with graders or dozers for later collection will be undertaken as a preferential less aggressive soil handling systems. – The surface of soil stockpiles will be left coarsely structured (as much as possible) in order to promote infiltration and minimise erosion until vegetation is established, and to prevent anaerobic zones forming. – Topsoil stockpiles will generally be maintained no higher than three metres. – If long-term stockpiling is planned (i.e. greater than three months), the stockpiles will be seeded and fertilised as soon as possible. An annual cover crop species that produces sterile florets or seeds will be sown. A rapid growing and healthy annual pasture sward will provide sufficient competition to minimise the emergence of undesirable weed species. The annual pasture species will not persist in the rehabilitation areas, however will provide sufficient competition for emerging weed species and enhance the desirable micro-organism activity in the soil. – Prior to re-spreading stockpiled topsoil, an assessment of weed infestation on stockpiles will be undertaken to determine if individual stockpiles require herbicide application and / or 'scalping' of weed species prior to topsoil spreading. • That clearing activities are timed, where possible, to avoid removal of hollow-bearing trees during breeding season of threatened species. • That a specialist ecologist is engaged to supervise vegetation clearing and ensure vegetation clearing, particularly the removal of hollow-bearing trees, is undertaken as outlined in this EIS. • Noise impacts are minimised. • Air quality impacts are minimised • Traffic impacts are minimised by covering loads of bulk material haulage trucks travelling to and from the proposed MSSS. A copy of the Construction Management Plan will be provided to Lake Macquarie City Council for review and comment on construction traffic management prior to the commencement of construction activities. All construction activity at the Mandalong South Surface Site will occur between the standard hours of 7.00 am to 6.00 pm Monday to Friday and 8.00 am to 1.00 pm on Saturday (no construction on Sundays or public holidays). The only exception to this will be the construction of the ventilation shafts, which will be undertaken 24 hours a day, seven days a week for a period of approximately 78 weeks.

Desired Outcome	Commitment/Action
	Rock hammering activities will be undertaken in areas that are away from the majority of residences and limited to between 8.00 am and 4.00 pm Monday to Friday and between 9.00 am and 1.00 pm on Saturdays (no rock hammering on Sundays or public holidays). Where necessary, and in consultation with potentially affected residents, temporary noise barriers will be established and maintained. To provide acoustic shielding for the shaft sinking activity at the Mandalong South Surface Site, a temporary barrier measuring seven metres high and 20 metres long will be installed at a distance of 20 metres from the drill rig at the intake shaft site (see Figure 54).
Exploration Drilling	
Enable Centennial Mandalong to conduct exploration activities in an environmentally responsible manner with due consideration to the community	Due-diligence field inspections and targeted surveys of proposed drill sites and access tracks will be undertaken by a qualified ecologist prior to commencement of works to ensure the potential for localised issues are minimised and, where necessary, appropriately managed.
	Prior to the commencement of works, Centennial Mandalong will ensure that the <i>Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales</i> (DECCW 2010) is followed prior to the commencement of works. Proposed drill sites and access tracks will be inspected according to the protocols in the approved ACHMP.
	Consultation with potentially noise affected landholders will be undertaken in accordance with a Stakeholder Engagement Strategy in which all neighbouring landholders and any residents within 450 metres of a drill rig are notified of the timing, location and anticipated duration of the exploration drilling activities. Where drilling is to be undertaken in close proximity of residents, noise mitigation measures will be implemented.
	Specific bushfire risk treatment actions will be implemented, including: - No drilling will be conducted on total fire ban days; - Fire fighting equipment will be kept on active sites at all times; and - Hot work activities will be required to obtain internal work permits. Access provisions to each drill site will be identified prior to commencement of works.
	Upon completion of exploration activities, all boreholes and surface disturbance will be sealed and rehabilitated in accordance with the appropriate guidelines at the time.
Mining Operation	
Continue mining operations of the Mandalong Mine	Centennial Mandalong will continue to extract ROM coal at a rate of up to 6 Mtpa.
	Centennial Mandalong will continue to operate Mandalong Mine 24 hours a day, seven days per week.
Environmental Management and Reporting	
Enable Centennial Mandalong to manage its operations in an environmentally appropriate manner	Within six months following development consent, Centennial Mandalong will review and update the Mandalong Mine Environmental Management System (EMS), including issue-specific environmental management plans and monitoring programs. The review will take into consideration the environmental assessments undertaken as part of this EIS, the commitments made in this EIS and all relevant consent conditions. The EMS will include the following: - Aboriginal Cultural Heritage Management Plan; - Air Quality Monitoring and Management Plan; - Energy Savings Action Plan; - Flora and Fauna Management Plan; - Groundwater Monitoring and Management Plan; - Noise Monitoring and Management Plan; - Surface Water Monitoring and Management Plan (which will include Erosion and Sediment Control Management Plan); and - Waste Management Plan.
	Centennial Mandalong will include a process to review the groundwater, surface water and flood models as part of the Water Management Plan.
	Centennial will consult with NSW Fisheries in the development of the Water Management Plan.
Enable Centennial	Centennial Mandalong will continue to report environmental monitoring results on

Desired Outcome	Commitment/Action
Mandalong to meet its statutory reporting obligations	Centennial's website in accordance with the POEO Act requirements.
	Each year, Centennial Mandalong will prepare an Annual Review, which will report environmental monitoring results and evaluate performance for the previous 12 month period, to be distributed to the relevant government agencies and the Mandalong Mine Community Consultative Committee.
Subsidence Monitoring and Management	
Manage subsidence associated with coal extraction from Mandalong Mine	Six months prior to the development of longwall 25, Centennial Mandalong will prepare the first Extraction Plan to manage subsidence associated with the proposed mining in the Southern Extension Area.
	As part of the development of each Extraction Plan, Centennial Mandalong will update the Public Safety Management Plan, Public Roads Management Plan, Telstra Management Plan and TransGrid Management Plan in consultation with relevant infrastructure owners.
	As part of the development of an Extraction Plan impacting Nextgen infrastructure, Centennial Mandalong will develop a Nextgen Infrastructure Management Plan in consultation with Nextgen.
	As part of the development of an Extraction Plan, Centennial Mandalong will prepare Property Subsidence Management Plans for impacted private properties and will include recommendations by DGS (2013) and specified in this EIS.
	If damage to a landholder's dam from subsidence results in a loss of water an alternative water supply will be made available until the dam can be repaired.
Monitor subsidence associated with coal extraction from Mandalong Mine	As part of the development of each Extraction Plan, Centennial Mandalong will update the subsidence monitoring program, including surface and sub-surface monitoring activities, as recommended by DGS (2013) and specified in this EIS.
Soil and Land Capability	
Appropriate management of topsoil during construction activities	Centennial Mandalong will incorporate soil stripping, handling, stockpiling and transportation management activities into the Construction Environmental Management Plan for the Mandalong South Surface Site.
Managing topsoil resources for future rehabilitation uses	During construction of the Mandalong South Surface Site, Centennial Mandalong will develop and maintain a soil inventory to keep track of topsoil materials available for planned rehabilitation activities.
Monitoring and management of soil erosion	The Erosion and Sediment Control Plan will be updated to include monitoring and mitigation strategies to deal with tunnel soil erosion caused or exacerbated as a result of subsidence.
Groundwater	
Minimise and monitor groundwater impacts on the environment and registered water users	Within six months following development consent, Centennial Mandalong will update the existing Groundwater Monitoring and Management Plan to include the following: - Proposed locations of nested monitoring bores at locations where the depth of cover is less than 250 metres. This is primarily throughout the north-eastern extent within the Wyee Creek and Mannering Creek catchments. It is intended to install three monitoring bores (nested) above each of the proposed longwall panels (2 years prior to mining and pending landholder granting access) where the depth of cover is less than 250 metres to monitored groundwater levels, pH and electrical conductivity. Monitoring will continue for a period of 2 years following the completion of mining in the subsequent adjacent panel. - Groundwater monitoring bores and/or vibrating wire piezometers within the Southern Extension Area to monitor the height of groundwater depressurisation prior to extraction of longwalls with lower depth of cover. An adaptive management approach will be adopted to ensure that if there is a risk of fracturing extending up to alluvial aquifers (based on monitoring data) actions will be taken to mitigate these impacts. - Installation of groundwater monitoring bores within areas of groundwater dependant ecosystems. - Monitoring of bore GW078601, which is the only registered water supply bore within the Southern Extension Area, subject to landowner approval.

Desired Outcome	Commitment/Action
	Centennial Mandalong will commit to implement "make good provisions" to any water supply work where the drawdown impacts exceed the 2 metre criteria as specified in the NSW Aquifer Interference Policy.
	Each year, Centennial Mandalong will engage a specialist to undertake an analysis of alluvial groundwater levels to identify non-rainfall related trends.
	During construction of the shafts at the Mandalong South Surface Site and where blind boring techniques are employed, Centennial Mandalong will ensure groundwater loss is limited by minimising the construction time and the time that the shafts are unlined.
	Centennial Mandalong will also use non-hazardous polymer drilling muds during boring to reduce the flow of groundwater into the hole.
Surface Water	
Monitor surface water impacts on the environment	Within six months of development consent, Centennial Mandalong will update the existing Surface Water Monitoring and Management Plan to include the following: - Monitoring of the watercourses within the Southern Extension Area to be undermined, particularly in locations identified as potential scouring points, to evaluate watercourse stability. Monitoring will be undertaken before and after undermining of the areas, with additional inspection of these locations following significant rainfall events. - Surface water quality monitoring at the same locations within the Southern Extension Area used to gather background information. - Continuous stream flow monitoring on Morans Creek, Mannering Creek, and Wyee Creek will be undertaken 2 years prior to mining and for 2 years after the completion of mining the adjacent longwall panel. - TARPs for the management of subsidence impacts on watercourses in consultation with relevant government agencies.
Manage impacts to waterways as a result of the construction of the MSSS and access road	Centennial Mandalong will design the proposed crossing over Morans Creek in accordance with the Fisheries NSW Policy and Guidelines titled <i>Why Do We Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (January 2003)</i>. Centennial Mandalong will design the proposed crossing over Morans Creek in accordance with the <i>Guidelines for Controlled Activities on Waterfront Land (2012)</i>. Centennial Mandalong will construct the sedimentation basin and its spillway at the MSSS in accordance with the <i>Guidelines for Controlled Activities on Waterfront Land (2012)</i>.
Manage impacts to waterways as a result of ongoing operations within the Project Application Area	Centennial Mandalong will undertake any works within watercourses and on the floodplain in accordance with the <i>Guidelines for Controlled Activities on Waterfront Land (2012)</i> .
Water Management	
Appropriate management and discharge of mine water at Cooranbong Entry Site	If the quality of mine water collected in the Borehole Dam is not suitable for discharge from the Cooranbong Entry Site, the water will be pumped back underground for recirculation (additional filtration and sediment settlement) through the Cooranbong Colliery goaf storage area before returning to the Borehole Dam. The storage volume of the Borehole Dam at the Cooranbong Entry Site will be increased to increase the settling capacity. In addition baffles will be retrofitted in the Borehole Dam to provide increased residence time and a flocculent will be introduced. Aquatic macroinvertebrate monitoring and sediment sampling will be undertaken every six months (spring and autumn).
Flora and Fauna	
Minimise impacts to ecology within the Southern Extension Area	As part of the detailed design phase for the Mandalong South Surface Site, Centennial Mandalong will ensure that that proposed access road is aligned to minimise disturbance and avoid removal of any <i>M. biconvexa</i> specimens. Centennial Mandalong will implement a vegetation condition monitoring programme 2 years before, during and 2 years after completion of mining in the adjacent longwall panel in sensitive environments (which will include floodplains and groundwater dependant

Desired Outcome	Commitment/Action
	ecosystems).
	As part of the construction activities at the Mandalong South Surface Site, a wheel wash will be installed to help prevent soil-borne disease (Phytophthora), pathogenic fungus (Myrtle Rust) transmission and weed seed dispersal.
	Within six months following development consent, Centennial Mandalong will develop a Flora and Fauna Management plan that includes: • Identification of weed management, monitoring and control practices to minimise the spread of exotic species. • Incorporation of the existing Wetland Management Plan. • Trigger Action Response Plan.
Offset the ecological impacts of the Project	Centennial Mandalong will install nest boxes to compensate for the loss of 9 hollow bearing trees containing 18 habitat hollows as a result of the construction of the MSSS. • Nest boxes will be installed at a ration of 1:1 (i.e. one nest box for every habitat hollow removed). • A mixture of nest box types are used to compensate for the variety of hollows being removed. • Nest box sizes will target microbats, gliders and possums. • All nest boxes will be rear entry. • The majority of nest boxes will be placed at a westerly aspect to maximize chances of colonization. • Standard nest box design (i.e. single walled nest boxes) will be used rather than double walled nest boxes as previous monitoring has identified a sharper uptake of animals in single-walled nest boxes.
Offset the ecological impacts of the Project	Within 12 months of development consent, Centennial Mandalong will implement a Land Management Plan (developed in consultation with the OEH) for land owned by Centennial in the Mandalong Valley. This plan will include the continuation of the following land management activities: • Management of weeds and feral animals. • Suitable fencing for the exclusion of stock from riparian areas. • Bushfire management. • A rehabilitation program for riparian areas where an assessment has determined that rehabilitation activities will improve water quality in the creek systems. • Provision of a nominal funding value towards research over the life of the Project into the habitat values of species likely to be impacted by the Project. • Provision of a nominal dollar amount for future maintenance of the land.
Aboriginal Heritage	
Monitor, mitigate and manage impacts to Aboriginal heritage sites	Six months prior to the commencement of construction activities associated with the Mandalong South Surface Site, Centennial Mandalong will engage a suitably qualified archaeologist and representatives from the Registered Aboriginal Parties to undertake sub-surface archaeological testing within Areas A, B and C (see Figure 44) in accordance with the Code of Practice (DECCW 2010). Within six months following development consent, Centennial Mandalong will update the Centennial Northern Holding's ACHMP (in consultation with the relevant government agencies and registered Aboriginal parties) to take into consideration the commitments made in this EIS and any relevant consent conditions. Immediately prior to and during construction of the Mandalong South Surface Site, Centennial Mandalong will ensure that a combination of silt and protective fencing is installed to ensure that run-off does not impact Aboriginal sites down slope of this area and that Aboriginal sites upslope are not inadvertently impacted by construction activities. As part of the preparation of each Extraction Plan, Centennial Mandalong will attempt to obtain access to unsurveyed privately owned land to identify any additional Aboriginal heritage sites.

Desired Outcome	Commitment/Action
	Centennial Mandalong will develop a cultural heritage awareness component of the induction for contractors involved in the construction activities in consultation with the Aboriginal community.
	Centennial Mandalong will ensure all employees and contractors working within the Southern Extension Area are made aware of their statutory obligations for Aboriginal heritage under the NPW Act 1974 as part of the site induction process.
Offset the Aboriginal heritage impacts of the Project	Within 12 months following development consent, Centennial Mandalong will formalise an agreement to authorise the local Aboriginal community access to suitable areas within its land holdings in the Southern Extension Area that contain Aboriginal cultural heritage sites.
	Prior to undermining specific Aboriginal heritage sites located on Centennial owned land, Centennial Mandalong will undertake the following research activities: - Detailed investigations on two Aboriginal rockshelter sites in consultation with the Registered Aboriginal Parties and the OEH in order to improve the cultural knowledge and understating of how the area was utilised by the Aboriginal people. - Subsidence monitoring and trial mitigation works for a grinding groove site that is located on Centennial-owned land and over the proposed mining area. The research program will be developed in consultation with the Registered Aboriginal Parties and the OEH.
Non-Indigenous Heritage	
Minimise impacts to items of European heritage	Six months prior to the commencement of construction activities associated with the Mandalong South Surface Site, Centennial Mandalong will ensure that the Landing Skid 2 is recorded by a qualified historical archaeologist.
	In the event that any additional non-Indigenous cultural heritage material is identified or uncovered during construction and/or exploration works, Centennial Mandalong will ensure that any surface works in the area ceases and will contact a heritage consultant to assess the condition of the item. Centennial Mandalong will adopt the appropriate mitigation measures, as provided by the heritage consultant, before recommencement of work.
	Centennial Mandalong will ensure that all employees and contractors working within the Southern Extension Area will be made aware of their statutory obligations for non-Indigenous heritage under the <i>NSW Heritage Act 1977</i> as part of the site induction process.
Air Quality	
Monitor air quality impacts	Within six months following development consent, Centennial Mandalong will update the Mandalong Mine Air Quality Monitoring and Management Plan to include the following: - Additional deposited dust gauges around the proposed Mandalong South Surface Site for both the construction and operational phases. - A PM10 and PM2.5 monitoring system, which will be used for model verification purposes and particulate management at the Mandalong Mine Access Site. The optimal location for these additional monitoring activities, along with the method and frequency of the monitoring activities, will be determined in consultation with a suitably qualified consultant.
Mitigate air quality impacts	The fan evasee at the Mandalong South Surface Site will be designed and constructed to face away from nearby surrounding residential receivers.
	The proposed MSSS access road will be sealed. All trucks carrying bulk materials (gravel, sand etc.) to the MSSS will have their loads covered.
Understand the source of particulate matter	Within six months following development consent, Centennial Mandalong will commission additional studies to establish the source of the particulate matter entering the mine and the contribution of this to the total emissions from the ventilations fans at the Mandalong Mine Access Site. These studies will inform the need for and scope of mitigation measures and management strategies considered necessary to address particulate matter emission from the ventilation fans.
Greenhouse Gas	
Reduce energy and diesel usage	Within six months following development consent, Centennial Mandalong will update the existing Energy Savings Action Plan to include: Continuation of the high voltage (33 kV) power line from the existing mine switchyard to the Mandalong South Surface Site, which will reduce energy losses through the

Desired Outcome	Commitment/Action
	transmission of higher voltages over longer distances before the point of use. • Use of power factor correction units at the Mandalong South Surface Site, which will improve the efficiency of the electrical power used in the underground workings and hence reduce the overall power consumption. • Underground storage/goaf areas will be used in the management of mine water to enable filtration and sediment settlement prior to the water being pumped to the surface. This will reduce energy losses through the ability to pump cleaner water with the use of high efficiency positive displacement pumps. • Bulk storage tanks/silos and boreholes will be installed at the Mandalong South Surface Site for the delivery of stone dust, concrete and ballast direct to the underground mine workings. This will result in significant diesel fuel savings by avoiding the transport of such materials via the decline tunnel.
Mitigate greenhouse gas emissions from the Project	Centennial Mandalong will progress the construction and commissioning of the gas flares, along with evaluating the electricity potential and capacity of the gas engines, at the Mandalong Mine Access Site to reduce greenhouse gas emissions.
	Centennial Mandalong will continue the trial of the VAM-RAB unit currently being constructed at the Mandalong Mine Access Site in order to determine whether it is a viable strategy for VAM abatement in the future.
	Centennial Mandalong will pay the relevant price per tonne of CO ₂ -e (carbon tax), depending on the year the liability is incurred, or purchase offsets. Where offsets are available and considered cost-effective, Centennial Mandalong will purchase only from registered suppliers under the relevant domestic or international certification scheme (the latter from July 2015 onwards).
Noise	
Monitor noise impacts from the Project	Within six months following development consent, Centennial Mandalong will update the existing Noise Monitoring and Management Plan to include quarterly operator-attended noise monitoring at and around the Mandalong South Surface Site.
Traffic	
Provide suitable and safe vehicle access to the Mandalong South Surface Site from Mandalong Road	As part of the detailed design phase for the Mandalong South Surface Site, Centennial Mandalong will ensure: • The access intersection from Mandalong Road to the proposed Mandalong South Surface Site is designed to be constructed as an at-grade (two roadways joining at the same level) BAR/CHL intersection (basic right turn treatment / channelised left turn) providing a left turn turning lane into the site. • The intersection is designed in accordance with Guide to Road Design Part 4A – Design of Unsignalised and Signalised Intersections (Austroads 2009). • That LMCC are consulted regarding the final location of the intersection. Appropriate sight distances along Mandalong Road and appropriate turning templates for heavy vehicles are achieved.
Identify and address any impact on road pavements as a result of construction	Within 3 months of completion of construction activities at the Mandalong South Surface Site, Centennial Mandalong, in consultation with LMCC, will undertake a road dilapidation review to identify areas of road pavement deterioration requiring maintenance treatment that could be directly attributed to the construction activities. These areas will be rehabilitated to Council's satisfaction by Centennial Mandalong.
Visual Amenity	
Minimising visual impacts from the Mandalong South Surface Site	During construction of the Mandalong South Surface Site, Centennial Mandalong will ensure that, wherever possible, infrastructure items are dark in tone and constructed of non-reflective materials.
	Within six months of construction activities at the Mandalong South Surface Site being completed, Centennial Mandalong will undertake landscape works, including along the proposed MSSS access road, such as shrub and tree planting, to increase the level of existing screening.
Bushfire	
Provide safe egress in the event of a bushfire	During construction of the Mandalong South Surface Site, Centennial Mandalong will establish an alternative egress route from the Mandalong South Surface Site and ensure it has a carrying capacity exceeding 15 tonnes.

Desired Outcome	Commitment/Action
Reduce risk of injury to personnel at the Mandalong South Surface Site in the event of a bushfire	Prior to commissioning the operation of the Mandalong South Surface Site, Centennial Mandalong will provide a safe place or fire bunker at the Mandalong South Surface Site to address the potential for an employee/contractor/visitor to be trapped at the surface site and unable to evacuate via the access road or alternate egress route.
Reduce risk to Centennial Mandalong infrastructure and local landholders' properties from bushfire	Within six months following development consent, Centennial Mandalong will review and update the existing <i>Emergency Management System</i> to incorporate the findings and conclusions of the bushfire risk assessment (Ecobiological 2013), the commitments made in this EIS and all relevant consent conditions.
	Subject to approval from the NSW Rural Fire Service, Centennial Mandalong will engage a specialist to undertake mosaic burns of forest vegetation outside of the designated APZ on a cyclic basis to reduce overall fuel loads approaching the APZ.
	Within three months of the completion of construction activities, Centennial Mandalong will establish the following Asset Protection Zones (APZs) in order provide a defensible space around infrastructure and avoiding flame contact and radiant heat exceeding 40 kilowatts per square metre: Mandalong Mine Access Site – an APZ will be established around the gas drainage and ventilation management infrastructure to the following distances - 20 metres to the north, south and west; and 10 metres to the east. Mandalong South Surface Site – an APZ will be established around the infrastructure to the following distances – 45 metres to the north and south; 20 metres to the east; and 30 metres to the west. Fuel reduction will be undertaken within these APZs by regular grass slashing, weed control, reducing tree canopy cover to less than 30 percent, lopping tree branches within three metres of ground fuels, reducing the shrub layer density to less than 20 percent, and removing timber piles and combustible materials.
	Within six months following development consent, Centennial Mandalong will extend the water supply system at the Mandalong Mine Access Site to include reticulated water supply and hydrant access in the area containing the gas drainage and ventilation infrastructure.
	Prior to commissioning the operation of the Mandalong South Surface Site, Centennial Mandalong will ensure the Mandalong South Surface Site has a dedicated water supply of greater than 20,000 litres for bushfire protection. This supply will be connected to a hydrant system or a stand pipe with suitable truck access.
	Centennial Mandalong will ensure buildings that contain combustible infrastructure include ember protection similar to the relevant standards in the <i>Australian Standard AS3959-2009 – Construction of Buildings in Bushfire-Prone Areas</i> . This will generally involve sealing or screening areas with gaps greater than 3 millimetres.
Dangerous Goods	
Provide safe storage, handling and disposal of dangerous goods	Within six months following development consent, Centennial Mandalong will review and update the existing Emergency Management System and Pollution Incident Response Management Plan to incorporate the Project, the commitments made in this EIS and all relevant consent conditions.
Social	
Continue to engage with stakeholders	Within six months following development consent, Centennial Mandalong will update the existing Stakeholder Engagement Strategy to provide a consistent management framework for the identification and consultation with stakeholders that have an interest in the mine.
Meet Centennial's corporate social responsibility objectives	Centennial Mandalong will contribute to improving local amenities and services in the Mandalong and Morisset communities. This will be achieved and agreed through ongoing consultation with LMCC.
Post-Mining Closure and Rehabilitation	
Rehabilitate the mine to an agreed final land use	Within five years of mine closure, Centennial Mandalong will prepare a detailed Mine Closure Management Plan with the aim of creating a land use capability compatible with the pre-mining land use (unless other beneficial uses are pre-determined and agreed). In addition to addressing the removal of surface infrastructure, the Plan will include: Rehabilitation of disturbed areas including spreading of stockpiled topsoil accordance

Desired Outcome	Commitment/Action
	with commitments in this EIS, revegetation using locally occurring native plant species, and rehabilitation of disturbed land to a condition that is self-sustaining or where maintenance requirements are consistent with an agreed post-mining land use; and • Final rehabilitation success criteria.
	Within twelve months following development consent, a Rehabilitation Environmental Management Plan will be prepared in accordance with the DRE requirements.

6.0 REFERENCES

- GHD (2012a). Design Report for Buttonderry Waste Management Facility - New Waste Cell 4.3 (August 2012).
- GHD (2012b). Specification for Excavation and Lining of Cell 4.3 - Buttonderry Waste management Facility (September 2012).

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7.0 APPENDICES

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Appendix 1 : Wetland Monitoring Report (April 2014)

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Appendix 2 : Groundwater Monitoring Report (AGE 2014)

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Appendix 3: F3 Freeway Air Quality Assessment (SLR 2014)

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Appendix 4: PM2.5 Impacts - Additional Information (SLR 2014)

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Appendix 5: Land Values Report (Baker & Magin 2008)

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Appendix 6: Subsidence Assessment for Buttonderry WMF (DgS 2014)

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