Centennial Coal

CENTENNIAL MANDALONG PTY LTD

Mandalong Mine

ANNUAL REVIEW

March 2016

Centennial Coal Environment Matters

Annual Review Title Block

Name of Operation	Mandalong Mine
Name of Operator	Centennial Mandalong Pty Ltd
Development Consent/ Project Approval #	SSD-5144, SSD-5145, DA97/800, DA 35-2-2004.
Mining Lease #	Mining Lease 1431 Mining Lease 1443 Mining Lease 1543 Mining Lease 1553 Mining Lease 1722 Mining Lease Application 457
Name of Holder of Mining Lease	Centennial Mandalong Pty Ltd
Water License #	20BL173524
Name of Holder of Water License	Centennial Mandalong Pty Ltd
MOP/RMP Start Date	1 January 2014
MOP/RMP End Date	30 November 2016
Annual Review Start Date	1 January 2015
Annual Review End Date	31 December 2015

I, Mick Cairney[1], certify that this audit report is a true and accurate record of the compliance status of Centennial Mandalong for the period 1 January to 31 December 2015 and that I am authorized to make this statement on behalf of Centennial Mandalong Pty Ltd.

Note:

a) *The Annual Review is an 'environmental audit' for the purposes of s122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion) in an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, $1 million and for an individual, $250,000.*

b) *The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (intention to defraud by false or misleading statement – maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents –maximum penalty 2 years imprisonment or $22,000,or both).*

Name of Authorised Reporting Officer	Mick Cairney
Title of Authorised Reporting Officer	Executive General Manager Operations
Signature of Authorised Reporting Officer	M Cairney
Date	23.3.16

[1] An **Authorised Reporting Officer** for the purposes of this Annual Review is a director of the subsidiary with the management responsibility of the operation for which this review has been generated.

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1 STATEMENT OF COMPLIANCE

Table 1: Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
DA97/800 (MOD10)	No
SSD-5144	Yes
SSD-5145	Yes
DA35-2-2004	Yes
EPL 365	No
Mining Lease 1431	Yes
Mining Lease 1443	Yes
Mining Lease 1543	Yes
Mining Lease 1553	Yes
Mining Lease 1722	Yes
20BL173524	Yes

Table 2: 2015 Non-Compliances

Relevant Approval	Condition #	Condition summary	Compliance Status	Comment	Table # Addressed in Annual Review
EPL365	M2.4	Monitoring and Recording Conditions	Administrative	Non-compliance with EPL365 Condition M2.4 as a result of not collecting a grab sample for a discharge from LDP001 at Cooranbong on 4 April 2015.	**Table 38**
EPL365	L5.1	Noise Limits	Low	A noise criteria exceedance was recorded at M9 (Mandalong Mine – Gimberts Road monitoring location) where an exceedance of the 45dBa LA (1 minute) night-time sleep disturbance criteria occurred due to a measured level of 57dBa being recorded.	**Table 39**
EPL365	M2.4	Monitoring and Recording Conditions	Administrative	Non-compliance with EPL 365 Condition M2.4, as a result of not collecting grab samples at LDP001 between 25 and 28 December 2015. Mandalong had planned to cease pumping and discharge from LDP001 during this period.	**Table 40**

Relevant Approval	Condition #	Condition summary	Compliance Status	Comment	Table # Addressed in Annual Review
DA97/800 (MOD10)	Condition 44	Noise & Vibration	Low	A noise criteria exceedance was recorded at M9 (Mandalong Mine – Gimberts Road monitoring location) where an exceedance of the 45dBa LA (1 minute) night-time sleep disturbance criteria occurred due to a measured level of 57dBa being recorded.	**Table 39**

Note: Compliance Status Key for Table 2

Risk Level	Colour Code	Description
High		Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium		Non-compliance with: • Potential for serious environmental consequences, but is unlikely to occur; or • Potential for moderate environmental consequences, but is likely to occur
Low		Non-compliance with: • Potential for moderate environmental consequences, but is unlikely to occur; or Potential for low environmental consequences, but is likely to occur
Administrative		Only to be applied where the non-compliance does not result in any risk of environmental harm (eg submitting a report to government later than required under approval conditions)

2 INTRODUCTION

Mandalong Mine is owned and operated by Centennial Mandalong Pty Ltd (Centennial Mandalong), a subsidiary of Centennial Coal Company Limited ('Centennial'). Centennial completed the purchase Mandalong Mine in August 2002. Centennial was subsequently purchased by Banpu Public Company Limited ("Banpu") in October 2010.

Mandalong Mine is a modern underground longwall operation located on the western side of Lake Macquarie near Morisset and west of the M1 Motorway. The Mine is situated approximately 130 km north of Sydney and 50 km from the Port of Newcastle, supplying up to six million tonnes of coal to the domestic power and export markets (**Figure 1**).

Figure 1: Regional Context

2.1 OVERVIEW

Mandalong Mine comprises the underground workings and surface infrastructure of:

- The Mandalong Mine underground workings including longwall panels, development units and surface infrastructure located near Morisset;
- The Cooranbong Entry Site, consisting of the Cooranbong Colliery underground workings and surface infrastructure located near Dora Creek;
- The proposed new surface facilities site, referred to as the Mandalong South Surface Site located off Mandalong Road; and
- The Delta Entry Site, which encompasses an entry and coal delivery system, located near Wyee at the Vales Point Rail Unloader Facility.

An Environmental Impact Statement (EIS) was submitted in 1997 and a Commission of Inquiry held in 1998. The Mine was granted development consent DA 97/800, in October 1998. After obtaining development consent, Centennial constructed the Mandalong Mine site and decline tunnel to access the Mandalong mining area. Longwall mining operations at Mandalong commenced in January 2005. The Mine has approval to extract up to six million tonnes per annum of coal from the West Wallarah Seam using the longwall mining method.

Development consent DA 35/2/2004 granted in July 2004 by the then NSW Department of Planning & Infrastructure approved the construction and operation of the coal handling and clearance system at the Delta Entry Site. Construction of the Delta Coal Clearance System was completed in 2006. The Cooranbong Entry Site and the Delta Entry Site contain coal handling infrastructure, enabling the Mandalong Mine to process and convey as permitted by their respective development consents up to ten million tonnes of coal per annum. These sites are maintained under current mine leases as detailed in **Table 4**.

Development consent SSD-5144 was granted by the Planning & Assessment Commission (PAC) on 12 October 2015. As per Condition 13 of Schedule 2 of SSD-5144, Centennial Mandalong shall surrender DA97/800 by 30 April 2017, or as otherwise agreed by the Secretary of the Department of Planning & Environment in accordance with Section 104A of the Environmental Planning and Assessment Act 1979 (EP&A Act).

2.2 SCOPE

This Annual Review details the progress of environmental management covering Mandalong Mine, Cooranbong Entry Site and Delta Entry Site collectively, for the period 1 January 2015 to 31 December 2015. The Annual Review has been prepared in accordance with the Mandalong Mine conditions of consent as detailed in SSD-5144 and DA 97/800.

Development Consent SSD-5145 (Northern Coal Logistic Project) was approved by the DPE on 29 September 2015. The approval consolidates the receipt, handling, processing and transport of run-of-mine coal from Centennial Coal's underground operations at Mandalong Mine, Newstan Colliery and Awaba Colliery.

This Annual Review document also addresses the requirements of Schedule 5, Condition 11 of SSD-5145 for the Cooranbong Entry Site (CES). The others operations covered by SSD-5145 are described in the Newstan Annual Review required by SSD-5145.

2.3 SUMMARY OF WORKS

2.3.1 Mandalong Mine

The majority of construction activities at the Mandalong Mine were completed by the end of 2004 in preparation for the workforce relocating from Cooranbong Colliery. In November 2004 Mandalong Mine became an operating mine site with personnel accessing the Mandalong underground workings via the decline tunnel. Completed facilities at the Mandalong Mine Site (refer to **Plan MG12032-1**) include:

- Surface to underground decline (1 in 8 gradient – 1400 metres in length);
- Bathhouse and Administration buildings;
- Store Warehouse;
- Diesel Refuelling Station and Storage Shed;
- Machinery Washdown Bay;
- Mechanical Workshop;
- Equipment and materials storage areas;
- Fire Fighting and Emergency Equipment Store;
- Compressor Sheds;
- Electrical Sub-Station;
- Mine Fan;
- Methane Gas Drainage Plant;
- Two Gas Flares;
- VAM-RAB Facility (methane abatement demonstration plant;
- Solcenic Mixing Plant; and
- Waste sorting area.

Construction of the VAM-RAB facility adjacent to the Mine's ventilation fan was completed in 2013. Civil works for construction of the gas flares was also completed in 2013, with automated operations also commencing in 2013. Further details on both the VAM-RAB facility and the gas flares are provided in **Section 6** of the Annual Review.

2.3.2 Delta Entry Site

The Delta Entry Site consists of the Delta Coal Clearance System and decline tunnel (refer to **Plan MG12032-3**). The Delta coal clearance system conveys coal from the underground mining areas by a 4.5 km long underground conveyor within the coal seam. Coal is then conveyed up the decline tunnel, to the surface at the Delta Entry Site. At the surface coal is transported by conveyor to the transfer tower and then into the crusher building to be sized. After coal is sized it is then transported by conveyor onto the Wyee overland conveyor and supplied to the Vales Point Power Station.

Construction on the coal conveyor systems was completed by the end of 2005.

2.3.3 Cooranbong Entry Site

The Cooranbong Entry Site consists of a Coal Handling Plant (CHP) and mine support infrastructure which includes decline tunnels, coal stockpiles, conveyors, mine fan, and

workshop buildings. The CHP and supporting infrastructure remain in use at the Cooranbong Entry Site to supply coal to the Eraring Power Station.

Construction of the approved CHP upgrades commenced in June 2009 with the removal of the decommissioned north drift conveyor gantry and drive head buildings. Construction of the CHP upgrades and haul road were completed in May 2010. The CHP and road haulage infrastructure is shown in **Plan MG12032-3** and consists of:

- Installation of new prefabricated aerial conveyor system;
- The installation of a 1200T truck loading bin;
- The construction of infrastructure for a nominal 100 000 T ROM stockpile;
- Upgrade works to the existing CHP (ROM bin) to maximise throughput;
- The installation of new electrical systems, incorporating energy saving components;
- The installation of a Plant Control System, incorporating remote monitoring via camera systems, and improved diagnostics to reduce plant downtime;
- Construction of internal road network capable of supporting B-Double haul trucks;
- A 100T, 27 m long truck weighbridge;
- Security fencing; and
- Drainage and water treatment systems to contain and manage dirty water from the new ROM, conveyor and road network.

Coal loading and haulage operations from the truck loading bin and 100 000 T ROM stockpile in 2015 were undertaken by Qube (Giacci Bros Pty Ltd). Coal handling operations were undertaken by Transfield at the Cooranbong CHP. Coal deliveries to customers in 2015 are described in **Table 5** and **Table 6**.

2.3.4 Cooranbong Haulage Road

A 3.5 kilometre section of new private haul road and rail overpass bridge was constructed in 2009 and 2010 immediately north of Cooranbong Entry Site and connects with the existing Newstan – Eraring private haul road. This haul road is designed to facilitate the transport of coal from the Mandalong Mine to the Newstan Colliery surface facilities for processing and transport into the export market.

The Cooranbong Haul Road provides the benefit that coal trucks do not need to use public roads and reduces the noise and dust impacts on the local community. The road was constructed along a horizontal alignment which has been selected to avoid threatened flora species and minimise environmental impact.

The construction consisted of stripping topsoil/vegetation to an average depth of 100 mm across the whole site, approximately 260,000 m^3 of cut to fill in clay, highly weathered rock, and moderately weathered rock which was carried out to achieve pavement sub-grades and the overall formation levels. The pavement material was imported to satisfy the structural requirements of the design life and criteria. The road is sealed with asphalt, line marked and signposted to Australian standards.

A new overpass Bridge approximately 33m long, 11m wide was constructed over the Main Northern Railway to the approved design and methodology of Railcorp. The bridge is a single span concrete structure with precast concrete Super-T girders.

Drainage culverts were installed in four locations to maintain existing creek flows. Several fauna overpass and underpass structures were included in the construction. Several sediment basins were installed to manage dirty water from the roadway and clean water diversion drains were constructed to intercept water from entering the dirty water system to avoid contamination. The entire western length of the haul road is fenced with fauna friendly security chainmesh.

The Cooranbong Haul Road is located within Consolidated Coal Lease (CCL) 746 and is therefore included in the Newstan Rehabilitation Cost Estimate (RCE).

Table 3: Centennial Mandalong Environmental Contact Details

Name	Position	Email	Phone
John Turner	Mine Manager	john.turner@centennialcoal.com.au	02 49730911
Jeff Dunwoodie	Environment & Community Coordinator	jeffrey.dunwoodie@centennialcoal.com.au	02 49730947
Phil Enright	Mining Approvals Coordinator	phil.enright@centennialcoal.com.au	02 49730948

3 APPROVALS

Table 4: Environmental approvals held by Centennial Mandalong.

Name	Description	Issued By	Expiry Date	Renewal Procedure
Consolidated Coal Lease 762	Title to Cooranbong Workings includes some surface land, some environmental conditions	Dept. Primary Industry (Mineral Resources)	13/10/2022	Manager Title and Property- North
Consolidated Coal Lease 746 (sublease)	Title for Cooranbong Workings includes some surface land – some environmental conditions	Dept. Primary Industry (Mineral Resources)	31/12/2028	Manager Title and Property- North
Mining Purposes Lease 191	Title to surface land for water tanks at Cooranbong – requires annual environmental management report on anniversary	Dept. Primary Industry (Mineral Resources)	24/2/2023	Manager Title and Property- North
Mining Purposes Lease 329	Title to surface land for old water supply line from Eraring Power Station – requires annual environmental management report on anniversary	Dept. Primary Industry (Mineral Resources)	4/8/2015	Manager Title and Property- North This MPL is surplus to requirements and will not be renewed
Mining Lease 1443	Mandalong Project Mining Lease – includes some surface land	Dept. Primary Industry (Minerals Resources)	01/03/2020	Manager Titles and Property- North
Mining Lease 1431	Title to surface land for proposed shaft at the back of Morisset	Dept. Primary Industry (Mineral Resources)	27/5/2019	Manager Titles and Property- North
Mining Lease 1543	Mining Lease – Mandalong Mine Project	Dept. Primary Industry (Mineral Resources)	25/11/2024	Manager Titles and Property- North

Name	Description	Issued By	Expiry Date	Renewal Procedure
Mining Lease 1553	Mining Lease Delta Link Project – includes surface land	Dept. Primary Industry (Mineral Resources)	07/09/2025	Manager Titles and Property- North
Mining Lease 1722	Mining Lease – Mandalong Southern Extension Project	NSW Industry – Resources & Energy	12/12/2036	Manager Titles and Property - North
Mining Lease Application 457 (MLA 457)	Assessment process Mining Lease – Mandalong Southern Extension Project	NSW Industry – Resources & Energy		Manager Titles and Property – North
Exploration Licence 6317	Exploration Licence (renewed 2nd Nov 2009)	Dept. Primary Industry (Mineral Resources)	08/08/2019	Manager Titles and Property- North
Exploration Licence 4443	Exploration Licence	Dept. Primary Industry (Mineral Resources)	23/10/2017	Manager Titles and Property- North
Exploration Licence 4968	Exploration Licence	Dept. Primary Industry (Mineral Resources)	31/07/2017	Manager Titles and Property- North
Exploration Licence 4969	Exploration Licence	Dept. Primary Industry (Mineral Resources)	31/07/2017	Manager Titles and Property- North
Exploration Licence 5892	Exploration Licence	Dept. Primary Industry (Mineral Resources)	31/07/2017	Manager Titles and Property- North
Authorisation 404	Exploration Licence	Dept. Primary Industry (Mineral Resources)	31/07/2017	Manager Titles and Property- North

Name	Description	Issued By	Expiry Date	Renewal Procedure
Mine Operations Plan (MOP)	Summary of Mining Activities – Mandalong	NSW Trade & Investment – Division of Resources & Energy	30/11/2016	MOP Amendment B approved for the period 1 December 2014 to 30 November 2016.
Environmental Protection Licence 365	Permits scheduled activity “coal mining” and discharge of water from licensed discharge points.	Environment Protection Authority	Perpetual	Requires payment and Annual Return February each year
Mandalong Mine Development Consent No.97/800	Permits development and works to occur as described in the EIS.	NSW Department of Planning	October 2020	Requires new development consent after expiry date.
Mandalong Mine Development Consent No. DA 35-2-2004	Permits construction and operation of the Delta Coal Handling Facility	NSW Department of Planning	July 2021	Requires new development consent after expiry date.
Mandalong Mine Development Consent SSD-5144	Extension of underground operations into the Mandalong Southern Extension Area.	NSW Department of Planning & Environment	31/12/2040	Requires new development consent after expiry date.
Centennial Norther Coal Services Development Consent SSD-5145	Receipt, handling, processing and transport of run-of-mine coal from Centennial Coal’s underground operations at Mandalong Mine, Newstan Colliery and Awaba Colliery.	NSW Department of Planning & Environment	31/12/2045	Requires new development consent after expiry date.
Cooranbong Borehole 20BL173524	Dewatering of Mine Workings	DPI - Water	23/7/2016	Submit renewal application
Radiation Licence RL46639	Radiation management	Environment Protection Authority	26/6/2016	Submit renewal application

3.1 DEVELOPMENT CONSENTS

The Mandalong Mine, which is an extension of the old Cooranbong Colliery, was originally granted Development Consent DA 97/800 by the then Minister for Urban Affairs and Planning on 14 October 1998 under Part 4 of the EP&A Act following the submission of the *Cooranbong Colliery Life Extension Project Environmental Impact Statement* (Umwelt, 1997) and a Commission of Inquiry. The currently approved Mandalong Mine comprises the underground workings and surface infrastructure of the:

- Mandalong Mine, including the Mandalong Mine Access Site, encompassing underground workings and associated surface infrastructure near Morisset;
- Cooranbong Entry Site encompassing a coal delivery system and surface infrastructure (coal handling and processing) near Dora Creek; and
- The proposed new surface facilities site, referred to as the Mandalong South Surface Site located off Mandalong Road.

The other operations directly related to the currently approved Mandalong Mine are the two components which comprise the Delta Link Project, namely:

- The construction and use of the Mandalong Coal Delivery System for the underground transportation of coal from the Mandalong Mine to the Delta Entry Site; and
- The receipt and handling of coal at the Wyee Coal Handling Plant at the Delta Entry Site.

The approved Mandalong Mine, and the other operations which directly relate to it, are currently regulated by five planning approvals.

Development Consent SSD-5144 for the Mandalong Southern Extension Project

Development Consent SSD-5144 was granted by the Planning & Assessment Commission (PAC) on 12 October 2015 for the Mandalong Southern Extension Project.

The primary components of the Project are:

- Continue the currently approved operations at the Mandalong Mine, with the exception of the surface infrastructure and operations at the Cooranbong Entry Site (i.e. the continued use of the coal delivery system, the ventilation shaft and the extent of workings at Cooranbong Entry Site for water management.) Note: The surface infrastructure and operations at the Cooranbong Entry Site are part of the Northern Coal Logistics Project SSD-5145, however continue to be managed by Centennial Mandalong;
- Extend the Mandalong Mine's underground mining operations into the area covered by EL 6317 (Southern Extension Area) using a combination of continuous miner and longwall mining methods;
- Extract up to 6 Mtpa of ROM coal from the West Wallarah and Wallarah-Great Northern Seams within the current mining lease areas and the area covered by EL 6317;
- Deliver ROM coal from the underground workings to the Cooranbong Entry Site at a rate of up to 6 Mtpa and to the Delta Entry Site at a rate of up to 6 Mtpa;
- Continue to utilise, and upgrade where required, the existing surface infrastructure of the Mandalong Mine Access Site and Delta Entry Site;
- Install and operate surface infrastructure at the proposed Mandalong South Surface Site to service the extended underground mining operation;

- Increase manning to 420 full-time employees and up to 50 contractors during longwall relocations;
- Undertake on-going exploration drilling activities within the bounds of Centennial Mandalong's mining leases and exploration licences;
- Increase the life of mine to 25 years from the granting of a mining lease(s) over EL 6317; and
- Continue to operate 24 hours per day, seven days per week.

Development Consent DA 97/800 for the Mandalong Mine - being development application DA 97/800 lodged with LMCC on 27 November 1997 and described in the *Cooranbong Colliery Life Extension Project Environmental Impact Assessment* (Umwelt, 1997), including the Applicants submissions to the Commission of Inquiry, and as modified on nine occasions as follows:

- **MOD 1 (August 2001) -** minor changes to the conditions of consent relating to the preparation of subsidence management plans and notification of landholder requirements, as described in the modification application dated 29 March 2001.
- **MOD 2 (February 2005) -** installation of methane drainage plant and the transport of 1,000 tonnes of mined coal by road, as described in *Mandalong Mine Methane Drainage Plant and Coal Haulage, Statement of Environmental Effects*, dated 28 October 2004 and prepared by Sinclair Knight Merz.
- **MOD 3 (March 2006) -** installation and operation of enclosed methane gas flare units for high purity methane drainage gas. This was undertaken in response to condition 60a(iii) imposed as part of MOD 2, which required Centennial Mandalong to submit a report on the progress towards implementing greenhouse gas abatement measures. This modification is as described in the *Statement of Environmental Effects for the Installation and Operation of Enclosed Methane Gas Flare Units*, dated February 2006 and prepared by Umwelt.
- **MOD 4 (July 2009) -** installation and operation of gas engines (yet to be constructed) to produce up to 12 megawatts of electricity using high purity methane drainage gas, increase the coal production rate from 4 Mtpa to 6 Mtpa, relocate a ballast borehole and update subsidence conditions. This modification is as described in the Environmental Assessment entitled *Mandalong Mine Modification to Development Consent Environmental Assessment*, dated September 2008.
- **MOD 5 (November 2009) -** coal from Mandalong Mine (Cooranbong Entry Site) permitted to be washed at Newstan Colliery and a temporary increase in the volume of coal transported by conveyor from the Cooranbong Entry Site to the Eraring Power Station stockpiles for subsequent road haulage to Newstan Colliery (until construction of the Cooranbong Private Haul Road was complete). This modification is as described in the Statement of Environmental Effects entitled *Washing of Mandalong Coal at Newstan Section 96(A) Application Statement of Environmental Effects*, dated October 2009.
- **MOD 6 (November 2009) -** changes to the locations and heights of approved (but not previously constructed) coal handling infrastructure at the Cooranbong Entry Site. This modification is as described in the Statement of Environmental Effects entitled *Relocation of Infrastructure within the Mandalong Services Site Section 96(1A) Application Statement of Environmental Effects*, dated November 2009.
- **MOD 7 (October 2011) -** installation and operation of a new technology known as a ventilation air methane regenerative after burner (VAM-RAB) as a trial unit to demonstrate the ability of the technology to capture and abate ventilation air methane from the underground mine. This modification is as described in the *Environmental Assessment: Ventilation Air Methane Abatement Demonstration Project, Mandalong Mine – Section 75W Modification*, dated June 2011 and additional information

provided in the document entitled *Mandalong Mine Ventilation Air Methane Abatement Demonstration Project – Response to Submissions* dated September 2011.

- **MOD 8 (August 2012) -** increase in the volume of coal permitted to be transported from the Cooranbong Entry Site to both Newstan Colliery and the Eraring Power Station from 2 Mtpa to up to 4 Mtpa and back haulage of middlings (middle quality coal product) from Newstan Colliery to the Cooranbong Entry Site for subsequent supply to the Eraring Power Station. This modification is as described in the *Environmental Assessment: Mandalong Mine – Cooranbong Entry Site – Cooranbong Distribution Project – Section 75W Modification to Development Consent DA 97/800*, (GSS Environmental, 2012) and additional *Noise Mitigation Assessment*, dated 31 May 2012.
- **MOD 9 (February 2013) -** administrative amendment to conditions 1A(c) and (d) to allow the coal delivery limits approved as part of MOD 8 (i.e. up to 4 Mtpa from Cooranbong Entry Site to both Newstan Colliery and the Eraring Power Station).
- **MOD 10 (November 2014) -** a minor modification to conditions 1A(b) and 1A (c) for a small increase in the amount of coal allowed to be delivered from the underground workings to the Cooranbong Entry Site from 4 Mtpa to 4.1 Mtpa in 2014 only.

Development Consent DA 35-2-2004 for the Delta Entry Site – being for the transportation of coal to the Delta Entry Site via the underground Mandalong Coal Delivery System, as approved by development consent DA 35-2-2004 and described in the *Delta Link Project – Statement of Environmental Effects* (Umwelt, 2004). This development consent is held by Centennial Mandalong.

Development Consent DA 2501/2004 for the Wyee Coal Handling Plant at the Delta Entry Site – as approved by development consent DA-2501/2004 and described in the *Delta Link Project – Statement of Environmental Effects* (Umwelt, 2004) and revised information letter dated 27 April 2004. This development consent is held by Delta Electricity.

Development Consent SSD-5145 for Northern Coal Logistics Project

Development Consent SSD-5145 for the Northern Coal Logistic Project was approved by the DPE on 29 September 2015. The approval consolidates the receipt, handling, processing and transport of run-of-mine coal from Centennial Coal's underground operations at Mandalong Mine, Newstan Colliery and Awaba Colliery.

The surface infrastructure and operations at the Cooranbong Entry Site are part of the Northern Coal Logistics Project SSD-5145, however continue to be managed by Centennial Mandalong.

3.2 MINING AUTHORITIES

The Mandalong Mine holding comprises a number of leases as shown in **Table 4**. Mining Lease 1722, covering the Mandalong Southern Extension Project was granted by DRE on 12 December 2015.

3.3 ENVIRONMENT PROTECTION LICENCE

Centennial Mandalong holds Environment Protection Licence (EPL) 365 under the Protection of the Environment Operations Act 1997 for the Mandalong Mine, Cooranbong Entry Site and the Delta Entry Site.

3.4 AUTHORISATIONS & EXPLORATION LICENCES

The Mandalong Mine holding comprises a number of leases as shown in **Table 4**.

One Mandalong Mine Exploration Licence was renewed during 2015. EL6317 (Mandalong Southern Extension Area) was renewed on 27 March 2015.

One amendment was made to the current MOP in 2015. Amendment A was approved by DRE on 13 October 2015 to extend the MOP period for a further 12 months from January 2014 to 30 November 2016 to allow for the Mandalong Southern Extension approval.

3.5 CONSENT CONDITIONS – ANNUAL REVIEW REQUIREMENTS

Condition 12 of Schedule 6 of SSD-5144 and Condition 11 of Schedule 5 of SSD-5145 include the requirements for the Annual Review. Conditions 105-107 of DA97/800 (MOD 10) also detail requirements for an Annual Environmental Management Report (AEMR) (now referred to as an Annual Review). Condition 15 of the Delta Entry Site Development Consent (DA 35-2-2004) requires an Annual Report to be submitted as part of the Mandalong Mine AEMR.

The 2014 Annual Review (Centennial Mandalong, 2015a) was provided to DPE, DRE, LMCC, NOW, EPA, OEH and the Mandalong Mine CCC consistent with DA97/800 condition 106(i).

As required by DA97/800 consent condition 105(v) a listing of any variations to approvals during the reporting period are provided in **Table 4**.

DA97/800 Consent Condition 24 requires a Land Access, Management and Compensation Security in the form of a Bank Guarantee and that evidence of the Guarantee shall be provided in the Annual Review. A copy of the current Bank Guarantee is included in **Appendix 1**.

4 OPERATIONS SUMMARY

Table 5: Production Summary & Forecast

Material	Approved Limit (and source)	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
Waste Rock/ Overburden	N/A			
ROM Coal	6 MTPA	5,939,001	5,704,663	5,999,998
Coarse reject	N/A			
Fine reject (Tailings)	N/A			
Saleable product	6 MTPA	5,873,159	5,679,309	5,980,998

4.1 OTHER OPERATIONS

Table 6: Operations Summary

	Approved Limit (and source)	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Comment
Hours of operation	24/7	24/7	24/7	
Transport (rail)	N/A			
Product to Vales Point PS	4 MTPA	1,856,298	1,606,547	
Mandalong to Cooranbong	6 MTPA	4,082,703	4,098,116	
Product to Eraring PS	6 MTPA	2,691,270	2,773,359	
Cooranbong to Newstan for Washing	6 MTPA	1,408,503	1,432,645	

4.2 EXPLORATION

Centennial Mandalong only drilled one exploration borehole in 2015, CM124. Drilling commenced on 9 December 2014 and was completed on 15 January 2016.

An application to relocate four holes (F5, X, Y and Z) approved under "*Mandalong Mine Review of Environmental Factors Modification No.3*" (SLR, 2013b) was submitted to DRE with approval received on 21 July 2015. An ESF4 application form was also lodged with the DRE on 17 November 2015 for the above four boreholes, with approval received on 19 November 2015.

Only three surface exploration boreholes are scheduled to be drilled in 2016 at approved locations X, Z & U (all on private property).

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

Mandalong, Cooranbong Entry Site and Delta Entry Sites

DRE in their letter dated 29 June 2015 found that the 2014 Annual Review was acceptable for the reporting period and completed a site inspection on12 June 2015. In the course of the DRE inspection, some issues were identified that either required comment or continued management as detailed in **Table 7**.

DPE provided correspondence dated 30 April 2015 which sought clarification on information regarding some DA 97_800 conditions also completed a site inspection on 12 June 2015 as detailed in **Table 7**.

Table 7: Actions from Previous Annual Review

Action Required	Requested By	Action Taken	Where addressed in Annual Review
Clarify the performance indicators associated with assessing the general health of wetlands and report on the performance of the same in the AEMR.	DRE	Performance indicators for wetlands are included in **Table 16** of Section 5 – Wetland Monitoring of the 2015 Annual Review.	**Section 6.4**
Confirm if CCL746, which is held by Newstan, has been included in the RCE.	DRE	The Cooranbong Haul Road is located within Consolidated Coal Lease (CCL) 746 and is therefore included in the Newstan Rehabilitation Cost Estimate (RCE).	**Section 2.3.4**
Suggest the status of the exploration program be summarised within a table. It is suggested that the table also note a reference to DRE's "SDN Approval Reference" and "Date Relinquished".	DRE	Update included in 2015 Annual Review	**Section 4.2**
To comply with condition 105 provide further review of monitoring results and site environmental performance. Where possible provide data graphically and analyse results against previous years. In particular, where a management plan for an environmental aspect is required by the consent, results and performance should be described in the context of the objectives and schedules within	DPE	Data was provided graphically in the 2014 AEMR where possible. Monitoring results have been compared where predictions were included in the Cooranbong Colliery Life Extension Project EIS (Umwelt, 1997) or within the relevant modification environmental	The 2014 Annual Review was revised to address all DPE requirements and re-submitted to DPE on 29 June 2015.

Action Required	Requested By	Action Taken	Where addressed in Annual Review
the plan. Comment should be made on any trends in the site performance and compared against the impact predictions in the EA or any statutory requirements. This is required for, but is not limited, to:		assessments.	
• Noise & Blasting		2014 revised AEMR Section 5.5, 5.6 & Appendix 8.	
• Air Quality		2014 revised AEMR Section 5.1 with Figures 1 & 2 added.	
• Surface water quality		2014 revised AEMR Section 5.3 & Appendix 6. Figures 6 and 7 are included within this revision.	
• Flooding & flood study		2014 revised AEMR Section 5.10.1 & Appendix 9.	
• Erosion & sediment control		2014 revised AEMR Section 9	
• Flora & fauna		2014 revised AEMR Section 5.8.1, 5.8.2, Appendix 12 & 14.	
• Waste		2014 revised AEMR Section 4.3	
• Heritage & Archaeology		2014 revised AEMR Section 5.8.3	
• Rehabilitation		2014 revised AEMR Section 9	
• Groundwater Quality		2014 revised AEMR Sections 5.2.2 (Figures 3, 4 & 5 included in this revision), 8.1.3.2 & Appendix 5.	

Action Required	Requested By	Action Taken	Where addressed in Annual Review
In response to the access to information requirements consent condition 112 and 113, please ensure all documents required to be on the proponent website are available. If any documents are incomplete or awaiting approval, please provide a summary of all of the outstanding documents from the consent that are required on the website and their status.	DPE	All documents required to be publicly available on the website are currently available with the exception of the Environmental Management Strategy and the Water Management Plan. A revised version of the Environmental Management Strategy was submitted to the Department for approval on 13 October 2014. A revised version of the Water Management Plan (including the Erosion & Sediment Control Plan & the Groundwater Monitoring & Management Plan) were submitted to the Department for review on 30 October 2014. Despite follow-up requests a response has not been received from the Department on either document.	N/A
The description of production is to provide details of output using naming and terminology consistent with the wording of the Limits of Approval.	DPE	Table 4 in the 2014 revised AEMR has been updated to include the Limits of Approval.	Included in 2015 Annual Review in **Table 5** and **Table 6**.
In response to condition 65, that the floodpath assessment and reporting is conducted, in particular for the regional flood events that occurred in April 2015.	DPE	Floodpath inspections were conducted in May and June 2015 following the flood events. The results will be included in the 2015 AEMR.	Included in 2015 Annual Review in **Section 6.10** and **Appendix 2.**
Ensure documents listed in the AEMR 2015 appendix are listed in the contents page of the document.	DPE	All Appendices are listed in the 2014 revised AEMR Table of Contents on Page V.	Refer to Table of Content - Appendices
With reference to the subsidence information in Section 5.10.1, the Department requests that the	DPE	The remnant ponding as a result of subsidence at these locations were	The 2014 Annual Review was revised to

Action Required	Requested By	Action Taken	Where addressed in Annual Review
results and analysis of monitoring of remnant vegetation over longwalls 9-11 is supplied.		minor extensions only to the existing pre-mining ponding. Ponding over longwalls 9 – 11 occurs in woodland/forest vegetation and these areas have not been remediated because it has been judged that damage by machinery to habitat, particularly the threatened Melaleuca biconvexa, would be unacceptable (Hunter Eco, July 2013). This land was subsequently sold by Centennial Coal in 2015 and is now privately owned. Wetland 6 has also been removed from the monitoring program due to the activities of the private landholder.	address all DPE requirements and re-submitted to DPE on 29 June 2015.
Please provide an explanation for the absent date in Appendix 6 for surface water LDP001 discharge monitoring.	DPE	Discharge from LDP001 at the Cooranbong Entry Site did not occur between February and October 2014 due to a cessation in pumping for the replacement of the extraction Borehole Pump at Cooranbong. Section 5.3.1 of the 2014 revised AEMR has been updated to reflect this.	The 2014 Annual Review was revised to address all DPE requirements and re-submitted to DPE on 29 June 2015.
Ensure that for conditions 105, 106 and 107 monitoring results are graphed and analysed against previous years. Comment should be made on any trends and the site performance against impact predictions in the EA, management plans or any	DPE	As per point 1 for the revised 2014 AEMR. Centennial Mandalong will continue to make further improvements for the 2015 AEMR.	The 2014 Annual Review was revised to address all DPE requirements and re-submitted to

Action Required	Requested By	Action Taken	Where addressed in Annual Review
statutory requirements. Where applicable, results should be compared to TARP tables, objectives, modelling and predictions form all strategies, plans, programmes or review documents required in the consent.			DPE on 29 June 2015.

5.1 MINE WATER REDUCTION TARGETS

DA97/800 Condition 66 requires the mine to investigate opportunities to reduce mine water discharge at Mandalong and report on such in the Annual Review. The water balance model (GHD, 2016) estimated 890 ML of water from the underground mine and surface water discharge from LDP001 in 2015 which is higher than the water volume discharged in 2014 (254 ML). This is because discharge from LDP001 at the Cooranbong Entry Site did not occur between February and October 2014 due to a cessation in pumping for the replacement of the extraction Borehole Pump at Cooranbong.

Investigations into reducing the mine water discharge by recycling underground mine water were undertaken in 2009 and 2010. These included a water treatment options study and engineering design & feasibility assessments. The preferred option, recycling the underground mine water by treatment in a Reverse Osmosis (RO) plant, was assessed as not feasible for the Mine. The feasibility of the RO plant was limited due to the inability to discharge waste brine generated by the RO plant to receiving waters. Disposal methods, other than the discharge of waste brine, were cost prohibitive and not feasible at this stage. In addition the RO treatment plant was not capable of supplying mining equipment with potable water for 100% of the time as required by operations, due to equipment malfunction and routine maintenance requirements. Given the currently limited options for waste brine disposal and RO treatment plant availability the investigations conclude recycling of underground mine water by an RO treatment, does not at this time, provide a feasible business option to reduce mine water discharges from the Mine.

5.2 WASTE MANAGEMENT

All opportunities for waste avoidance and minimisation are considered by all staff and contractors across all areas including; contracts, purchasing, equipment procurement and waste generation processes.

Waste oil and greases are stored in tanks and drums within bunded areas for removal by a licenced waste management contractor for recycling or disposal. Oil water separation is achieved by the use of hydro-cyclone oil water separators at Mandalong and at the Cooranbong Entry Site on flows from vehicle work and storage areas and the wash down bays.

Hydrocarbon spill kits are inspected weekly by a licenced waste management contractor and re-stocked as required. Oily rag bins and oil filter bins are also serviced on a weekly basis.

Office paper and cardboard is collected and recycled by a licenced waste management contractor on a weekly basis. Metals are collected and stored in steel bins at Mandalong and the Cooranbong Entry Site. In 2015, a total of 568 tonnes of scrap steel was recycled. This is an increase compared to 2014 during which a total of 268 tonnes of scrap steel was recycled due to an ongoing major clean-up of equipment at Cooranbong.

General refuse and non-recyclable materials are sorted and stored in 30m steel bins at Mandalong and the Cooranbong Entry Site. The material was collected by a licenced waste management contractor for disposal in 2015. In 2015, 437 tonnes of refuse material was taken off-site for disposal which is a significant reduction compared with 544 tonnes of refuse material in 2014.

Of the total waste collected at Mandalong in 2015, 74% was recycled including steel, timber, liquid waste, oils, paper and cardboard, filters grease, oily rags and oil filters. This compares with a recycling result of 67% in 2014.

6 ENVIRONMENTAL PERFORMANCE

Condition 12 of Schedule 6 of SSD-5144, Condition 11, of Schedule 5 of SSD-5145 and Condition 105(iii) of DA97/800 (MOD 10) require the presentation and discussion on all monitoring required under the Development Consents and other approvals. **Table 8** includes a summary of the monitoring required by the Development Consents, current status and report section in the Annual Review

Table 8: Summary of Monitoring Requirements

Monitoring Type	Status	Report Section
Noise Monitoring	Annual survey	**Section 6.1**
Blast Monitoring	As required	**Section 6.2**
Air Quality Monitoring	Ongoing	**Section 6.3**
Independent Noise and Dust Monitoring	Not Requested	**N/A**
Greenhouse Gas reporting and abatement measures	Ongoing	**Section 6.3.6**
Groundwater Monitoring Surface Water Monitoring	Ongoing Ongoing	**Section 7.3.2** **Section 7.1**
Wetland Monitoring	Ongoing	**Section 6.4**
Rehabilitation Monitoring	Off-set area annual survey for first five years (commenced 2012).	**Section 6.5**
Meteorological Monitoring	Ongoing	**Section 6.7**

Delta Entry Site

Condition 15(a) of DA 35-2-2004 for the operation of the Delta Entry Site requires the reporting of the amount of coal transported on the Mandalong coal delivery system. This is reported in **Table 6** of the Annual Review. Condition 15(b) of the Delta consent requires groundwater monitoring data to be reported, which is also addressed in **Section 7.3.2** of this Annual Review.

6.1 NOISE MONITORING

Annual noise monitoring was conducted to assess operational noise levels compared to the noise limits specified by DA97/800 Consent Condition 44 and EPL 365 in accordance with the Noise Monitoring & Management Plan (NMMP). The Mandalong Mine Noise Monitoring Program requires Centennial Mandalong to survey noise from the operation annually.

Operator attended noise surveys were conducted during August 2015 at each of the nine (9) locations, with the exception of M1, (refer to **Table 2**) for a minimum of 1.5 hours during the day, 30 minutes during the evening and 1 hour during the night, to determine the character and relative contribution of ambient noise sources and mine contributions.

Measurements were conducted during typical worst case operational conditions for both Mandalong and Cooranbong Entry Sites in order to capture associated typical worst case noise emission levels.

The Cooranbong Colliery Life Extension Project EIS predicted that the noise emissions from the Mine Access Site during the operational phase at all the EIS assessment locations comply with or only marginally (1 or 2 dBa) exceed the recommended night-time noise limits, during neutral meteorological, adverse north-westerly winds and adverse temperature inversion conditions (Umwelt, 1997).

The noise impact assessment completed as part of the Cooranbong Distribution Project EA (GSS Environmental, 2012) predicted that operational noise levels at Cooranbong will meet the project-specific noise criteria at all nominated residential locations with the exception of Residences 23 and 26 under temperature inversion conditions. The noise impact assessment predicted that compliance with the project-specific noise criteria for Residences 23 and 26 will be achieved following the installation of cladding on the Cooranbong Coal Handling Plant and the with installation of an acoustic barrier adjacent to the export truck loading bin. Both of these projects were completed in 2013.

6.1.1 Summary of Noise Monitoring Results

SLR was engaged by Centennial Mandalong to conduct an annual noise compliance assessment for the Mandalong Mine and Cooranbong Entry Site in accordance with the Mandalong Mine Noise Monitoring Program.

Operator-attended noise measurements were conducted at the nine (9) focus locations surrounding the operations from during the day on Monday 10 August 2015 to Friday 14 August 2015. Measurements were conducted during worst case operational scenarios for both Mandalong and Cooranbong sites in order to capture associated worst case noise levels.

Mine operations noise contributions were found to be within the relevant consent conditions at all monitoring locations with the exception of M9 where an exceedance of the night-time sleep disturbance criteria was determined from an on-site alarm. Given the alarm external noise level was below 60 dBA and was a single event during the night, the measured exceedance is unlikely to cause any awakening reaction.

Noise monitoring in 2016 will be undertaken in accordance with the requirements of SSD-5144 and SSD-5145. A comparison with the noise predictions in the EIS documents for the Mandalong Southern Extension Project and the Northern Coal Logistics Projects will be provided in the 2016 Annual Review.

6.2 BLAST MONITORING

Mandalong

There was no blasting carried out at the Mandalong Mine in 2015.

Delta and Cooranbong Entry Sites

There was no blasting carried out at the Delta and Cooranbong Entry sites during 2015.

6.3 AIR QUALITY MONITORING

6.3.1 Mandalong

The Cooranbong Colliery Life Extension Project EIS stated that there were not expected to be any significant dust emissions during the operational phase of the Mandalong Mine Access Site as all coal will be conveyed underground from the site to the Coal Handling Plant at Cooranbong (Umwelt, 1997).

Depositional dust monitoring results are shown in **Table 10**.The results are presented as:

- Long-term average (all data since the commencement of monitoring at its present location - Sept 1999 to present);
- Average during the report period (January 2014 to December 2014); and
- Pre-construction average (September 1999 to August 2000).

Table 9: Description of Depositional Dust Gauges

Dust Gauge No.	Locality
D1	Cooranbong Entry Site (western boundary)
D4	41 Gradwells Road Dora Creek (near Cooranbong Entry Site)
D5	Northern end Mandalong Mine Site (Adjoining Property)
D6	Mandalong Mine Site Eastern Boundary (Near Sediment Basin)
D7	Rear of the former Project Office (Mandalong Site)
D8	West of main front entrance (Mandalong Site)
D9	184 Mandalong Road
D10	202 Mandalong Road West of Mandalong Mine
D11	North Western Boundary fence on Mandalong Mine

Table 10: Summary of depositional dust results between January 2015 and December 2015 surrounding Mandalong Mine.

	Insoluble Solids (Combustible Matter + Ash) g/m^2/month						
	DG5	**DG6**	**DG7**	**DG8**	**DG9**	**DG10**	**DG11**
Long Term Average	0.8	1.3	1.2	0.8	1.2	1.4	1.1
Average 2015 (Reporting Period)	0.5	1.0	1.3	0.6	0.6	1.1	0.7
Pre-Construction Average	0.7	0.8	3.4	0.8	0.9	*	*
EPA Dust Deposition Goal	4.0	4.0	4.0	4.0	4.0	4.0	4.0

* not available. Dust gauges installed after commencing construction.

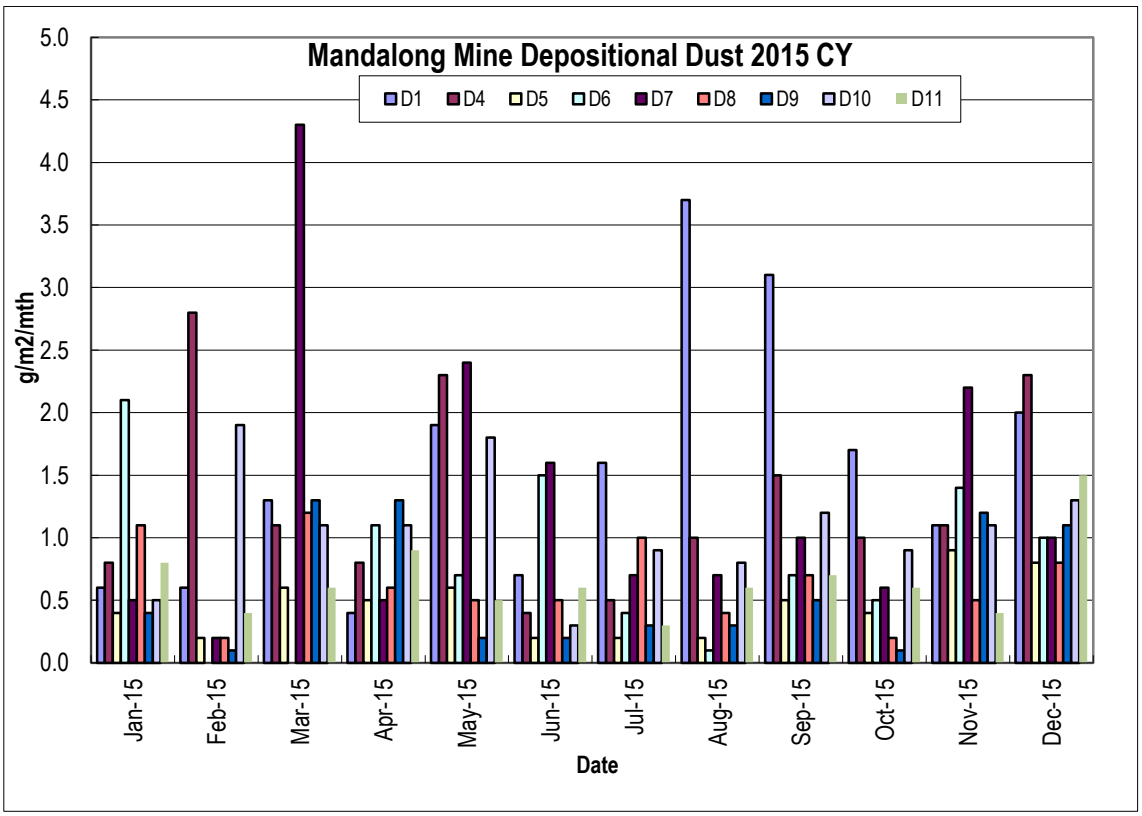


Figure 2: Depositional dust results surrounding Mandalong Mine for 2015

6.3.2 Delta Entry Site

Three dust deposition gauges were installed at the Delta Entry Site in July 2004. Table 11 details the location of the dust gauges and their localities are shown on plan **MG10722C**. These gauges were positioned to monitor depositional dust around the Delta Entry Site.

Table 11: Location of Delta Entry Site Depositional Dust Gauges

Dust Gauge No	Locality
DG1	North east side of settling ponds on decline site.
DG2	Main gates to decline off Rutley's Road.
DG3	Delta clearing left hand side Rutley's Road.

Depositional dust monitoring results are provided in **Table 12**. The complete monthly dust monitoring data for the Delta Entry Site are included in **Figure 3**.

Table 12: Summary of Depositional Dust Results between January 2015 and December 2015 surrounding Delta Entry Site

	Insoluble Solids (Combustible Matter + Ash) g/m^2/month		
	DG1	DG2	DG3
Long Term Average	0.7	0.8	0.7
Average 2015 (Reporting Period)	0.6	0.7	0.6
EPA Dust Deposition Goal	4.0	4.0	4.0

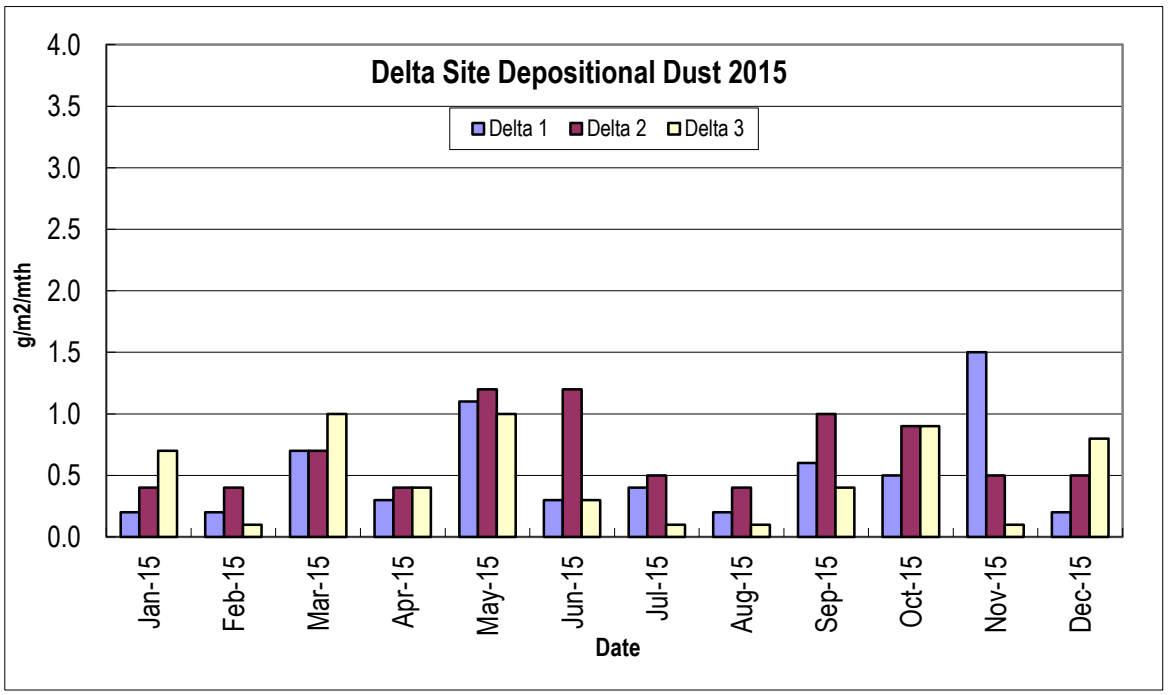


Figure 3: 2015 Depositional Dust Results for Delta Entry Site

6.3.3 Cooranbong Entry Site

The Cooranbong Colliery Life Extension Project EIS predicted that dust emissions from the operational phase of the Cooranbong Preparation Plan were unlikely to cause a dust nuisance due to the distance to sensitive receptors (Umwelt, 1997). The Cooranbong Distribution Project EA (GSS Environmental, 2012) and the Northern Coal Logistics Project EIS (March 2014) modelling predictions for dust deposition also show that incremental and cumulative annual average dust deposition rates are predicted to be well below the impact criteria of 2g/m^2/month and 4g/m^2/month (assuming a background rate of 1.2 g/m^2/month) at the nearest surrounding residences.

Annual average depositional dust results for 2015 and the EPA goal are provided in **Table 13**. The complete monthly dust monitoring data is provided in **Figure 2.**

Table 13: Summary of Depositional Dust Results between January 2015 and December 2015 surrounding the Cooranbong Entry Site.

	Insoluble Solids (Combustible Matter + Ash) g/m^2/month	
	DG1	**DG4**
Long Term Average	1.6	1.2
Average 2015 (Reporting Period)	1.6	1.3
EPA Dust Deposition Goal	4.0	4.0

6.3.4 Air Quality Monitoring Data Interpretation

6.3.4.1 Mandalong Mine & Cooranbong Entry Site

DA97/800 requires that the Mine does not increase the dust deposition rate by more than 2g/m^2/month, averaged over any 12 month period, as shown in **Table 10**, **Table 12** and **Table 13**. All dust gauges recorded depositional dust levels that averaged an increase of less than 2 g/m^2/month in the 12 month period.

All dust gauges recorded results as shown in **Table 10**, **Table 12** and **Table 13** are well below the EPA air quality goal of annual dust deposition of 4 g/m^2/month. Dust levels at DG 8, 10 & 11 located at the nearest sensitive receivers at the Mandalong Mine Access Site boundary were well below the EPA air goals, confirming that the activities had minimal impact on surrounding air quality in 2015 as predicted in the Cooranbong Colliery Life Extension Project EIS (Umwelt, 1997) and the Mandalong Southern Extension Project EIS (SLR, 2013a).

Dust levels at DG4 located at the nearest sensitive receivers and on the operational boundary at Cooranbong were well below the EPA air goals, confirming that the Cooranbong operational had minimal impact on surrounding air quality in 2015 as predicted in the Cooranbong Colliery Life Extension Project EIS (Umwelt, 1997), the Cooranbong Distribution Project EA (GSS Environmental, 2012) and the Northern Coal Logistics Project EIS (SLR, 2014c).

Dust gauges 5, 6, 8, 9, 10 and 11 recorded 2015 annual averages lower than their respective long term averages. Dust gauges 1 recorded an annual average equal to its long term averages while dust gauges 4 and 7 recorded annual averages slightly above the long-term average however; these increases were well below the EPA Air Quality Goals of 4 g/m^2/month.

All dust results for 2015 were well below the EPA annual dust deposition air quality goal of 4 g/m^2/month.

Table 14: Detailed Dust Monitoring and Analysis showing the Annual Rolling Average and Change in Deposition from the Pre-construction Average (PCA) for Dust Gauges DG6, DG8 and DG9.

	DG6			DG8			DG9		
Date	**Monitored Dust**	**Rolling Average (since 2012)**	**Change from PCA**	**Monitored Dust**	**Rolling Average (since 2012)**	**Change from PCA**	**Monitored Dust**	**Rolling Average (since 2012)**	**Change from PCA**
22/01/15	2.1	1.4	0.5	1.1	0.8	-0.1	0.4	0.9	-0.5
20/02/15	*	1.4	0.5	0.2	0.8	-0.1	0.1	0.9	-0.8
20/03/15	*	1.4	0.5	1.2	0.8	-0.1	1.3	0.9	0.4
20/04/15	1.1	1.4	0.5	0.6	0.8	-0.1	1.3	0.9	0.4
22/05/15	0.7	1.3	0.5	0.5	0.8	-0.1	0.2	0.9	-0.7
23/06/15	1.5	1.3	0.5	0.5	0.8	-0.2	0.2	0.9	-0.7
23/07/15	0.4	1.3	0.5	1.0	0.8	-0.1	0.3	0.9	-0.6
20/08/15	0.1	1.3	0.4	0.4	0.8	-0.2	0.3	0.9	-0.6
21/09/15	0.7	1.3	0.4	0.7	0.8	-0.2	0.5	0.9	-0.4
19/10/15	0.5	1.2	0.4	0.2	0.7	-0.2	0.1	0.8	-0.8
17/11/15	1.4	1.2	0.4	0.5	0.7	-0.2	1.2	0.8	0.3
17/12/15	1.0	1.2	0.4	0.8	0.7	-0.2	1.1	0.8	0.2

* Sample not collected due to contamination.

6.3.4.2 Delta Entry

Average annual depositional dust results for dust gauges DG1, DG2 and DG3 are relatively low. The highest average depositional dust rate for the period was 0.7 g/m^2/month for DG 2. All results are well below the EPA air quality goal of 4 g/m^2/month and are provided in **Table 12, Figure 3** and **Figure 4**.

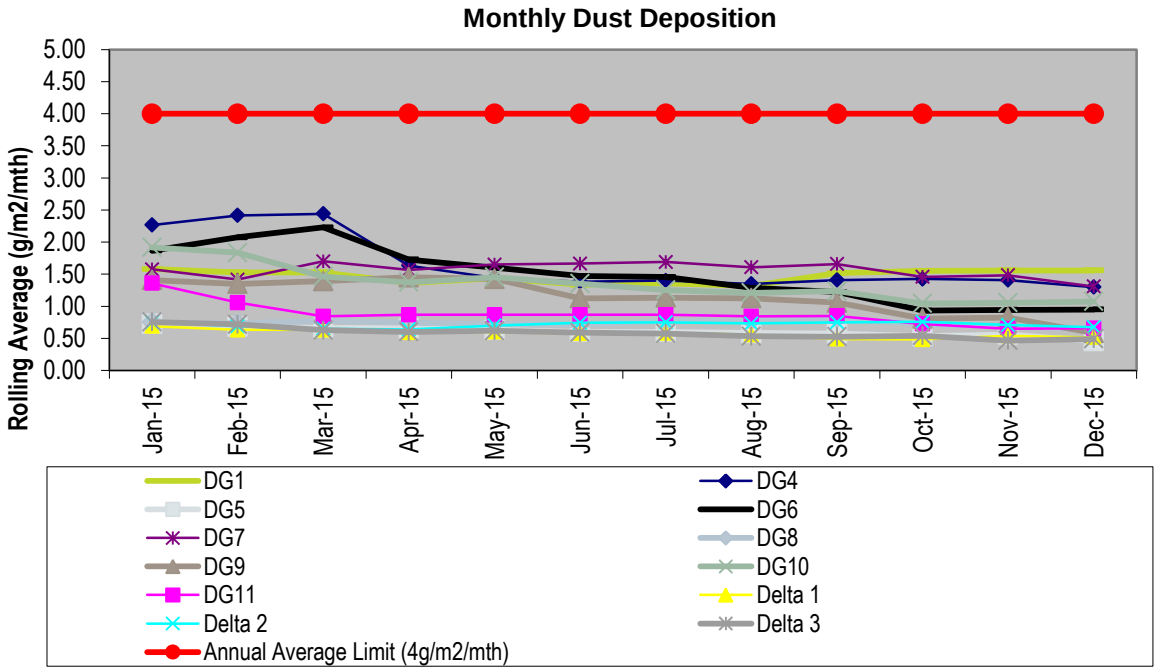


Figure 4: Monthly Rolling Annual Average Dust Deposition for 2015.

6.3.5 Particulate Matter

The Cooranbong Distribution Project EA (GSS Environmental, 2012) and the Northern Coal Logistics Project EIS (SLR, 2014c) both concluded that incremental and cumulative annual average TSP concentrations were predicted to be well below the impact criterion of 90 ug/m^3 at the nearest sensitive residences. The EA and the EIS also predicted that incremental and cumulative annual average PM10 concentrations will be below the impact criterion of 30 ug/m^3 at the nearest surrounding residences.

Continuous dust monitoring was installed in June 2013 at the Cooranbong Entry Site to monitor total suspended particles (TSP) and particulate matter (PM10) as per the condition M2.2 of EPL365. DA 97/800 and SSD-5145 require that air quality impacts at the Cooranbong Entry Site do not exceed the limit criteria of:

- 90ug/m^3 annual average for TSP;
- 30ug/m^3 annual average for PM10; and
- 50ug/m^3 24 hour average for PM10

TSP and PM10 monitoring results are shown in **Figure 5.** The results are presented as annual average for the monitoring period (July 2013 to December 2015). TSP and PM10 monitoring results to date since installation in June 2013 are in accordance with the predictions from the air quality impact assessment for the Cooranbong Distribution Project EA (GSS Environmental, 2012). TSP and PM10 monitoring results to date since October 2015 are in accordance with the predictions from the air quality impact assessment for the Northern Coal Logistics Project EIS (SLR, 2014c).

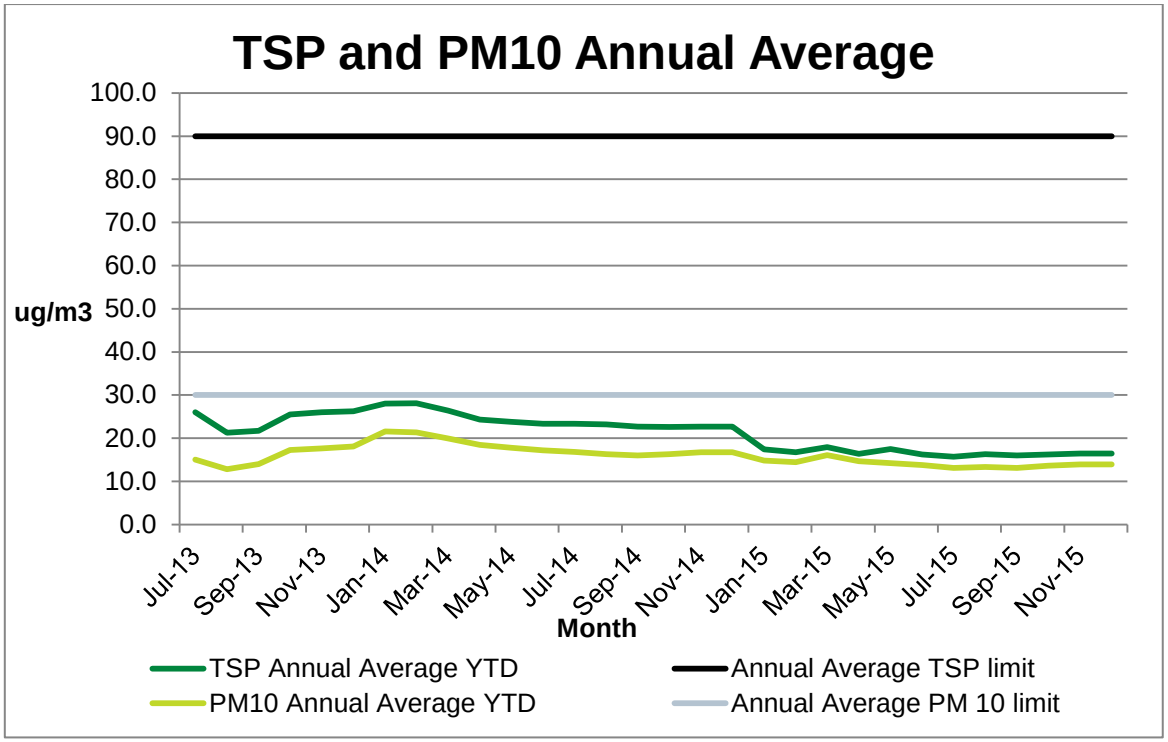


Figure 5: TSP and PM10 2015 Annual Rolling Average

6.3.6 Greenhouse Gas Monitoring

DA97/800 conditions 60A (i) & (iv) require Mandalong Mine to monitor greenhouse gas (GHG) emissions and report these in the Annual Review. In accordance with Centennial Coal's standard for GHG reporting the 2015 financial year (FY 1 July 2014 to 30 June 2015), emissions in CO2 equivalent tonnes (Co2-eT) as defined in the *National Greenhouse and Energy Reporting Act 2007* are provided in Table 15.Total GHG emissions for the 2015 FY period were 1,009,234 Co2-eT, which is higher than the 2014 FY emissions of 805,228 Co2-eT.

The majority of GHG emissions in 2015 were caused by fugitive methane contributing to 81 % of all GHG emissions. Mandalong Mine as discussed below is currently working towards GHG reduction measures to abate fugitive methane emissions.

Table 15: Total GHG Emissions from Mandalong Mine in 2015 Financial Year

Emissions Summary (Co2-eT) July 2014 to June 2015	Total
Electricity	62,039
Diesel	2,258
Petroleum Based Oils and Greases (PBOG)	168
SF6	7
Fugitives - CH4	817,409
Fugitives - CO2	39,161
Surface Fugitive - Post Mining	88,198
TOTAL	**1,009,234**

6.3.7 Greenhouse Gas Abatement Investigations Measures

As reported previous Annual Reviews, Centennial Coal has invested in technologies to reduce fugitive methane GHG emissions from the Mandalong Mine. A three stage process is planned to address this Greenhouse Abatement. Construction of Stage 1 and Stage 2 were completed in November 2013.

Stage 1 Gas Flares - A consent modification approval was obtained in 2005 to construct multiple enclosed flares planned to be used to reduce fugitive methane GHG emissions from the Mine's surface gas drainage plant. Civil works for construction of the gas flares commenced in October 2012, with final commissioning completed and automated operations commencing in November 2013. The construction of the enclosed gas flare will assist with abating drainage gas emissions of up to 1,500 litre/sec flow rate.

Stage 2 Ventilation Air Methane Regenerative After Burner (VAM RAB ®) - Approval for a modification to DA97/800 was sought in 2011, to allow for the installation and ongoing operation of a single VAM RAB® unit as a demonstration project to examine the performance capability. Approval was granted by the Planning Assessment Commission (PAC) on behalf of the Minister for the then Department of Planning and Infrastructure on 11 November 2011.

The VAM RAB® technology initially proposed for Mandalong includes installation and operation of a single VAM RAB® unit as part of a demonstration project to demonstrate capture and abatement of approximately 10 cubic metres per second (m^3/s) of the mine's total Ventilation Air Methane (VAM). The VAM is a low concentration methane in the mine ventilation stream and the VAM RAB® system overcomes this technical difficulty by directing the mine ventilation air into a large oxidation vessel, oxidising the methane into carbon dioxide. This technology is based on well tested coke-oven principles, utilised in the steel industry.

This project, undertaken on behalf of the NSW Government and the underground coal industry, is co-funded by the Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) via the NSW Clean Coal Fund (NSW CCF).

Civil construction works on the surface pad for the VAM RAB® unit commenced in December 2011 and were completed in November 2013. The VAM RAB® demonstration plant has been heated up on a number of occasions during the last six months of 2014, with some minor configuration changes made in 2015 and it is expected to complete its commissioning processes in 2016.

To build on these current research and development (R&D) efforts into ways of reducing dilute methane from coal mine ventilation, Centennial has proposed a VAM RAB® 2 project to safely connect a commercial scale VAM RAB® to one of its mine fans. The VAM RAB® 2 project has received funding from the Commonwealth Department of Resources, Energy and Tourism through the Coal Mining Abatement Technology Support Package (CMATSP). CMATSP aims to support industry efforts to develop and demonstrate technologies that will provide future solutions to safely reduce fugitive methane emissions from coal mines.

Matching funding has been received from ACA Low Emission Technologies (ACALET). This is an industry body that administers the COAL21 Fund, the voluntary levy paid by NSW and QLD black coal producers to research clean coal technologies. The $30M VAM RAB® 2 project will build and test a VAM RAB® plant that will be able to process between 100 and 150 m^3/s of mine air and a safety duct for a safe connection to the mine. It will be a first of type in Australia.

The VAM RAB® 2 plant will be located adjacent to the mine's main fans and gas flare infrastructure. This R&D project is currently in the initial planning phases, and will progress to the detailed VAM RAB® 2 design stage in 2016. Centennial Mandalong will apply for a consent modification for the project in 2016, which will include an environmental assessment of the potential impacts on our close neighbours and the environment. The successful completion of the VAM RAB® 2 project would see an approximate 30% reduction in annual greenhouse emissions from the Mandalong Mine site and provide a technology option to the broader underground mining industry.

Stage 3 Gas Engines In July 2009 Mandalong Mine received approval from the then DP&I to construct and operate multiple methane gas engines to generate electricity. If the generation facility is implemented, power will be supplied to the site and excess power sold to the grid. The flare units will remain available as back-up or for peak gas flows.

6.4 WETLAND MONITORING

The Cooranbong Colliery Life Extension Project EIS predicted that the preferred longwall design (250 metre wide longwall panels) would result in some substantial changes to the existing wetlands within the Mandalong Valley, and as a result the extent of the wetlands may increase if drainage mitigation works were not undertaken (Umwelt, 1997). The EIS also predicted alteration to contours over the area which "…*may result in some of the current wetlands drying out or changing in shape or extent, other areas are likely to become inundated, with new wetland areas forming adjacent to or interconnected with the original wetlands*" (Umwelt, 1997).

The current longwall mining width at the Mandalong Mine is 160 metres which significantly reduces maximum subsidence levels to around 20% of those predicted in the EIS. This reduction in longwall mining width has reduced the impacts on wetlands within the Mandalong valley to below the levels that were predicted in the EIS.

Condition 74 of DA97/800 requires monitoring and management of wetlands in the mining area. The Wetlands Management and Monitoring Plan (WMP) approved by LMCC was prepared by Hunter Eco (Hunter Eco, 2013a), identifying nine wetlands for monitoring (**Figure 6).** Wetlands 1, 2, and 3 are located outside of the subsidence zone and are control sites while the remaining six wetlands are within the mining area. Wetlands 1 and 6 were removed from the monitoring program in 2015 as a result of private landowner activities detrimental to the program. Probably as a consequence of a period of intense grazing, there had been no aquatic vegetation in Wetland 1 since 2012. A new owner of the Wetland 6 property conducted slashing across the property including part of the monitoring transect, as well as introducing cattle. An additional monitored wetland (Wetland 9) was added in November 2015 in an area of ponding formed as a result of subsidence from Longwall 8. It is intended to monitor the development of a new wetland.

In April 2009 a baseline report was prepared by Hunter Eco which described the status of the wetlands prior to any subsidence having occurred.

Two monitoring rounds occurred in April 2015 (Hunter Eco, 2015b) and November 2015 (Hunter Eco, 2015c). The following is a summary monitoring results from the current report *"Mandalong Wetlands Monitoring Report"* by Hunter Eco (2015c).

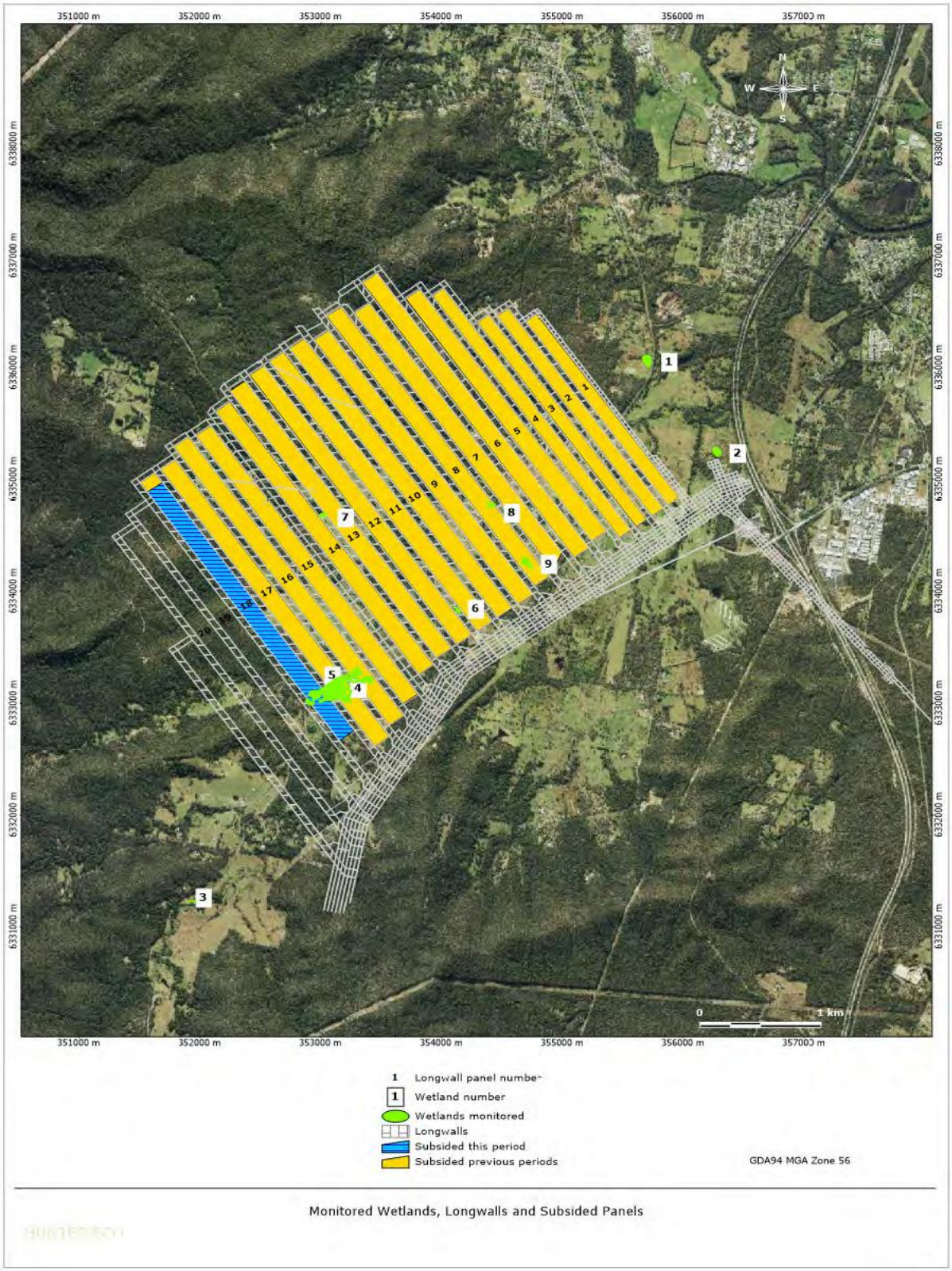


Figure 6: Wetland Monitoring Locations and underground workings.

The purpose of the monitoring program, as prescribed in DA97/800, is to determine what, if any, changes in the monitored wetlands in the Mandalong floodplain can be attributed to subsidence.

Monitoring of the eight wetlands commenced in April 2009, so as at November 2015 the total monitoring period has been over six years, 14 monitoring occasions. All wetlands started out with water then began to dry until May 2010 when only Wetlands 1 and 3 had water. An increasing rainfall trend has been evident over the entire monitoring program with short-term fluctuations. Prior to and including May 2015 there has been higher than average rainfall resulting in elevated water levels; in fact there had been some flooding that refreshed the wetland water. Rainfall then dropped up to November 2015.

Hunter Eco have described the Mandalong wetlands as dynamic ecosystems with species composition and diversity varying with the amount of available water and seasonal conditions. Variable land-use activities also have an influence on the state of the wetlands. Water analysis results continue to be highly variable, showing no trends over time or within or among wetlands.

Wetland 7 is located over a pillar between panels 13 and 14, both of which have been subsided. There is no subsidence monitoring through this wetland, however this wetland was again in a healthy condition in November 2015. Wetlands 4 and 5 are part of a larger wetland that had been drained in late 2014 and early 2015 as a consequence of subsidence in Longwall 16 which temporarily lowered the wetland overflow point. The wetland capacity has mostly been restored following the subsidence of Longwall 18 and is expected to be further remediated following subsidence of Longwall 19 in 2016.

Weeds have been identified as being primarily confined to the surrounding dry grassland with no invasion into the aquatic ecosystem (except Isolepis prolifera in Wetland 5 which declined in the period from November 2012 to April 2014, and has disappeared as of November 2015). The proportion of weeds to native species over time has reduced significantly for Wetlands 7 and 8 but has remained unchanged for the others.

Changes in the amount of the threatened Maundia triglochinoides have fluctuated with whole local populations disappearing by April 2011 (Wetlands 2 & 6) or substantially reducing in numbers (Wetlands 1 & 4). Since then the species has not been present in Wetlands 1, 2, and 4 until its reappearance in Wetland 4 in November 2015. Since November 2011 a large area of the species at the south eastern end of Wetland 6 had recovered by November 2012 but had declined in April 2013 and November 2013, was longer present in April 2014 and had recovered in January 2015. The species was found in Wetland 8 during the May 2015 and November 2015 monitoring, having not been recorded there previously.

Wetlands 4 and 5 had been fenced from stock since November 2012 however the property tenants reported seeing deer inside the fence and deer droppings were present along Wetland 4 transect in January 2015. There was continued evidence of deer in November 2015.

Herbivory and environmental degradation caused by feral deer is listed as a Key Threatening Process in the NSW Threatened Species Conservation Act 1955. The impact of deer on wetlands could arise from direct grazing of wetland plants and indirectly by destroying underwater regrowth with continual trampling. Depending on severity, this type of disturbance will add a confounding factor to comparison between wetlands.

Table 16: Wetland Trigger Action Response Plan and Assessment

Trigger	Result at December 2015	Response
A steady trend in the decline of water level observed in more than one round for monitoring at monitored wetlands that cannot be explained by rainfall data or upstream agricultural activity.	Water levels were normal as a consequence of increased rainfall. W4 level was normal and W5 had recovered following Longwall 18 subsidence.	No further action needed.
A significant increase in the trend of EC levels observed over greater than one monitoring round. AGEC (2008) describe the alluvial aquifer as having substantially elevated EC levels. Any increase in EC in a wetland could be the result of the alluvial aquifer coming into contact with surface water.	EC levels were all within an acceptable range.	No further action needed.
Substantial physical erosion or damage to the wetland soil that cannot be explained by natural or man-made erosion process and is caused subsidence cracking (>200 mm in width).	No erosion or cracking was found.	No further action needed.
A significant increase in water nutrient levels, particularly N and P that cannot be explained by natural variations in nutrient levels or manmade influences.	Nutrient levels were acceptable.	No further action needed.
A steady trend in declining biodiversity observed over a period greater than one monitoring round.	Two wetlands have shown statistically significant declining diversity indices.	Not related to subsidence.
A landholder submits a complaint that a wetland has changed as a result of subsidence.	No landholder reports had been received.	No further action needed.

Source: (Hunter Eco, 2015c)

6.5 VAM-RAB REHABILITATION OFF-SET MONITORING

Centennial received approval in 2011 (DA97/800 Modification 8) for the trial installation of a ventilation air methane regenerative afterburner unit (VAM-RAB) that would remove and breakdown the exhaust methane.

Installation of the VAM-RAB unit necessitated clearing of some native vegetation. Two endangered ecological communities (EEC) listed in Schedule 3 of the NSW Threatened Species Conservation Act 1995 were included in the areas to be cleared. These were: Swamp Sclerophyll Forest (SSF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions; and River-Flat Eucalypt Forest (RFEF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

DA97/800 Condition 76A included a requirement for a 1.25 hectare rehabilitation off-set area to be established on cleared land adjoining the VAM-RAB construction site. These EEC were represented by communities described in the regional vegetation mapping and classification (NPWS 2000) as: MU37 Swamp Mahogany Paperbark Forest (SSF); and MU38 Redgum – Rough-barked Apple Swamp Forest (RFEF).

An ecology survey (Hunter Eco, 2011) prepared for the VAM-RAB project application described the area to be rehabilitated as mostly dominated by weeds. This being the case, active regeneration was required and this was commenced in January 2012 and completed in March 2012.

Further to the requirement to rehabilitate, DA97/800 Condition 76A also requires that the progress of the rehabilitation be monitored annually for five years. Hunter Eco commenced baseline monitoring in October and November of 2012, with the first annual monitoring completed in October 2013, the second annual round of monitoring completed in December 2014 and the third annual round of monitoring completed in December 2015 (Hunter Eco, 2015d).

The aim of the monitoring program conducted by Hunter Eco was to collect data that would enable a quantitative comparison between the relatively undisturbed communities and the areas being rehabilitated. This is achieved through the collection of floristic data from 400 m^2 permanently established plots. The normal plot size is 20 m x 20 m but the dimension can vary depending on the configuration of the available space. Two plots were established in each of the two undisturbed communities and two in each of the two areas being rehabilitated to these communities; eight plots in all.

All plots were permanently established with star pickets at each corner in 2012, and floristic data were collected on 9 December 2015.

Hunter Eco have found that rehabilitation areas remain substantially different to that in the reference areas. However, as time goes by the cover contribution of the planted species will increase and should contribute to improved similarity. Hunter Eco have recommended that *Kunzea ambigua* and Blackberry regrowth are controlled and that the annual planting program is maintained, particularly replacing any losses. This will ensure canopy density is maintained and will result in a spread of age classes. Following recommendations from the survey, *Melaleuca nodosa* paperbark and the sedge *Carex appressa* have been planted in Plots P3 and P4 as that species is a significant component of the two reference plots (P1 and P2). Further additional plantings will be undertaken in 2016.

Overall Hunter Eco (2015d) have concluded that the results to date are encouraging suggesting that the measures taken should result in successful rehabilitation, although over a longer period than the required five year monitoring program. An indication of the

improving habitat was the observation of a Southern Emu-wren (Stipiturus malachurus) in the rehabilitation area in 2015.

Source (Hunter Eco, 2014b)

Figure 7: Location of Floristic Sample Plots

6.6 CULTURAL HERITAGE & ARCHAEOLOGY

6.6.1 Aboriginal Archaeology

No archaeological sites were recorded in the Cooranbong Colliery Life Extension Project EIS within Areas 1 (longwall mining area) and 2 (pillar extraction area) (Umwelt, 1997). The EIS identified a number of landforms and features within Areas 1 and 2 which are potentially archaeologically sensitive including;

- Stream channels and banks;
- Ridge and hill crests;
- Sandstone outcrops on any landform.

The EIS identified that the most likely impact to archeological sites from underground mining will be through inundation and / or fracturing of sandstone strata. This risk was based on supercritical longwall extraction from longwalls panels to a maximum of 250m wide and developing up to 3m of vertical subsidence.

RPS was commissioned to prepare Cultural Heritage Assessments for the SMP LW15-17 and LW18-21 applications. The Cultural Heritage Assessments considered the environmental and archaeological context of the LW 15-17 and LW18-21 SMP Areas, developed a predictive model, reported on the results of an archaeological survey for Aboriginal and non-Aboriginal cultural heritage and provided an impact assessment for the proposed development based on field survey results.

A survey of the LW 15-17 SMP Area was undertaken by RPS archaeologist Laraine Nelson accompanied by Aboriginal Registered Stakeholders from Awabakal Local Aboriginal Land Council, Awabakal Descendants Traditional Owners Aboriginal Corporation and Awabakal Traditional Owners Aboriginal Corporation. The field survey was undertaken between 13 to 15 December 2011 and 11 and 12 January 2012. This report has been prepared in accordance with the NSW Department of Energy and Minerals SMP approval guidelines (RPS, 2012).

Based on the area surveyed during the field trip, a total of six Aboriginal cultural heritage sites inside the Project Application Area were identified. These comprised three isolated artefacts, two artefact scatters and one set of grinding grooves. If subsidence remains inside the range proposed for the area it is considered unlikely there will be impact on the isolated artefact and artefact scatter sites. The grinding grooves have a greater potential to be adversely affected by subsidence (RPS, 2012). A further four Aboriginal cultural heritage sites were identified outside the Project Application Area. No historical sites were identified in the areas surveyed.

RPS Mand Nth 9 (Grinding Grooves) were considered more susceptible to damage than the other recorded sites. The grinding grooves located in the RPS (2012) survey are located over the three heading Maingate 14. The impact of any increased subsidence over the long-term stable maingate pillars is expected to be minimal. The site was included in the subsidence monitoring program. Subsidence over Maingate 14 was within predicted levels (0.15m) and there was no observed impact to the grinding groove site as shown in Figure 8.

Figure 8: Post Mining Photographs of Grinding Grooves at RPS Mand Nth 9 Site

RPS Mand Nth 1 & 2 (Artefact Scatters) and RPS Mand Nth 7, 8 & 10 (Isolated Artefacts) were not expected to be impacted by subsidence mining activities at the predicted levels. The most recent subsidence monitoring within the vicinity of the above sites confirmed that subsidence was within the predicted levels. **Table 17** provides the location, predicted subsidence and actual subsidence at the artefact sites.

The majority of the SMP LW18-21 application area was covered by the survey for SMP LW 15-17, undertaken by RPS (2012) archaeologist Laraine Nelson accompanied by Aboriginal Registered Stakeholders from Awabakal Local Aboriginal Land Council, Awabakal Descendants Traditional Owners Aboriginal Corporation and Awabakal Traditional Owners Aboriginal Corporation. The field survey was undertaken between 13 to 15 December 2011 and 11 and 12 January 2012. A Heritage Due Diligence Assessment was also undertaken by RPS (2013b) to provide full coverage of the SMP LW18-21 area. A visual inspection of this area was conducted on 8 July 2013 and undertaken by RPS Cultural Heritage Consultants, Jeremy Hill and Philippa Sokol.

Based on the areas surveyed, a total of 10 Aboriginal cultural heritage sites were located inside the Project Area. These comprised:

- Five isolated artefacts (#45-3-3538; #45-3-3452; #45-3-3451; #45-3-3456; #45-3-3455);
- Four artefact scatters (#45-3-3446; #45-3-3458; #45-3-3457; #45-3-3453); and
- One set of grinding grooves (#45-3-3454).

RPS (2013a) assessed that if subsidence remains inside the range proposed for the area it is considered unlikely there will be impact to the eight sites in the subsidence zones. Two sites (#45-3-3446; and #45-3-3558) are outside of the predicted subsidence zones but are located close to access tracks so there remains a remote chance of surface impact if not managed correctly.

The current mine plan ensures Grinding Groove AHIMS Site #45-3-3454 will not be undermined and as such no harm will occur. The grinding grooves located in the RPS (2013a) survey are located outside of the extraction void and will be exposed to subsidence less than 20mm.

Table 17: Subsidence on Aboriginal Cultural Heritage Sites

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence	Actual Subsidence	Comment
45-3-3458	RPS MAND Nth 1	Artefact Scatter	Maingate 17	0.50m	0.47m	
45-3-3457	RPS MAND Nth 2	Artefact Scatter	Longwall 18	0.70m	0.46m	
45-3-3456	RPS MAND Nth 3	Isolated Find	Maingate 18	0.50m	0.09m	Subsidence not completed.
45-3-3455	RPS MAND Nth 4	Isolated Find	Maingate 18	0.60m	0.22m	
45-3-3454	RPS MAND Nth 5	Grinding Groove	Angle of Draw Longwall 20	0.02m		Not mined
45-3-3453	RPS MAND Nth 6	Artefact Scatter	Bleeder pillar Longwall 20	0.10m		Not mined
45-3-3452	RPS MAND Nth 7	Isolated Find	Maingate 17	0.35m	0.10m	
45-3-3451	RPS MAND Nth 8	Isolated Find	Abutment Pillar Longwall 14	0.05m	0.01m	
45-3-3450	RPS MAND Nth 9	Grinding Groove	Maingate 14	0.15m Strain <1m/m Tilt <1mmm	0.15m Strain 1mm/m Tilt 1mm/m	No visible impact to grinding groove or rockshelf/boulders following subsidence.
45-3-3449	RPS MAND Nth 10	Isolated Find	Longwall 17	0.85m	0.50m	

6.6.2 European Heritage

Subsidence on the section of Convict Road (Brisbane Waters to Wallis Plains Road) above Longwall panels 1 and 2 was last recorded at 320mm in 2012. No observed subsidence damage was identified to the road which is in accordance with the predictions in the EIS (Umwelt, 1997). Subsidence monitoring was completed in 2012 as approved by the DRE.

A Historic Heritage Management Plan will be developed for Mandalong in 2016 to address any heritage items within the Mandalong lease boundary.

6.7 RAINFALL MONITORING RESULTS

The total monthly rainfall data is shown below in **Table 18** and in **Figure 9**.

Table 18: Rainfall at Mandalong Mine for the Period January 2015 to December 2015.

2015 Month	Mandalong Mine Total Rainfall (mm)
January	195.4
February	51.0
March	102.0
April	389.4
May	116.2
June	67.6
July	9.8
August	20.6
September	80.6
October	49.8
November	113.6
December	120.8
Total	**1316.8**

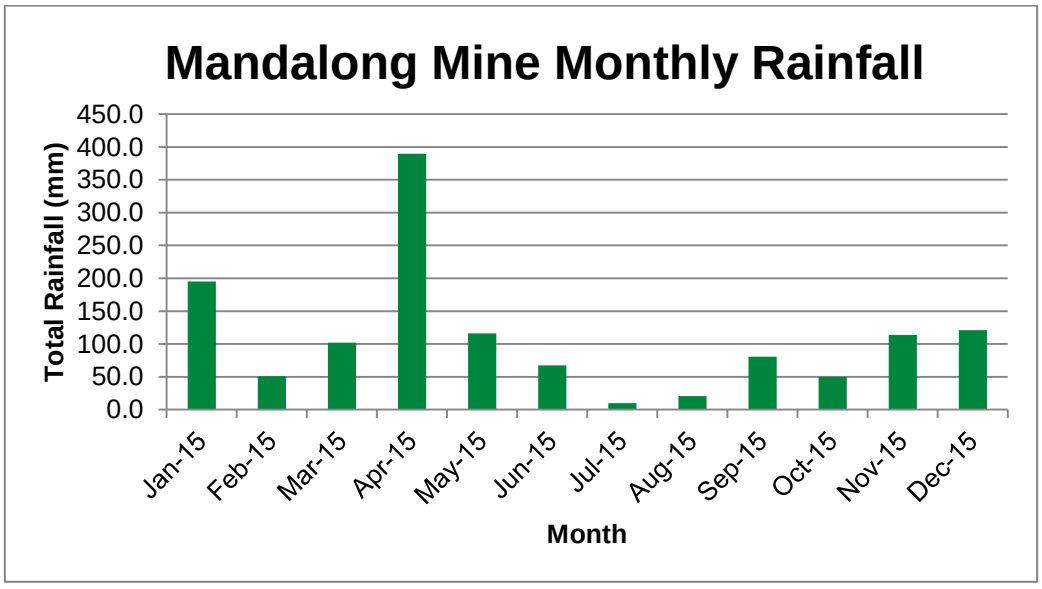


Figure 9: Mandalong Annual Rainfall

A total of 1316.8 mm of rainfall was recorded at the Mandalong Mine site during the reporting period. The total annual rainfall for 2015 was greater than the total rainfall (1057.8mm) recorded in 2014. The wettest period was in April 2015 recording 389.4mm.

6.8 SUBSIDENCE MONITORING

Subsidence monitoring programs are developed an approved for each Subsidence Management Plan (SMP). During 2015, two longwall panels were extracted. Subsidence from Longwall 17 was managed in accordance with SMP LW15-17 and Longwall 18 in accordance with SMP LW18-21 requirements. Subsidence monitoring aims to confirm that subsidence predictions and expected subsidence impacts are consistent with the relevant SMP. Where subsidence predictions or impacts are greater than predicted, Trigger Action Response Plans (TARPs) provide the appropriate and agreement management. The current Subsidence Monitoring Program was approved by DRE Principal Subsidence Engineer on 21 August 2015 for monitoring up to and including Longwall 19. The subsidence monitoring program includes monitoring for subsidence performance, private dwellings, surface infrastructure including public roads, Telstra Network, Ausgrid powerlines, wetlands, creeks, steep slopes and flood path inspections.

6.8.1 Subsidence Performance Measures

Development Consent DA97/800 specifies subsidence performance measures for private properties and natural features. **Table 19** provides a summary of the performance measures.

Table 19: Summary of DA97/800 Subsidence Performance Measures

Feature	Subsidence Performance Measures
Private Property	
Dwellings	Remain Safe, Serviceable and Repairable (SSR) – acquisition and compensation procedure if beyond SSR
Flood	Dwelling floor level to remain above post mining 100 year ARI flood level - acquisition and compensation procedure if floor level is below flood level.
	No increase in flood hazard at dwelling or dwelling access at 100 year ARI flood level - acquisition and compensation procedure if flood hazard is increased.
Landuse	No loss of agricultural productivity or adverse impact to landuse including buildings and flooding - acquisition and compensation procedure if landuse is impacted.
Infrastructure	
Local Roads and Access	Access to properties and within properties is maintained at no less than existing standard during the period of mining and at least five years thereafter.
Environmental	
Flora and Fauna	No specific subsidence performance measures. Requirement to develop management plans for each item. Predicted subsidence impacts and subsidence management is documented and approved in Subsidence Management Plans.
Heritage and Archaeology	
Erosion and Sediment Control	
Floodplain	
Wetlands	
Groundwater	

6.8.2 Subsidence Reporting

The SMP for LW15 -17 required fortnightly Subsidence Management Status reports, four monthly Subsidence Management Status reports and an End of Panel Reports to be prepared and provided to DPE, DRE and relevant stakeholders. The SMP LW18-21 also requires fortnightly Subsidence Management Status reports to be prepared and made available to the DRE when requested. The preparation of an Annual Report replaced the requirement for the preparation of four monthly status reports. All reports were completed at the specified timeframes as detailed in **Table 20**.

Table 20: Subsidence Reports 2015

Report	Report Period	Date Issued
Subsidence Management Status Report No. 34	1 January 2015 to 30 April 2015	May 2015
LW 17 Subsidence Management Status Reports	Fortnightly (13 reports)	November 2014 to May 2015
SMP LW18-21 Annual Report	July 2014 to June 2015	July 2015
End of Panel Report Longwall 17	Completion of Longwall 17	August 2015
LW18 Subsidence Management Status Reports	Fortnightly (16 reports)	May to December 2015

6.8.3 Subsidence Performance Summary

Subsidence measured over Longwall 17 and Longwall 18 was generally within the predicted maximum vertical subsidence values. **Table 21** and **Table 22** provide a summary of maximum vertical subsidence measured over the two longwall panels. Note that maximum subsidence on the longwall panels is realised after the subsequent adjacent longwall is extracted and subsidence is developed over the intervening chain pillar.

Table 21: Maximum Vertical Subsidence developed over LW17 following extraction of LW18

Subsidence Line	Depth of Cover (m)	Predicted Maximum Subsidence LW17 (m)	Measured Maximum Subsidence LW17 (m)	Difference Measured less Predicted (m)	Comment
Crossline 2	280	0.65	0.70	0.05	
Crossline 3Ex	260	0.70	0.60	-0.10	
Crossline 19	260	0.75	0.66	-0.09	Tobins Rd
Crossline 8	250	0.80	0.77	-0.03	Mandalong Rd
Crossline 18	240	0.85	0.88	0.03	
17 Centreline 14	240	1.20	0.92	-0.28	Thinner conglomerate identified

It is expected that the final subsidence over Longwall 18 will be within the predicted maximums as indicated in the second last column of **Table 22**.

Table 22: Maximum Vertical Subsidence developed over LW18

Subsidence Line	Depth of Cover (m)	Predicted Maximum Subsidence LW18 (m)	Measured Maximum Subsidence LW18 (m)	Difference Measured less Predicted (m)	Predicted Maximum Final Subsidence LW18 (m)	Comment
Crossline 2	310	0.35	0.38	0.03	0.75	
Crossline 20	290	0.35	0.30	-0.05	0.70	
Crossline 3Ex	270	0.35	0.39	0.04	0.65	
Crossline 19	260	0.35	0.46	0.11	0.65	Tobins Rd
Crossline 8	250	0.45	0.52	0.07	0.90	Mandalong Rd
Crossline 18	240	0.50	0.66	0.16	1.00	Thinner conglomerate identified

Values for Safe Serviceable and Repairable (SSR) criteria for dwellings have been assessed as being less than 5mm/m for tensile and compressive strains and less than 7mm/m of tilt. To review the range of tilt and strain measurements across both Longwall 17 and Longwall 18, frequency histograms for tilt, tensile strain and compressive strain have been used after the extraction of each panel to assess subsidence performance. The histograms are based on the results of all subsidence monitoring lines located over the longwall panel as shown in **Table 21** and **Table 22** above. The histograms compare the subsidence results against the SSR criteria values. **Table 23** provides a summary of the histogram results measured over Longwalls 6 to 18 compared to SSR criteria for dwellings. The results confirm the high level of confidence in the mine design achieving low levels of subsidence and impact on both built and natural features.

Table 23: Measured Subsidence Frequency Histogram Summary Longwalls 6 to 18

Frequency Histogram Summary for Longwalls 6 to 18 Measured Subsidence Compared Against SSR Criteria for Dwellings			
Longwall Panel	Tilt Less that 7mm/m	Tensile Strain Less than 5mm/m	Compressive Strain Less than 5mm/m
LW6	97.7%	99.8%	97.4%
LW7	97.6%	100%	97.8%
LW8	100%	100%	99.4%
LW9	100%	100%	100%
LW10	98.8%	100%	98.5%
LW11	96.5%	100%	100%

Frequency Histogram Summary for Longwalls 6 to 18 Measured Subsidence Compared Against SSR Criteria for Dwellings			
Longwall Panel	**Tilt Less that 7mm/m**	**Tensile Strain Less than 5mm/m**	**Compressive Strain Less than 5mm/m**
LW12	96.4%	100%	93.3%
LW13	95.6%	100%	95.6%
LW14	100%	100%	100%
LW15	96.9%	100%	100%
LW16	90.9%	100%	96.7%
LW17	96.0%	100%	96.3%
LW18	97.9%	100.0%	95.7%
Average	**97.3%**	**100.0%**	**97.6%**

Table 24 provides a summary of the assessment of subsidence performance against the specified subsidence performance measures and predicted impacts in SMP LW15-17 and SMP LW18-21. As shown in the summary table, subsidence impacts were within the predicted levels for private property, surface infrastructure, natural features and heritage items.

Table 24: Assessment of Subsidence Performance against Performance Measures and Predicted Impacts

Feature	Subsidence Performance Measures	Predicted Subsidence Impact SMP LW15-17 SMP LW18-21	Assessment of Performance against Predicted Impact
Private Property			
Dwellings	Remain Safe, Serviceable and Repairable (SSR) – acquisition and compensation procedure if beyond SSR	Subsidence predictions below SSR criteria, with all dwellings remaining SSR.	*Impact as predicted* Six dwellings impacted by subsidence from LW17 and LW18 all remained SSR. There were no reports of subsidence damage to the dwellings.
Flood – dwelling and access	Dwelling floor level to remain above post mining 100 year ARI flood level - acquisition and compensation procedure if subsided floor level is below flood level.	All dwellings freeboard remains above 100 year flood level at the maximum predicted subsidence and two times maximum predicted subsidence.	*Impact as predicted* Maximum subsidence was within prediction at dwelling locations.
	No increase in flood hazard at dwelling or dwelling access at 100 year ARI flood level -	No predicted increase to the flood hazard category at all dwellings or access at	*Impact as predicted* Maximum subsidence was within prediction at dwelling locations. No

Feature	Subsidence Performance Measures	Predicted Subsidence Impact SMP LW15-17 SMP LW18-21	Assessment of Performance against Predicted Impact
	acquisition and compensation procedure if flood hazard is increased.	the 1:100 year ARI Storm Event at predicted maximum subsidence and for two times predicted maximum subsidence.	observed or report changes to flooding at private properties.
Landuse	No loss of agricultural productivity or adverse impact to landuse including buildings and flooding - acquisition and compensation procedure if landuse is impacted	No impact to landuse to State Forest, private property (hobby farms) and Centennial properties.	*Impact as predicted* No reported or observed impact to landuse.
Infrastructure			
Local Roads and Access	Access to properties and within properties is maintained at no less than existing standard during the period of mining and at least five years thereafter. Public Roads Management Plan	Low damage predicted to Tobins Rd and Mandalong Rd. To remain safe, serviceable and repairable. No change to flood hazard	*Impact as predicted* Subsidence within prediction. No cracking or damage to road pavement or impact to road drainage.
Powerlines	Powerline Management Plan	No impact to serviceability to powerlines.	*Impact as predicted* No observed or reported damage to powerline infrastructure.
Communications	Telstra Management Plan	Low impact. No disruption to copper cable network. No impact to inactive fibre optic cable located along Mandalong Rd.	*Impact as predicted* Subsidence monitoring confirmed subsidence within predicted maximum values. OTDR testing confirmed no impact to inactive fibre optic cable. No interruption to service detected or reported.
Natural Features			
Flora and Fauna	No net loss of ecologically significant vegetation communities within DA area.	No net loss of native flora and fauna habitat.	*Impact as predicted* There has been no observed or reported impact to flora and fauna affected by LW17 and LW18 subsidence.
Floodplain	Floodplain inspection and	Minimal changes to	*Impact as predicted*

Feature	Subsidence Performance Measures	Predicted Subsidence Impact SMP LW15-17 SMP LW18-21	Assessment of Performance against Predicted Impact
	monitoring	creek channel flows or alignment. Predicted no surface cracking on floodplain.	Minimal changes to creek channel grades resulting in a negligible change to stream flows. No mining induced erosion or deterioration in stream bank condition. No subsidence related soil cracking was observed in 2015 in areas with higher depth of cover or alluvial flood plain area above LW1 to LW18.
Wetlands	Wetland Monitoring Management Plan	Predicted temporary changes to large wetland, covering LW16-18. No long-term impact was predicted. Minor increase in extent of ponding predicted at eastern and southern extents or wetland.	*Impact as predicted* The temporary lowering of wetland water level during extraction of LW16 (2014) was restored following development of subsidence from LW17 (April 2015). Water level has increased following completion of LW18. Subsidence was within prediction and increase in ponding at the eastern extent of the wetland observed. Wetland Monitoring is ongoing as per management plan.
Remnant Ponding	Flood Modelling	Predicted remnant ponding at locations above LW15 and LW16 on private property. Increased ponding at extents for large wetland over LW17 and LW18.	*Impact as predicted* Ponding over LW15 did not eventuate. The increase in extent of existing ponding over LW16 has been remediated to return ponding to pre-mining levels and to the satisfaction of the landowner. The increase in wetland ponding over LW17 occurred as predicted. It is expected that the predicted ponding over LW18 will occur following

Feature	Subsidence Performance Measures	Predicted Subsidence Impact SMP LW15-17 SMP LW18-21	Assessment of Performance against Predicted Impact
			subsidence from LW19.
Groundwater	Groundwater Monitoring and Management Plan	Predicted no adverse subsidence related impacts on alluvium groundwater levels.	*Impact as predicted* The monitoring data indicates that although mining has impacted groundwater levels in overburden rocks, there has been no long-term impact, even in faulted areas, on groundwater levels in the alluvial aquifers.
Steep Slopes	Public Safety Management Plan	No cliffs or potential for rock fall hazards exist. Possible opening of rock joints. No additional risk to public safety	*Impact as predicted* Subsidence within predicted levels. No observed impact to steep slopes or evidence of rock falls or rollout. No opening of rock joints observed.
Heritage			
Heritage and Archaeology	No specific subsidence performance measures	Ten Aboriginal cultural heritage sites identified in the SMPs.	*Impact as predicted* Subsidence within prediction. No visible impact to grinding groove site 45-3-3450

6.9 AGRICULTURAL LAND SUITABILITY

This section details the assessment of changes to agricultural land suitability resulting from the mining operations, including cumulative changes, at the Mandalong Site as required by DA97/800 condition 105(iv).

6.9.1 Agricultural Suitability Classification

The agricultural suitability and land capability of the Mandalong area was classified in the Environmental Impact Statement titled *"Cooranbong Colliery Life Extension Project"* (Umwelt, 1997). As stated in the EIS the land areas range from fairly level country in which the majority of the areas have been cleared, to steep heavily timbered country which is not capable of sustaining economically viable agricultural operations. Agricultural land suitability classification is mapped using the definitions in the Department of Urban Affairs and Planning *"Rural Land Evaluation Manual",* which classifies land into five different classes, based on the potential productivity of the land in the relevant social and economic context. The agricultural suitability system classifies land in terms of suitability for general agricultural use, including both cropping and pastoral purposes.

The Agricultural Suitability of the land in the Mandalong area was assessed in the EIS (Umwelt, 1997) to range from class 3 to 5. The majority of the level land at Mandalong has an Agricultural Suitability of 3, suited to grazing and limited cultivation in rotation pasture. The timbered area on level ground and timbered areas on sloping foothills were classified in the EIS with an Agricultural Suitability of 4 and 5 respectively. Agricultural Suitability with a classification of 4 is not suitable for cultivation but is suitable for grazing. These areas tend to be prone to water logging and production of these areas is constrained by the land size. Timbered land with an Agricultural Suitability of 5 in the Mandalong area is not suitable for agricultural production due to major constraints by native vegetation regulation and the costs associated with improving this land to a productive level.

To update information in the EIS (Umwelt, 1997) 19 agricultural assessments have been completed on properties during the development of Private Property Subsidence Management Plans (PSMP's). In 2009 an additional five agricultural surveys were undertaken on private properties located above longwall panels 11 to 14 for PSMP's. No further agricultural assessments were required in 2015.

The agricultural assessments completed in 2009 concurred with the agricultural suitability classes described in the EIS. Monitoring has confirmed that Longwalls 1 to 15 are stable. Tilts and strains have also remained unchanged over these 15 longwall panels. Agricultural assessments for the properties above these panels are unchanged from previous Annual Reviews and as such are removed from **Table 25**. The properties situated above the current zone of subsidence in 2015 above Longwall 17-18 are highlighted in **Table 25** and have an agricultural classification ranging from three to five as defined above.

Table 25: Agricultural Suitability Classification and Land Use

Property Reference (Number)	Agricultural Suitability Class 3	Agricultural Suitability Class 4	Agricultural Suitability Class 5	Current Agricultural Land use
82	**x**			Nil
35		**x**	**x**	Nil
38		**x**	**x**	Nil
77	**x**		**x**	Nil
Centennial 21	**x**	**x**		Horses
20	**x**	**x**	**x**	Nil
Centennial 33		**x**	**x**	Nil
Centennial 32		**x**	**x**	Nil
Centennial 37	**x**	**x**		Horses & Beef Cattle
Centennial 68	**x**	**x**	**x**	Horses
91		**x**	**x**	Nil
Centennial 70	**x**	**x**		Horses

6.9.2 Assessment of Agricultural Suitability

Since commencing longwall mining operations, Mandalong Mine has fully extracted Longwalls 1 to 18. No additional subsidence was recorded above Longwalls 1 to 12 (refer to in 2015. As such the agricultural suitability following mining is as reported in previous Annual Reviews. In 2015, 12 properties were influenced by subsidence movements on Longwalls 17 to 18. Of these 12, as highlighted in **Table 25**, four currently use land for agricultural purposes and typically have agricultural land suitability of class 3 or 4. The predominant land use on these properties is recreational/lifestyle, horse breeding and agistment and cattle/horse grazing.

6.9.3 Agricultural Suitability Impact Assessment

Vertical subsidence levels on Longwalls 17 to 18 are generally within predicted maximums. The distribution of subsidence above Longwalls 17 to 18 indicates subsidence on the floodplain, where the majority of pasture areas are found, typically ranges up to 0.90 m. There is little evidence that these relatively low levels of subsidence have impacted on pasture condition, as further discussed below.

A number of private and Centennial owned properties as described in **Table 25** were noted as undertaking cattle and horse enterprises. Inspections of these properties were undertaken during surveys to assess the level of subsidence related changes. No significant changes to stock levels were reported as a result of subsidence following the extraction of Longwalls 17 and 18 in 2015.

In 2013, Hunter Eco completed a report titled "*Monitoring the Impact of Subsidence on Wetlands of the Mandalong Floodplain - Detection and Management of Surface Ponding*" (Hunter Eco, 2013c). LiDAR surface data and high resolution aerial photography (time series) were used to detect surface ponding. The analysis completed by Hunter Eco has shown that remote LiDAR data and aerial imagery can be useful in detecting areas of ponding resulting from mine subsidence.

Twenty-four ponding locations have identified by Hunter Eco and Centennial Mandalong as per the predictions in the flood modelling assessments. Most of which were in open grassland and have since been drained and restored by Centennial Mandalong. **Table 26** provides a description of each ponding instance and what if any remediation was undertaken.

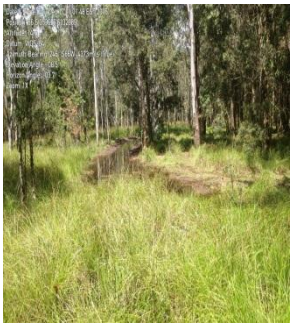
Table 26: Details of Ponding & Remedial Action

Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Remediation Status
Longwall 1 (P1)	Open grassland	Proposed new dam and area levelled as per PSMP	Continuing negotiations with landowner.	No	Yes	Negotiations with landowner ongoing
Longwall 2 (P2)	Open grassland	Drained	Constructed open drain and connected to nearby water course. 	Yes	Yes	Completed
Longwall 3 (P3)	Open grassland	Drained	Constructed open drain and connected to nearby water course. 	Yes	Yes	Completed

Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Remediation Status
Longwall 4 (P4)	Open grassland	Allowed to remain as a source of water for stock.		Yes	Yes	Completed
Longwall 5 (P5)	Open grassland	Drained	Constructed open drain and connected to nearby water course. 	No	Yes	Completed
Longwall 6 (P6)	Open grassland	Drained	Installed sub-surface drainage and drainage to Stockton Creek. 	Yes	Yes	Completed
Longwall 6 (P6A)	Open grassland	Drained	Improved existing open drainage to ponded area. 	No	Yes	Completed
Longwall 7 (P7)	Open grassland	Drained	Constructed open drain and connected to nearby	Yes	Yes	Completed

Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Remediation Status
	fringed with Cabbage Gums and *Melaleuca biconvexa*.		water course. 			
Longwall 7 (P7A)	Open grassland	Allowed to remain as extension of existing dam.	Extension of existing dam	Yes	Yes	Completed
Longwall 8 (P8)	Expansion of an already wet area having scattered Swamp Mahogany and *Melaleuca biconvexa*.	Ponded area fenced to establish freshwater wetland. Included in wetland monitoring program.	Drainage of this area is impractical with little fall available from the ponded area into the nearest creek, over 300 m to the east. This ponded area was fenced from stock and allowed to develop into a freshwater wetland. 	Yes	Yes	Completed
Longwall 8 (P8A)	Open grassland and *Melaleuca biconvexa* Existing wetland	Expansion of existing Wetland 8.	Continue to monitor and report on Wetland 8 as per Wetland Management Plan.	No	Yes	Completed
Longwall 9 (P9)	Mixed Cabbage Gum and paperbark forest.	Remain as extension of existing freshwater wetland.	Several threatened *Melaleuca biconvexa* paperbarks are present and remediation would involve losses of these through gaining access by machinery. Consequently remediation was not undertaken.	Yes	Yes	Completed
Longwall	Mixed Cabbage	Remain as freshwater	Several threatened paperbarks *Melaleuca*	No	Yes	Completed

Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Remediation Status
10 (P10)	Gum and paperbark forest.	wetland.	*biconvexa* are present and remediation would involve losses of these through gaining access by machinery. Consequently remediation was not undertaken.			
Longwall 11 (P11)	Mixed paperbark woodland in an already periodically inundated area. Contains threatened *Melaleuca biconvexa* paperbarks. Ponding has extended an existing wetland.	Remain as freshwater wetland.	Several threatened paperbarks *Melaleuca biconvexa* are present and remediation would involve losses of these through gaining access by machinery. Consequently remediation was not undertaken.	Yes	Yes	Completed
Longwall 13 (P13)	Open grassland and Redgum Rough-barked Apple Forest	Currently being assessed by Ecologist	Existing ponding has been moved towards centre of longwall panel. 	Yes	Yes	Monitoring
Longwall 13 (P13A)	Open grassland	Minor increase in low lying area. No permanent ponding.	No impact on grazing area.	Yes	Yes	Completed
Longwall 15 (P15)	Alluvial Tall Moist Forest and Redgum Rough-barked Apple Forest.	No remediation required.	No increase to existing ponding evident.	Yes	Yes	Completed

Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Remediation Status
Longwall 16 (P16)	Redgum Rough-barked Apple Forest and Coastal Foothill Spotted Gum-Ironbark Forest.	Increase in existing ponded area remediated to pre-mining condition. Minimal impact on flora.		Yes	Yes	Completed
Longwall 16 (P16A)	Open grassland	Fill to restore drainage.	Increase in depth and extent of existing ponding slightly greater than predicted.	Yes	Yes	Survey completed.
Longwall 17 (P17)	Freshwater Wetland Complex EEC and Redgum Rough-barked Apple Forest EEC	Increase in extent of wetland as predicted. No remediation required.	Currently monitoring area and waiting on subsidence to be completed on LW19.. Marginal increase in extent and depth of wetland has occurred as predicted. No predicted long-term impact on wetland. Wetland 4 & 5 in Wetland Management Plan 	Yes	No	Monitoring
Longwall 17 (P17A)	Open grassland and Redgum Rough-barked Apple Forest EEC	Slight increase in area and depth of existing ponding. No remediation expected.	Currently monitoring area and waiting on subsidence to be completed on LW18.	Yes	Yes	Monitoring
Longwall 18 (P18)	Freshwater Wetland Complex EEC and Redgum Rough-barked Apple Forest EEC		Marginal increase in extent and depth of wetland predicted. No predicted long-term impact on wetland. Wetland 4 & 5 in Wetland Management Plan	Yes	No	Monitoring

Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Remediation Status
						
Longwall 18 (P18A)	Open grassland with Cabbage Gum trees.	Fill ponded area to restore pasture.	Increase in existing ponded area.	No	No	Survey completed
Longwall 19 (P19)	Farm dam and open grassland		No ponding or remediation expected with LW18 and LW19 shortened to protect property improvements.	Yes	No	Monitoring

6.10 FLOODPATH MONITORING

The condition of floodpaths and stream channels are discussed in the Mandalong Mine "*Floodpath Condition Report 2015*" (Centennial Mandalong, 2016) in **Appendix 2**. DA97/800 requires the condition of major floodpaths be inspected every six months or following a flood event in an area subject to a Subsidence Management Plan (SMP) application. This Floodpath Condition Report for 2015 has been developed to compile survey and photographic records of subsidence induced changes to Stockton Creek and Morans Creek as per the assessment methodology in **Appendix 2**.

Appendix 2 assesses the changes to the condition of floodpaths along stream reaches undermined by Longwall 17 and 18 in 2015 and previously subsided longwall panels 1 to 16, identifying the effects of subsidence on the floodpaths. The pre-mining condition of the floodpaths above longwall panels 19 and 20 is also documented in this report.

On the basis of the information obtained from field surveys, the pre mining characteristics of Morans Creek can be described as having a generally poorly defined channel system, in which creek lines give way to undefined overland flow paths in several areas. The levels of predicted subsidence and associated grade changes along Morans Creek over proposed Longwalls 19 and 20 are of a similar order of magnitude to the existing creek bed slopes. The levels of predicted subsidence along Morans Creek are relatively small over proposed Longwalls 19 and 20 and it is therefore considered that these will not significantly alter the flow conveyance capacity of the existing channels. The associated impacts on the maximum flood depths and flood hazards that have been modelled are not considered to be significant.

The subsidence levels above longwall panel's 3 to 6 remained unchanged in 2015. The stream condition (Stockton Creek) in 2015 above longwall panels 1 to 3 and 6, where stock have been excluded, were in a similar condition to that recorded pre mining. No changes to the well established riparian vegetation was found on stream banks and with no further bank erosion.

The bank widening and erosion process above longwall panels 4 and 5 in Stockton Creek has been occurring prior to mining and for a considerable length of time prior to mining given the large difference in stream widths compared to other stream sections. This erosion

process is unlikely to have been caused by subsidence as, the areas of erosion identified prior to mining, were observed in June 2008 and April 2015 to be a result of the concentrated flows on the opposing bank causing further erosion.

7 WATER MANAGEMENT

Mandalong Mine holds a licence (20BL173524) permitting the extraction of groundwater water from the coal measures encountered during the process of mining. This extraction licence permits the Mine to dewater the underground coal measures via a submersible dewatering pump located at Cooranbong. The extraction bore entitles the Mine to extract an annual entitlement of 1825 ML of groundwater for the period. This mine water is subsequently discharged at LDP001.

Table 27: Water Take

License #	Water Sharing Plan, source and management zone (as applicable)	Entitlement	Passive take / inflows	Active pumping	TOTAL (1 July to 30 June).
20BL173524	Hunter Unregulated and Alluvial Water Sources - Dora Creek Water Source	1825 ML	0 ML	471 ML	471 ML

7.1 SURFACE WATER MONITORING

7.1.1 Mandalong & Cooranbong Entry Site

There is an established surface water quality monitoring program for the Mandalong catchment conducted since periodic sampling commenced in 1996, with the program established on a regular frequency since August 1999. Three surface water monitoring points (SW13-15) above LDP001 & LDP002 at the Cooranbong Entry Site and two monitoring points (SW16-17) in the receiving waters below the LDP's were added in late 2011. The monitoring locations are shown on **Plan MG10722e**, **Plan MG10502**, **Plan MG10722d** and are summarised below in **Table 28**.

7.1.2 Cooranbong Haul Road

The Cooranbong Haul Road crosses three ephemeral creeks in the Lords Creek sub-catchment. Six sediment basins have been constructed along the haul road to contain dirty water runoff. Monitoring of the water quality in the haul road sediment control dams was undertaken in 2015 to assess the effectiveness of water treatment prior to controlled releases.

Table 28: Summary of Monitoring Locations with Respect to Position within the Catchments

Location Reference	Creek Sub-catchment	Position along Creek Sub-catchment
SW008	Stockton Creek	Upper
SW004	Stockton Creek	Mid
SW012	Stockton Creek	Lower
SW011	Moran's Creek	Upper
SW003	Moran's Creek	Mid
SW006	Moran's Creek	Lower
SW002	Stockton and Moran's	At Confluence
SW001	Stockton Creek	Downstream Confluence
SW009	Pourmalong Creek	South
SW010	Pourmalong Creek	North
SW13	Muddy Lake (Unnamed tributary upstream LDP001).	Upper
SW14	Muddy Lake (Unnamed tributary upstream LDP002).	Upper
SW15	Muddy Lake (Unnamed tributary upstream LDP002).	Upper
SW16	Muddy Lake (Unnamed water body 1km downstream Simpson Rd Causeway Crossing)	Mid
SW17	Muddy Lake (North Dora Creek Village)	Lower

7.1.3 Surface Water Monitoring Results

7.1.3.1 Mandalong

Surface water quality is monitored at 11 locations on a monthly or quarterly basis. These locations encompass four different catchment areas. The water is tested for pH, Total Suspended Solids (TSS) and Electrical Conductivity (EC). The annual and long-term average (LTA) results are summarised in **Table 29**.

Table 29: Average Surface Water Quality for the 12 month Period from January 2015 to December 2015 ('Annual') and the Long-term Average ('LTA').

Site Location	Catchment	pH		TSS		Specific Conductance uS/cm	
		Average	LTA	Average	LTA	Average	LTA
SW008	Stockton	7.1	6.0	40.0	31.3	1040.0	863.8
SW004		6.9	6.7	25.0	18.9	621.8	634.1
SW012		6.8	6.1	23.3	32.7	720.0	1155.5
SW18		7.4	7.3	67.7	45.4	461.7	547.7
SW011	Moran's	6.7	6.6	44.7	52.1	553.0	559.4
SW006		6.5	6.6	15.8	18.4	374.0	526.0
SW003		6.4	6.4	20.0	15.2	399.8	479.8
SW002	Stockton and Moran's Creek (Confluence)	6.8	7.0	16.7	14.8	9252.0	14478.4
SW001		6.9	7.1	12.0	12.1	27075.0	30143.4
SW009	Pourmalong	6.8	6.4	35.7	18.5	347.0	303.8
SW010		5.5	6.0	327.0	33.8	1077.0	478.2
SW13	Muddy Lake	6.9	5.9	9.6	14.8	4007.5	2766.6
SW14		7.0	7.0	15.5	16.0	508.0	545.0
SW15		5.5	5.8	74.4	78.0	71.8	86.5
SW16		8.2	8.2	37.7	25.7	3324.2	2786.2
SW17		8.2	8.2	12.8	545.7	2840.3	2821.3

7.1.3.2 Cooranbong Entry Site

Water quality is monitored daily as per the requirements of EPL 365 at Licenced Discharge Points (LDP) LDP001 and LDP002 located at the Cooranbong Entry Site as shown on the plan **MG10722e**. The water is tested for pH, Total Suspended Solids (TSS), EC and Oil and Grease (mg/L). The average annual results at LDP001 & LDP002 are summarised in **Table 31** and **Table 32**. Graphs of the LDP001 & LDP002 water quality results for these parameters are provided in **Figure 10**, **Figure 11** and **Figure 12**.

Table 30: LDP001 Discharge Volume

Frequency	No. of measurements made	Lowest result	Mean result	High result	Unit of measure
Daily during any discharge	360	0	2387.09	4319.95	kilolitres per day

Table 31: Water Quality LDP001

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Oil & Grease	milligrams per litre	301	307	0	0.19	6
pH	pH	301	306	7.03	7.88	8.34
Total suspended solids	milligrams per litre	301	305	0	2.00	17

Table 32: Water Quality LDP002

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of sample	Highest sample value
Oil & Grease	milligrams per litre	3	3	0	0	0
pH	pH	3	3	7.04	7.41	8
Total suspended solids	milligrams per litre	3	3	12	21.67	30

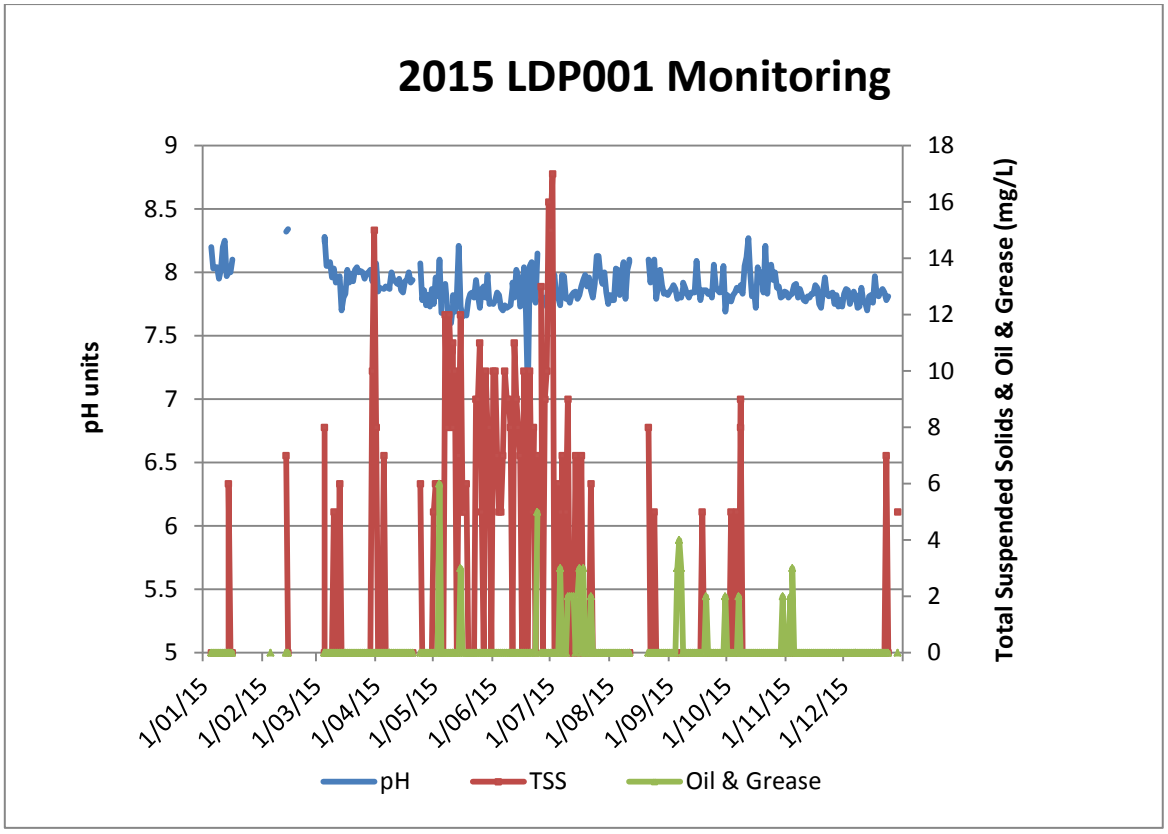


Figure 10: LDP001 Water Quality Monitoring

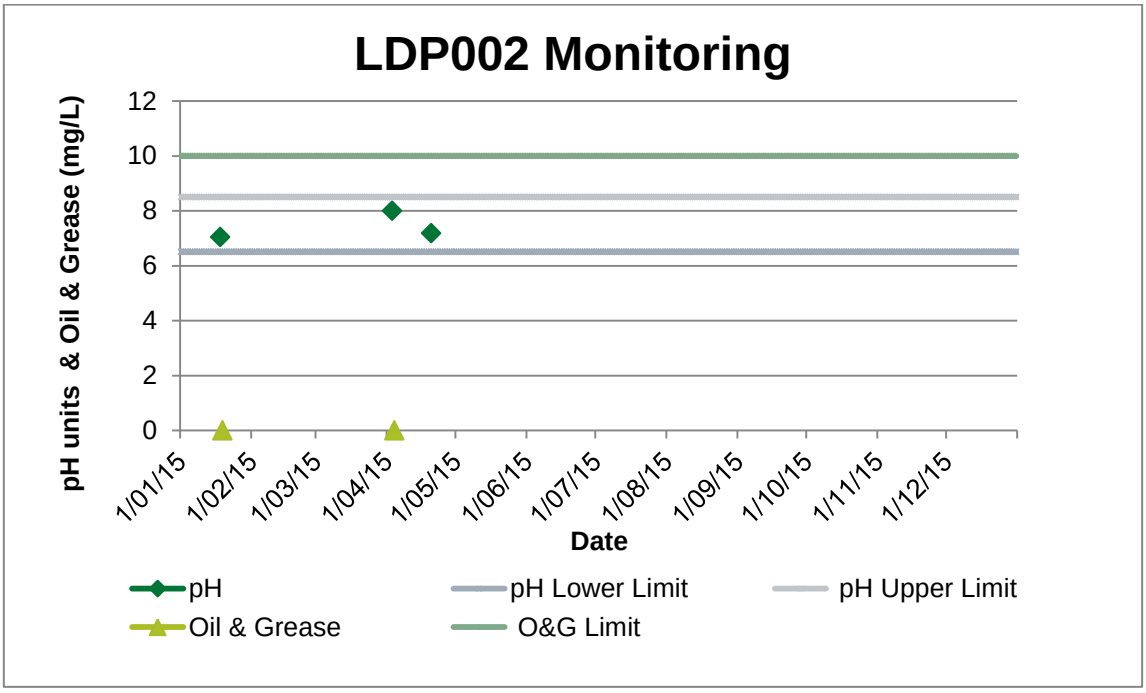


Figure 11: LDP002 Water Quality Monitoring (pH & Oil & Grease).

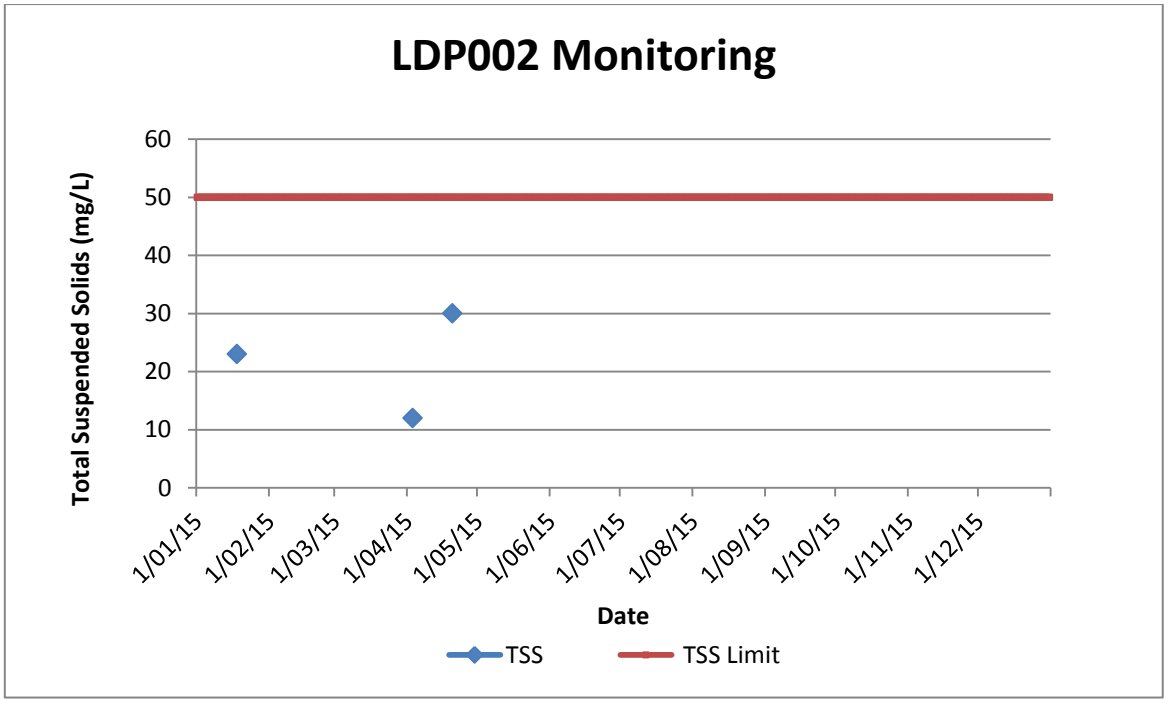


Figure 12: LDP002 Water Quality Monitoring (TSS).

7.1.4 Data Interpretation

The results presented in **Table 29** are characteristic of the natural conditions of the area, particularly Stockton and Moran's Creek. Both Stockton and Moran's creek are the main drainage systems for the Mandalong area. Stockton Creek is located within the longwall mining area (LW1-16) and Moran's Creek is also located within the current longwall mining area (LW15-19).

7.1.4.1 Mandalong

Surface waters are tested for pH, Total Suspended Solids (TSS) and Specific Conductance/Electrical Conductivity (EC) and the annual and long-term average (LTA) results are summarised in **Table 29**. The Cooranbong Entry Site monitoring sites SW13, SW14, SW15, SW16 and SW17 were sampled on a monthly basis. The monitoring sites SW001, SW002, SW003, SW004, SW006, SW008, SW009, SW010, SW011, and SW012 were sampled on a quarterly basis during the reporting period.

The EC (salt content) for the 2015 period shows a relatively consistent level compared to the long-term average. The average EC recorded for sites SW001, SW002, SW003, SW004, SW006, SW011, SW012, SW014, SW015 and SW018 for this period is lower than the long-term average.

The average total suspended solids (TSS) for 2015 are relatively low and are characteristic of natural surface water conditions in creeks. SW010 recorded the highest annual average TSS of 327 mg/L in 2015. At sites SW001, SW006, SW011, SW012, SW013, SW014, SW015, SW017, the 2015 average was lower than the LTA.

At the majority of monitoring points, the results showed an annual average pH similar to the long-term average. SW10 and SW15 had the lowest pH average of 5.5 in 2015. The highest pH average recorded during 2015 was 8.2 recorded at SW016 and SW017.

7.1.4.2 Cooranbong Entry Site

Plan **MG10722e** shows the location of the discharge monitoring points LDP001 and LDP002. The results shown in **Table 29** indicate an average pH 7.88 at LDP001 was similar to the 2014 average pH of 7.96. An average Total Suspended Solids (TSS) result at LDP001 of 2.00 mg/L was recorded in 2015. LDP002's average TSS of 21.67 mg/L, pH 7.41 and low levels of Oil and Grease 0mg/L were lower than the 2014 average (TSS 95 mg/L, pH 4.99, O&G 0 mg/L), however there was only one discharge and sampling event at LDP002 in 2014.

EPL 365 permits the Mandalong Mine to discharge a maximum of 5 ML/day from LDP001 and exceed this limit when 10 mm rainfall has fallen in the prior 24 hours. The average daily discharge volume of 2.387 ML was recorded at LDP001 in 2015 and the highest daily discharge was 4.319 ML in November 2015.

7.1.4.3 Cooranbong Haul Road

Monitoring for the surface water in the six sediment control dams on the haul road was conducted to determine compliance with the EPA licence limits prior to discharge. Prior to discharge the sediment control dams were treated by adding a flocculent to the water to remove suspended solids. Prior to discharge water quality in the haul road sediment control dams is required to meet the water quality discharge criteria detailed in the EPL and the Cooranbong Haul Road Surface Water Management Plan.

7.2 WATER BUDGET

This section summaries the water balance analysis prepared by GHD (2016) in the report titled *"2015 Water Balance Mandalong Mine"*. In accordance with DA97/800 condition 105 (vi) the quantity of water used from water storages and details of water discharges from the Mine are discussed below.

7.2.1 Water Supply, Use & Discharge

The Mandalong Mine is connected to town water and sewer. Potable water for underground use is currently supplied by Hunter Water Corporation (HWC) via a pipeline to the Cooranbong Entry Site and to the Mandalong Mine. Potable quality water is used underground in mining equipment as; uncontaminated water is required for cooling systems on drive motors, in dust suppression sprays on miners and transfer points. The total potable water used in 2015 was 466.6 ML. A total of 420.8 ML was supplied via the Cooranbong Entry Site & Mandalong Mine Site to underground equipment. A total of 0.6 ML was used on the surface within the Cooranbong CHP and bathhouse, 35.8 ML in the Mandalong Mine bathhouse.

The total potable water usage (466.6 ML) for 2015 is above the water usage in 2014 (443.8 ML). Potable water was primarily supplied to the longwall and underground equipment (longwall, continuous miners and conveyors) for coolant on motor transmissions and dust suppression. 376.1

GHD's (2016) water balance model indicates 1061.4 ML was discharged in 2015 from the Mandalong Mine, Cooranbong Entry Site and the Delta Entry Site. This consisted of 37.2 ML from the Mandalong Mine Sediment Control Dam. A total of 947.7 ML was discharged from the Cooranbong Entry Site, with 889.8 ML from LDP001, 13.6 ML from LDP002 (5 ML Dam) and 44.5 ML from the Construction Dam (clean water dam). 76.3 ML of surface water run off water was discharged from Delta Entry Site dams.

7.2.1.1 Mandalong Mine

Managing runoff from rainfall events is the only surface water management required at the Mandalong Mine Pit-Top. Clean water is diverted around the western area of the site. A dam has been constructed to capture this water. Clean water runoff from Mandalong Road, the Freeway on-ramps and the car park has been diverted around the eastern perimeter of the site.

Water from all other areas of the surface is considered 'dirty' and is directed to sediment control systems. Surface and subsurface drainage directs dirty water to the sediment control system. This system comprises of a Gross Pollutant Trap (GPT), a Sediment Control Dam and a polishing lagoon. Water from the Sediment Control Dam is used for irrigation of surrounding grassed areas as required. An oil water separator at the GPT removes hydrocarbons from potentially contaminated runoff from the refuelling bay, oil store, workshop, washdown bay and equipment yard.

7.2.1.2 Cooranbong Entry Site

Water from the hardstand area is directed to the 5 ML dam for treatment before discharge by an overflow culvert at LDP002. A dewatering pump installed in the 5 ML Dam allows low water levels in the dam to be maintained. Contaminated water from the workshop, equipment storage and washdown bay areas drain to an oil water separator used to remove hydrocarbons from waste water.

Dirty water contaminated with coal fines from the CHP, conveyor gantries and ROM stockpile is directed to dedicated sediment control sumps to remove course fines material. Dirty water is then directed to the large GPT for further settlement of fines. Treated water from the GPT is then pumped to Sediment Dam 1 or directly underground. Sediment Dams 1 and 2 have a capacity of 7.6 ML.

A sediment control dam (ROM Stockpile Dam) and GPT were constructed in 2010 to capture and treat contaminated surface water runoff from the 100 000 T ROM coal stockpile. Sediment is captured in the ROM Stockpile Dam prior to flowing via pipeline into Sediment Dam 1 (via the Export Bin Sump).

7.2.1.3 Delta Entry Site

Clean and dirty water systems have been constructed at the Delta Entry Site. Site runoff also utilises the existing stormwater infrastructure at the Wyee Coal Unloader, which includes clean water diversion drainage and two large dirty water settling ponds (9ML capacity) sufficient to treat contaminated water prior to discharge.

Another settling pond was constructed down slope of the decline portal for the pre-treatment of dirty water from the Delta Site. Sediment in runoff is settled out via the Final Sediment Sump (constructed in 2015) and the decline settling pond prior to discharge into the large 9 ML settlings ponds.

7.2.1.4 Cooranbong Haul Road

Clean and dirty water are separated along the haul road. Clean water is diverted by drains away from the haul road. Dirty water from the haul road and batters, is captured and treated within 6 sediment basins constructed along the haul road. Dirty water contained within the sediment basins is required to meet specific water quality criteria prior to discharge.

7.2.2 Mine Water Management

7.2.2.1 Mandalong Mine

Water from the active mining area is pumped to a temporary settling area to reduce suspended solids. All water is then pumped to a goaf (Cooranbong underground longwall void) area in the north-west of the Cooranbong Entry Site. This void area has a significant storage capacity, and also acts as a primary settlement area for the removal of suspended solids. Dirty water from the Cooranbong Sediment Dams is also pumped or decanted via the existing infrastructure to the Cooranbong void to maintain low water levels in the surface dams.

Water in the Cooranbong void is then pumped to the surface through a borehole pump and overland to the Borehole Dam at the Cooranbong Entry Site. Water discharges via a surface pipeline directly to LDP001.

7.2.2.2 Delta Site

No mine water is discharged from the Delta entry site, as inseam water from the Delta underground headings and decline tunnel is pumped to the existing Mandalong Mine water system.

7.3 GROUNDWATER MANAGEMENT

7.3.1.1 Mandalong Mine

An annual review of the groundwater monitoring results was undertaken by AGE Consulting Pty Ltd tilted *"Mandalong Longwall Annual Groundwater Monitoring Review 2015"* (AGE, 2016). An extensive groundwater monitoring network has been developed at Mandalong Mine with monitoring undertaken on many of the bores since August 1997. This program has been established to provide timely warnings of deviations from natural or background levels, so that if necessary, remedial measures and/or management strategies can be put in place.

The current monitoring network consists of 57 bores; 26 alluvial monitoring bores, 29 overburden monitoring bores and 2 coal seam monitoring bores. The bores consist of 16 nests of 2 or 3 bores monitoring strata at increasing depth at the same site. The bores are monitored every month with the water level, EC and pH being measured.

Table 33 provides a summary of the establishment timeframe and purpose of the network.

Table 33: Summary of Monitoring Bore Network Establishment

Bores	Established	Location	Purpose
BH1 – 14	June 1997	Mandalong Valley alluvial	To monitor groundwater levels and quality in the alluvium.
BH15 – 16	February 1998	Private property 1 km south-east of mine	To monitor water levels and the impact of mining on the coal seam.
BH17 – 19	Sept-Oct 2002	Over longwall panels LW4 and LW5	To monitor water levels and the impact of mining on the overburden aquifers.
BH20, 20A, 20B BH21, 21A	October 2003	Nested bores over longwall	To monitor the impact of mining LW1 and LW2 on the

Bores	Established	Location	Purpose
		panels LW1 and LW2	alluvial and overburden aquifers.
BH2A, 2B, 2C BH3A, BH3B BH6A, BH6B BH7A, BH7B, BH17A1 BH22, BH22A, BH22B BH23, 23A, 23B	Sept – Oct 2005	Nested monitoring bores over longwall panels	To provide a broader coverage of monitoring of the impact of longwall mining on the alluvial and overburden aquifers.
BH9A, BH9B, BH10A, BH10B, BH24A, BH24B, BH24C & BH25A, BH25B, BH25C.	May 2010	Nested monitoring bores over longwall panels	To provide a broader coverage of monitoring of the impact of longwall mining on the alluvial and overburden aquifers.
BH26A, BH26B, BH26C, BH27A, BH267B & BH27C.	September 2011	Nested monitoring bores.	To provide a broader coverage of monitoring of the impact of longwall mining on the alluvial and overburden aquifers.

Source (AGE, 2015)

There are essentially three groundwater systems in the Mandalong Valley (mine lease area) – alluvial groundwater, bedrock groundwater and overburden/interburden.

The alluvial groundwater is the most important as a usable resource, however there are not many licensed extraction bores within the Valley. The alluvial groundwater is typically recharged from surface infiltration through the sands and upstream recharge.

The bedrock groundwater is less important as a usable resource. The permeability of the Narrabeen Group rocks is generally very low, with little groundwater yield. Any water that is localised in joints or fractures is typically of poor quality.

In the coal seam itself, the bulk permeability is low with some occasional high permeability zones associated with joints, fracture zones or faults, which results in the seam being a confined aquifer relative to the surrounding strata.

7.3.2 Groundwater Monitoring Results

7.3.2.1 Mandalong

Groundwater is monitored on a monthly frequency at the groundwater wells shown on the **Plan MG10502**. The groundwater monitoring results are summarised in **Table 34**, **Figure 13** **Figure 14** and **Figure 15**.

Table 34: Average Groundwater Quality for the Mandalong Valley for the 12 month period from January 2015 to December 2015 ('Avg') and the Long-Term Average ('LTA').

Bore	pH		Ec (uS/cm)		Depth (m)	
	Avg	LTA	Avg	LTA	Avg	LTA
BH001	6.17	6.45	476.42	492.30	3.55	3.52
BH002	5.37	5.64	3690.00	4371.70	2.30	2.62
BH02C	5.28	5.38	1411.33	1600.48	2.52	2.76
BH02B	6.37	6.26	6328.89	6431.89	3.14	3.42
BH02A	7.07	7.17	5931.11	5937.66	21.31	19.52
BH003	6.12	6.44	3385.83	3024.86	3.37	3.53
BH03A	6.01	6.18	6998.33	6576.28	2.67	2.85
BH03B	6.89	6.78	10010.00	9825.67	17.65	16.41
BH004	6.02	6.21	13120.00	12947.41	0.89	0.77
BH005	6.26	5.03	2068.50	11581.26	1.11	1.31
BH006	6.27	6.40	4735.83	4606.19	2.87	2.81
BH06A	7.27	7.30	7360.83	7498.45	8.26	8.49
BH007	5.91	6.38	11343.33	9794.40	1.24	1.11
BH07B	6.63	8.60	8062.50	7764.11	9.80	7.73
BH008	6.43	6.63	7452.73	6886.91	1.98	2.07
BH009	6.10	6.32	252.07	356.26	1.98	2.19
BH09A	*	11.77	6108.75	6926.30	18.42	12.14
BH010	5.79	6.13	2527.50	2616.98	1.72	1.85
BH010A	7.32	7.64	6422.50	6118.36	4.90	4.29
BH010B	*	11.49	5144.44	4986.35	23.08	14.40
BH011	5.60	5.95	5222.50	5185.47	0.79	0.92
BH012	6.24	6.72	8083.64	7189.32	1.46	1.42
BH013	6.59	6.59	457.33	3878.64	1.21	0.92
BH014	6.23	6.42	13984.17	12498.95	0.92	1.08
BH17A1	6.10	5.96	1162.83	1854.13	2.67	2.99
BH020A	6.02	6.17	7272.50	7235.67	1.47	1.68
BH020B	6.24	6.32	5310.58	537.00	1.62	1.70
BH021	8.39	8.12	7575.45	7508.33	53.25	53.25

Bore	pH		Ec (uS/cm)		Depth (m)	
	Avg	LTA	Avg	LTA	Avg	LTA
BH021A	5.58	5.90	7283.33	6779.60	3.22	3.42
BH22A	6.16	6.44	5857.27	5523.27	1.92	2.07
BH22B	7.59	7.43	9914.64	10591.89	10.37	10.79
BH23	7.19	7.25	5908.57	5929.14	56.25	56.30
BH23A	7.49	7.37	5520.00	5633.30	16.38	12.33
BH23B	6.24	6.35	4320.50	4477.15	3.06	3.31
BH24A	6.35	6.71	9595.00	9297.09	2.72	1.78
BH24B	*	9.02	9200.91	9423.85	15.31	10.06
BH24C	*	8.17	8880.00	8963.86	35.37	13.82
BH25A	6.29	6.58	6478.33	5851.07	0.85	0.87
BH25B	7.25	7.22	6804.17	6342.55	5.24	4.25
BH25C	*	8.53	7318.18	6889.26	11.97	8.00
BH26A	5.69	6.33	11789.17	8808.49	1.80	1.77
BH26B	7.06	7.18	6750.00	6044.87	1.13	0.99
BH26C	*	8.16	5265.83	5432.11	11.60	8.76
BH27B	8.35	7.70	5808.33	5396.58	79.30	78.00
BH27C	*	7.95	4393.33	4434.21	93.41	84.66

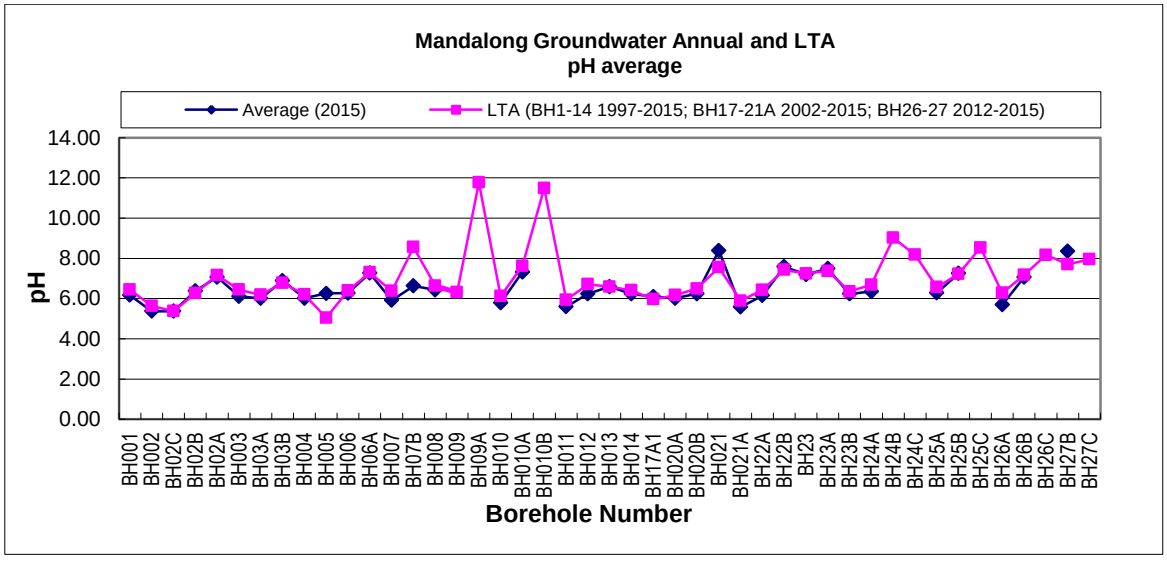


Figure 13: Long-Term Average (LTA) and Annual Average Groundwater pH

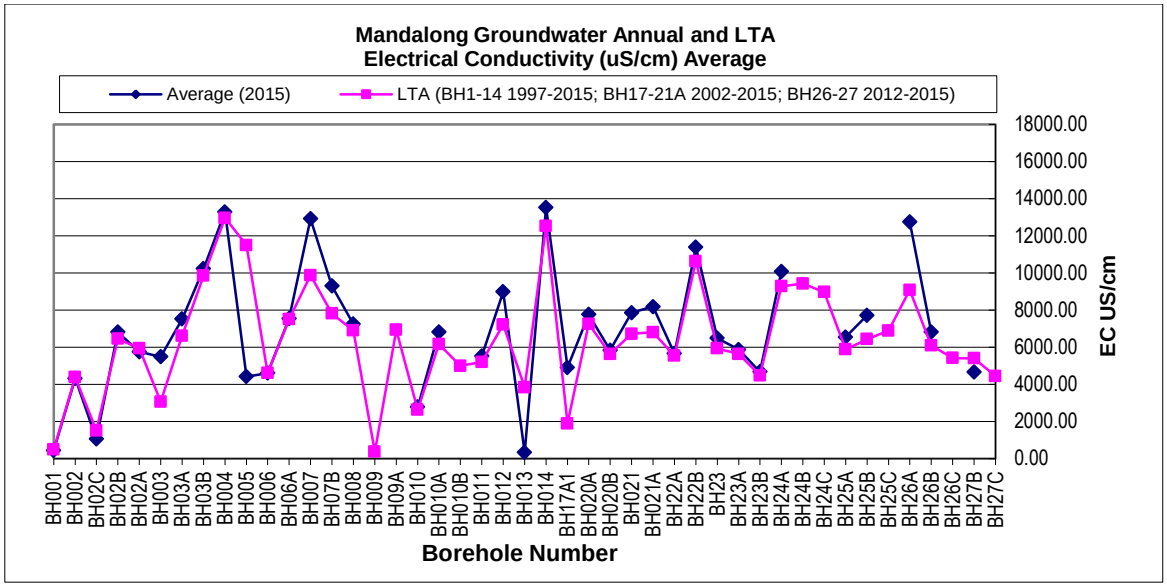


Figure 14: Long-term Average (LTA) and Annual Average Groundwater EC

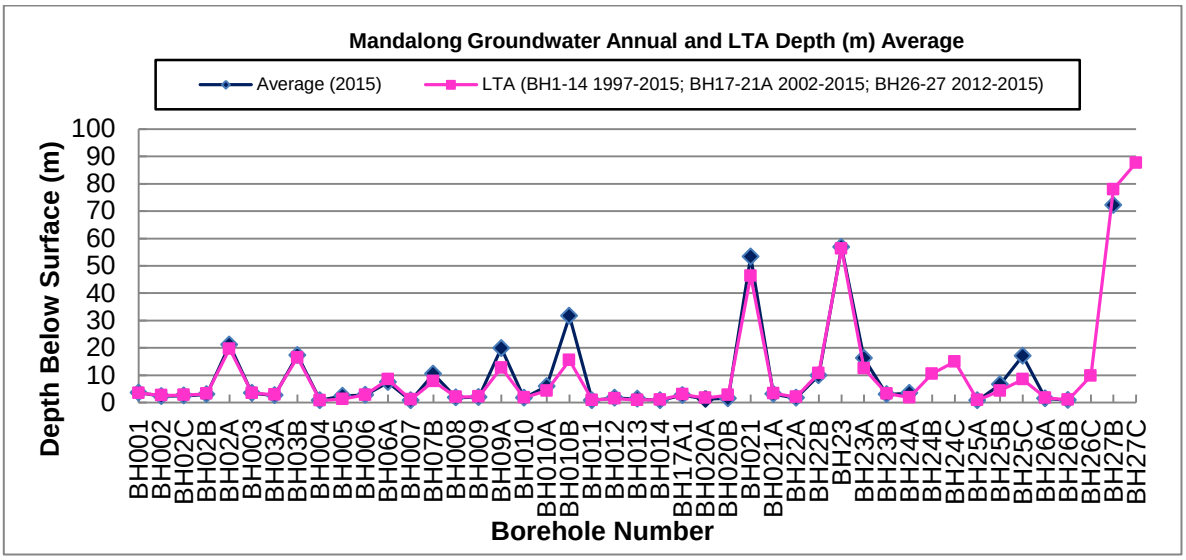


Figure 15: Long-term Average (LTA) and Annual Average Groundwater Borehole Depth (m)

7.3.2.2 Delta Entry

Groundwater monitoring at the Delta site was finalised at the completion of construction in December 2005. No groundwater is discharged at the Delta site. The Delta underground workings are limited to two Maingate roadways therefore, inseam groundwater make is minimal and is pumped via the existing inseam dewatering system to the Cooranbong longwall void area and discharged via LDP001 at the Cooranbong Entry Site.

7.3.3 Data Interpretation

7.3.3.1 Mandalong

This section discusses the recorded groundwater data. The natural groundwater system shows some variability in quality and depth. The pH ranges from a low of 4.93 in April 2015 at BH011 to a high of 8.81 at BH021 in December 2015. The majority of boreholes display

an annual pH average very similar to their respective long-term averages. BH05 and BH07B however showed a difference in the annual average pH compared to the long term average.

The electrical conductivity is characterised by variability. The freshest water (lowest EC) is found at BH02C, with an EC of 161.5 µS/cm recorded in April 2015. The most saline water was found at BH26A, with an EC of 15770 µS/cm recorded in May 2015. Most of the results are relatively consistent with the long-term trend. The greatest variation from the long term average was seen at BH07B.

The recorded depth is relative to the ground surface. The deepest water is found at BH27B averaging 72.14 m during the report period. The shallowest groundwater is found at BH007, which averaged 0.75m for the reporting period. **Figure 15** shows the annual average and long-term average depths are very similar with only minor variations for most boreholes.

In the 1997 Pacific Power International groundwater study of the overburden strata for the Cooranbong Colliery Life Extension Project EIS concluded that "*the height of interconnected fracturing above the extracted seam would range from 60 to 90 metres depending on the seam thickness and overburden lithology*". At the Mandalong Mine, the depth of cover ranges from 160 m to 350 m and therefore it was considered unlikely that mining will result in any significant vertical drainage of the surface alluvial aquifer (Umwelt, 1997). The Longwall panels at the Mandalong Mine have also been designed as relatively narrow in order to limit vertical fracturing and the potential to impact the alluvial aquifers and associated water courses.

The annual review of groundwater monitoring results completed by AGE (2016) provided the following conclusions:

- *2015 groundwater level data indicates that there has been no impact to alluvial groundwater levels from mining. Also, all alluvial bores correlated closely with the CRD, indicating recharge is primarily related to rainfall.*
- *The shallow overburden has been impacted on various levels by mining, most likely due to subsidence-related bedding parting. Water levels, however, generally stabilised or recovered, especially in bores away from active mining.*
- *Mining of the longwall panels generally results in depressurisation of the deeper overburden.*
- *The monitoring data has confirmed the Kendorski (1993) model and previous assessments of the potential impact of goafing associated with longwall mining on the overlying aquifers, viz:*

    - *water levels in the alluvium and shallow overburden are not significantly impacted by mining;*
    - *water bearing overburden strata at depths of greater than 90 m below ground level are depressurised / dewatered as a result of hydraulic connection with the longwall panel; and*
    - *the coal seam aquifer that is being mined is locally depressurised / dewatered.*

- *Based on the analysis of the groundwater monitoring data, there has been no adverse long-term impact on the alluvial aquifers or shallow overburden from longwall mining of panels LW1 to LW18. However, it is acknowledged that dewatering of the goafed zones in addition to the depressurisation of the deeper overburden has occurred due to mining.*

In summary, the monitoring data indicates that although mining has impacted groundwater levels in overburden rocks, there has been no long-term impact, even in faulted areas, on groundwater levels in the alluvial aquifers. Based upon the data collected and the absence of a marked and steady change to EC trends indicates that mining of these panels has not impacted the salinity of the overlying aquifers in 2015.

Therefore impacts to the surface alluvial aquifers to date have been shown to be in accordance with the predictions included in the Cooranbong Life Extension Project EIS.

The approved LW18-21 Environmental Monitoring Program specifies that if the alluvial groundwater data indicate anomalous groundwater behaviour, an assessment of the changes against climatic conditions and further investigation into the occurrence will be undertaken. To date, the alluvium groundwater boreholes indicate groundwater water levels trend with Cumulative Rainfall Departure (CRD) and there has been no permanent adverse impact recorded in alluvial groundwater monitoring boreholes as a result of mining. Therefore, no anomalous alluvial groundwater results have occurred requiring a groundwater investigation program and routine monitoring will continue.

8 REHABILITATION

The conceptual long-term mine rehabilitation objective for Mandalong Mine is to provide a low maintenance, geotechnically stable and safe landform. Centennial Mandalong has committed to undertaking a post-mining land use options assessment prior to mine closure. Specific conceptual long-term objectives include:

- Prevent public access to former underground workings;
- Re-establishing land disturbed by the operations of Centennial Mandalong to an appropriate final land use following completion of the post-mining land use options assessment;
- Provide habitat for fauna and corridors for fauna movement within the final landform;
- Monitor rehabilitation success in terms of physical and biological parameters;
- Relinquishment of the surface leases as rehabilitation objectives are achieved; and
- Compliance with appropriate Centennial and regulatory policies and guidelines.

As described in the Mandalong Southern Extension Project EIS the Mandalong Mine Access Site is intended to be re-developed for an industrial-based land use(s). The proposed Mandalong South Surface Site is intended to be decommissioned and rehabilitated to native bushland commensurate with the surrounding environment (SLR, 2013a). A Rehabilitation Plan (including the Mining Operations Plan) will be prepared in 2016 in accordance with SSD-5144 Schedule 3 Condition 33.

Due to the nature of operations at the Cooranbong Entry Site, along with private haul roads, surface disturbance and the need for progressive rehabilitation, particularly revegetation, is relatively minor compared to active mining operations. However Centennial Mandalong does adopt a progressive approach to rehabilitation as needed, including on-going maintenance of previously rehabilitated areas. As described in the Northern Coal Logistics Project EIS the intention is for the Cooranbong Entry Site to be re-developed for an industrial-based land use(s) (SLR, 2014c). A Rehabilitation Management Plan is required to be prepared for the Northern Coal Logistics Project (including the Cooranbong Entry Site) in accordance with SSD-5145, Schedule 3 Condition 29.

Table 35: Rehabilitation Status

Mine Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
	2014 (ha)	**2015 (ha)**	**2016 (ha)**
A. Total mine footprint[2]	37.0	37.0	37.0
B. Total active disturbance[3]	37.0	37.26	37.26
C. Land being prepared for rehabilitation[4]	0	0.26	0.26

[2] **Total Mine Footprint:** includes all areas within a mining lease that either have at some point in time or continue to pose a rehabilitation liability due to mining and associated activities. As such it is the sum of total active disturbance, decommissioning, landform establishment, growth medium development, ecosystem establishment, ecosystem development and relinquished lands (as defined in the DRE MOP/RMP Guidelines). Please note that subsidence remediation areas are excluded.

[3] **Total Active Disturbance:** includes all areas requiring rehabilitation

Mine Area Type	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
	2014 (ha)	2015 (ha)	2016 (ha)
D. Land under active rehabilitation[5]	8.6	8.6	8.6
E. Completed rehabilitation[6]	0	0	0

8.1 MANDALONG MINE REHABILITATION

The majority of Mandalong Mine site has been rehabilitated following the completion of construction activities in 2005. Rehabilitated sections of the Mine's surface area are well established and have provided vegetation cover to effectively minimise the potential for erosion.

Centennial Mandalong received approval in 2011 (DA97/800 Modification 8) for the trial installation of a ventilation air methane regenerative afterburner unit (VAM-RAB) that would remove and breakdown the exhaust methane. Installation of the VAM-RAB unit in 2012 necessitated clearing of some native vegetation. Two endangered ecological communities (EEC) listed in Schedule 3 of the NSW Threatened Species Conservation Act 1995 were included in the areas to be cleared. These were: Swamp Sclerophyll Forest (SSF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions; and River-Flat Eucalypt Forest (RFEF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

DA97/800 Condition 76A included a requirement for a 1.25 hectare rehabilitation off-set area to be established on cleared land adjoining the VAM-RAB construction site. These EEC were represented by communities described in the regional vegetation mapping and classification (NPWS 2000) as: MU37 Swamp Mahogany Paperbark Forest (SSF); and MU38 Redgum – Rough-barked Apple Swamp Forest (RFEF).

An ecology survey (Hunter Eco, 2011) prepared for the VAM-RAB project application described the area to be rehabilitated as mostly dominated by weeds. This being the case, active regeneration was required and this was commenced in January 2012. Further to the requirement to rehabilitate, DA97/800 Condition 76A also requires that the progress of the rehabilitation be monitored annually for five years. This monitoring was conducted by Hunter Eco in December 2015 and is described in **Section 6.5** of this document.

8.1.1 Longwall Mining Area

The surface areas above the completed longwall mining panels are inspected as per the schedules prescribed in the approved Environmental Monitoring Plans for LW15-17 and LW18-21 and the Subsidence Monitoring Program. The EMP requires the floodpaths to be inspected every six months or after a flood event (refer to **Appendix 2**) and the SMP requires surface inspections during surveying of monitoring lines. During the course of

[4] **Land being prepared for rehabilitation:** includes the sum of mine disturbed land that is under the following rehabilitation phases – decommissioning, landform establishment and growth medium development (as defined in DRE MOP/RMP Guidelines)

[5] **Land under active rehabilitation:** includes areas under rehabilitation and being managed to achieve relinquishment – includes 'ecosystem and land use establishment' and 'ecosystem and land use sustainability (as defined under the DRE MOP/RMP Guidelines)

[6] **Completed rehabilitation**: requires formal sign off from DRE that the area has successfully net the rehabilitation land use objectives or completion criteria

these inspections observations are made on the progress of remedial measures implemented to minimise subsidence related effects (refer **Table 26**).

The area disturbed during the construction of subsurface drainage, installed to alleviate remnant ponding above Longwall 6 on a Centennial owned property (56) was rehabilitated in October 2009. The area was inspected in 2015 following rainfall events. This confirmed the drains take up to seven days to remove ponded water from the paddock which can vary depending on the amount of rainfall and the water level in Stockton Creek. Horses are able to use the paddock and are rotated out in wet conditions similar to other ponded areas of floodplain. This drying period is consistent with other areas of the flood plain which drain or dry out over a similar period.

The remnant ponding on Centennial's properties above Longwalls 5 and 6 are now free draining following works to re-instate and extend existing surface drainage. Land use by the tenants for cattle and other activities are now occurring as they did prior to mining.

Remnant ponding was observed in limited areas above longwall panel 7 and 8 situated on an existing low lying area of Centennial's properties. The area consists of exotic pasture species primarily used for horse grazing. Centennial Mandalong has completed the construction of a drain to remediate the longwall 7 ponding in 2015. The drainage of the area above longwall 8 area is impractical with little fall available from the ponded area into the nearest creek, over 300 m to the east. In 2015, this ponded area has been fenced from stock and allowed to develop into a freshwater wetland and has been incorporated into the bi-annual wetlands monitoring program.

An increase in the existing ponded area above LW16 on private property was remediated, with the installation of a drain in late 2016. Following remediation water levels have since been restored to the pre-mining condition. An access agreement is in place with the landowner to monitor and undertake remediation. Quarterly flora monitoring of the ponded area will be undertaken by a qualified ecologist and will continue in 2016.

8.1.2 Exploration Sites

One surface exploration drill site was prepared in 2015 (CM124). This site required no surface disturbance and was located on private property. This site was rehabilitated following the sealing of the borehole. Existing tracks were utilised to gain access to the exploration drill site where possible and required no vegetation clearing. Site CM124 was seeded with sterile grass species to stabilise the drill site following the re-instatement of the land surface.

Ongoing monitoring and maintenance of rehabilitated sites will be conducted in 2016 and reported in the Annual Review.

8.1.3 Delta Entry Site

Construction of the Delta coal clearance system was largely completed in 2005 and rehabilitation of the site was completed in 2006. Rehabilitation at the Delta Entry Site was inspected in 2015 to assess the effectiveness of the works to stabilise disturbed areas onsite. The direct seeding rehabilitation methods used have been successful in establishing a substantial area of the site with pasture and tree groundcover. Ground cover on the direct tree seeded areas is approximately ninety percent similar to those recorded in 2015. Ninety-five percent ground cover has been achieved in rehabilitated pasture seeded areas. The area is slashed to maintain access to infrastructure and as part of the asset protection zone.

8.1.4 Cooranbong Entry Site

A total of 3.9 hectares have been disturbed from the construction of the upgrades to the CHP and haul road at the Cooranbong Entry Site in 2009. Construction activities were

completed in May 2010 with all disturbed areas rehabilitated by the Contractor shortly after. No further rehabilitation works were undertaken in 2015.

8.1.5 Cooranbong Haul Road

The haul road construction resulted in approximately 18 ha of disturbance. Of this 3.9 hectares of disturbed land associated with the CHP upgrades (stockpile and conveyor) and haul road are located on Mandalong Mine's Mining Lease. 1.25 hectares of disturbed area not occupied with haul road and CHP infrastructure was rehabilitated in 2010. The remaining areas are located on the Newstan Colliery Mining Lease CCL764. Of this, nine hectares along the haul road was rehabilitated in 2009. Six hectares of land will not be rehabilitated as it is occupied by the haul road infrastructure.

As per the requirement of the Mandalong Haul Road Landscape and Rehabilitation Plan, the Mandalong Environment & Community Coordinator audited the rehabilitation on the haul road in November 2015. The audit assessment required the following issues be addressed: -

- An *assessment of surface and slope stability.*
- *Properties of the soil or root zone media (such as chemistry, fertility and water relations).*
- *Plant community structural attributes (such as cover, woody species, density and height).*
- *Plant community composition (such as presence of desirable species, weeds).*
- *Selected indicators of ecosystem functioning analysis (such as soil microbial biomass).*

The 2015 audit focused on identifying sites where remedial action or maintenance is required to bring sites to an acceptable standard. The inspection strategy involved one person inspecting the full length of the Haul Road to access 100% of the disturbed area.

In total seven sites were inspected and recorded an action priority from highest to lowest. The highest priorities included maintenance of sediment and erosion controls along the Haul Road drains.

The audit provides a useful assessment of baseline rehabilitation completed to date on the haul road following the completion of all construction activities in 2011. In general rehabilitated sections of the haul road are well established and continued growth occurred in 2015. Maintenance and effectiveness of the haul road rehabilitation will be assessed in 2016 and reported in the next Annual Review.

8.2 BUILDINGS

8.2.1 Mandalong Mine

No buildings or infrastructure were removed or decommissioned in 2015.

8.2.2 Delta Entry Site

All buildings at the Delta Entry Site are associated with the coal conveying system and as such are a permanent fixture. The buildings associated with the construction of the site were decommissioned and removed prior to the site being rehabilitated in 2006. No construction or decommissioning of buildings occurred at the Delta Entry Site in 2015 and as such no rehabilitation of buildings was undertaken.

8.2.3 Cooranbong Entry Site

To ensure continuation of coal handling operations and mine support infrastructure, surface buildings and mine related infrastructure have been retained at the Cooranbong

Entry Site. The Cooranbong Entry Site, CHP and supporting infrastructure were used in 2015 to supply coal to the Eraring Power Station and to Newstan.

No buildings or infrastructure at the Cooranbong Entry Site were removed or decommissioned in 2015.

8.3 REHABILITATION TRIALS AND RESEARCH

8.3.1 Moran's Creek Rehabilitation Trials

During consultation with local Mandalong landowners, concerns were raised regarding historical land management practices which have resulted in extensive clearing of native vegetation and severe erosion of creek banks and drainage lines across the valley. The Moran's Creek Rehabilitation trial was initiated in 2007 to respond to local landowner concerns in particular the historical erosion on Moran's Creek caused by flood flows and stock accessing creek areas. Local landowner's sited evidence that excavation of the creek in the 1950's caused the creek to widen as a result of the creek banks eroding. In November 2007 a trial commenced to rehabilitate a section of Moran's Creek on a Centennial owned property. The objective of the trial is to assess the effectiveness of direct seeding and tube stock planting to re-establish a native vegetation community on a degraded section of Moran's Creek.

Direct seeding of the trial area commenced in January 2008 with inspections in 2011, 2012, 2013, 2014 AND 2015 concluding that the direct seeding method has been successful in establishing tree cover over the majority of the area. Juvenile species including *Eucalyptus Tereticornis, E. robusta* and *Casuarina Glauca* have successfully established on the trial area. The trial direct seeding area has been largely successful in re-establishing the native vegetation found along Moran's Creek. Further weed spraying was conducted in 2015 to control Tobacco, Scotch Thistle and Blackberry.

The 2000 tube stock planted in November 2008 along the fenced Moran's Creek rehabilitation corridor are now established along Moran's Creek with trees heights of up to 6 m. The rehabilitation site is a reference site for the Catchment Management Authority (CMA) vegetation monitoring report. The monitoring has recorded the baseline vegetation conditions and will evaluate the rehabilitation measures implemented at Moran's Creek.

8.3.2 Translocation Research Program

Field investigations for the haul road project had established that the local populations of *Grevillea parviflora subsp. parviflora* and *Tetratheca juncea* were so extensive that it would not be possible to avoid the loss of some plants of these species no matter where the haul road was located. Consequently a translocation research programme was developed in consultation with the EPA for the translocation and ongoing monitoring and reporting for the threatened flora species *Tetratheca juncea* and *Grevillea parviflora* that would have otherwise been lost as a result of the haul road construction. The main aim of this translocation project was to implement an experimental model that would add to the knowledge base regarding the translocation of these species, building on available information from any previous attempts. The overall experiment ran for 5 years with interim reports prepared at the end of each year and a final report after the 5th year. Hunter Eco produced the final Centennial Coal Cooranbong-Awaba Haul Road Threatened Flora Translocation Monitoring Report for Centennial Coal in November 2013 (Hunter Eco, 2013b).

In January 2010 the first detailed monitoring report was completed by inspection of all sites containing the translocated threatened plant species within and around the haul road. The current report by Hunter Eco *"Cooranbong-Awaba Haul Road Threatened*

Flora Translocation Report" (2013b), has established the extensive presence of *Grevillea parviflora* subsp. *pariflora* and *Tetratheca juncea* that has undergone a threatened flora translocation research programme between 27 April 2009 and 6 May 2009.

One recipient site for *Grevillea parviflora* subsp *parviflora* and three sites for *Tetrathea juncea* were established which were translocated by methods of an excavator and individual clumping.

8.3.2.1 Grevillea parviflora subsp. parviflora

Translocation of this taxon appears to have been a success with the population established, consisting of robust mature plants along with a range of early successional plants. There was no evidence of fruit production despite consistent flowering so it is likely that the smaller plants are clones sprouting from underground rhizomes.

8.3.2.2 Tetratheca juncea

There were three aims of this translocation experiment:
1. To compare translocating individual clumps (Site 2) with using an excavator to move large groups of clumps (Sites 3 and 4);
2. At Site 2, to determine whether loosening of soil around the recipient hole facilitated vegetative spread compared with unloosened soil;
3. At Site 3, to determine whether translocating *Tetratheca juncea* using an excavator could assist in rehabilitating a highly disturbed area.

Unfortunately these aims were thwarted by heavy grazing of the translocated *Tetratheca juncea* by herbivores at all three sites. Grazing pressure was such that the translocated clumps were not able to establish themselves. In this regard, comparison can be made with the *Tetratheca juncea* translocation experiment conducted at Gwandalan (Driscoll and Bell 2008 in (Hunter Eco, 2013b)) where herbivory was not a problem. That experiment was subdivided into ten groups of ten clumps each, all located in a variety of habitat types. In favourable habitat survival was as high as 90% after five years.

9 COMMUNITY CONSULTATION

Mandalong Mine consults with the community through forums such as, the Mandalong Mine Community Consultative Committee and community organised events.

Meetings of the Mandalong Mine Community Consultative Committee (CCC) were held in February, June, August and October 2015. Representatives of the Mandalong community, a Dora Creek community representative, appointed community representatives; relevant government organisations and company representatives attended the meetings. A detailed presentation was provided to attendees at each CCC meeting on the Mine's production, geological update, subsidence results, environmental monitoring, SMP update and sponsorship. Additional agenda items discussed in 2015 included the Mandalong South Extension Project, the Northern Coal Logistics Project, TL24 Modification, the Mine's exploration drilling, VAM RAB project, and Centennial's land management.

9.1 SMP CONSULTATION

Extensive community consultation with landowners in the Mandalong mining area is undertaken for the purpose of monitoring and assessing subsidence effects on private properties. The existing community consultation process that is established under the Mandalong Mine Development Consent provides a good foundation to address the requirements under the SMP process. In general, the Mandalong Mine community consultation has included:-

- Community consultation in line with the Landowner Communication and Consultation Plan (LCCP).
- Individual landowner notification and consultation associated with the development of the Extraction Plan for LW22-24A and their PSMP's.
- Consultation and general communication with all relevant government agencies and infrastructure owners during the development and subsequent approval of SMP for Longwalls 18 to 21.
- Individual landowner consultation and implementation of PSMPs during mining of Longwall 17, 18 and Longwall 19.
- Notification of Mining Lease 1722 (Lakes Mail, February 2016).
- Four meetings of the Mandalong Mine Community Consultative Committee (MMCCC) chaired by Margaret MacDonald-Hill delivered updates on the status of SMP approvals, subsidence monitoring and management, including a presentation by Hunter Eco Environmental Biologist, Dr. Colin Driscoll on wetland monitoring and management in Mandalong.
- Ongoing consultation with relevant stakeholders on the development and implementation of infrastructure Management Plans including Public Roads (LMCC), Ausgrid, Telstra and TransGrid.
- One month mining notifications were provided to landowners prior to mining beneath their property, with follow-up meetings undertaken where requested.
- Subsidence Management Status reports were completed on a four monthly basis, the End of Panel Report for Longwall 17 and the Annual Report for SMP LW18-21 was prepared and provided to DRE, DPE, CCC and stakeholders.

9.2 COMMUNITY SPONSORSHIP

The Mandalong Mine continues to support the local community through various sponsorship avenues such as:

- Sponsorship of Morisset Agricultural Society Show held in February 2015;
- Sponsorship provided to 10 Morisset children to attend the Razzamatazz Festival held by the Gosford Rotary Club;
- Park to Peden's Event (community walking event for Lifeline Hunter);
- Annual Morisset Community Festival;
- Westpac Rescue Helicopter's Outback Mountain Bike Adventure;
- Cooranbong Pre-school – funding provided to assist with storm damage repairs;
- Supported Eastlakes NAIDOC Day in July 2015;
- Plastic rib mesh donated to Wangi Men's Shed;
- Sponsored Avondale School Family Festival in September;
- Sponsored Cooranbong Public School Family Fun Day in December;
- Conveyor belting provided to Hunter Wetlands for use in their nursery;
- Cancer Council Mystery Box Rally;
- Lake Macquarie Heritage College Country Fair & Fun Day;
- 2015 Morisset Pro-Am Event;
- Southlakes Community Services Fundraising Trivia Night;
- Sponsorship provided to Westlakes Computer Club;
- Peninsula RFS Film Night;
- Timber donated for the Dora Creek Primary School Bell Restoration Project.
- Southlakes Carers Christmas Lunch;
- St. John Vianney Morisset & Cooranbong Public School end of year awards presentations;
- Morisset Public School Raffle;
- 9 volt batteries donated to Wangi Wangi Fire Station;
- Morisset United Soccer Club;
- Dora Creek Primary School Bell Restoration; and
- Marks Point Public School.

9.3 COMMUNITY COMPLAINTS

One complaint was received by Centennial Mandalong from the community during the period January 2015 to December 2015, as described in **Table 36**.

Table 36: 2015 Community Complaint Details.

Mandalong Complaint Log Number	Date Complaint Logged	Type of Complaint	Comments
4/2015/ccapp1000230	12/5/2015	Subsidence	There was one community complaint received on 22 April 2015 regarding the "loss of water" observed in the large wetland located on Centennial property following the recent subsidence of Longwall 16. Mandalong Mine provided a response to the complaint on 23 April 2015 stating that the impact to the wetland is as predicted and is being monitored and managed with water levels to be restored following the completion of mining for LW17 and LW18. Subsidence monitoring completed in January 2016 has confirmed that water levels have returned to pre-mining levels at Transect 4. Water levels are expected to return to pre-mining levels at Transect 5 following the completion of Longwall 19.

A total of one community complaint was received in 2015, showing no increase over the previous reporting period, as detailed in **Table 37**.

Table 37: Record of annual community complaints for 2014 & 2015

Community Complaints						
Year	**Air**	**Water**	**Noise**	**Waste**	**Other**	**Total**
2015	0	0	0	0	1	1
2014	0	0	0	0	1	1

Figure 16 shows a general decrease in the number of community complaints received since 2011 with only one complaint received in 2013, 2014 and 2015 respectively. Since 2011 no community complaints have been received regarding air quality, water, noise or waste.

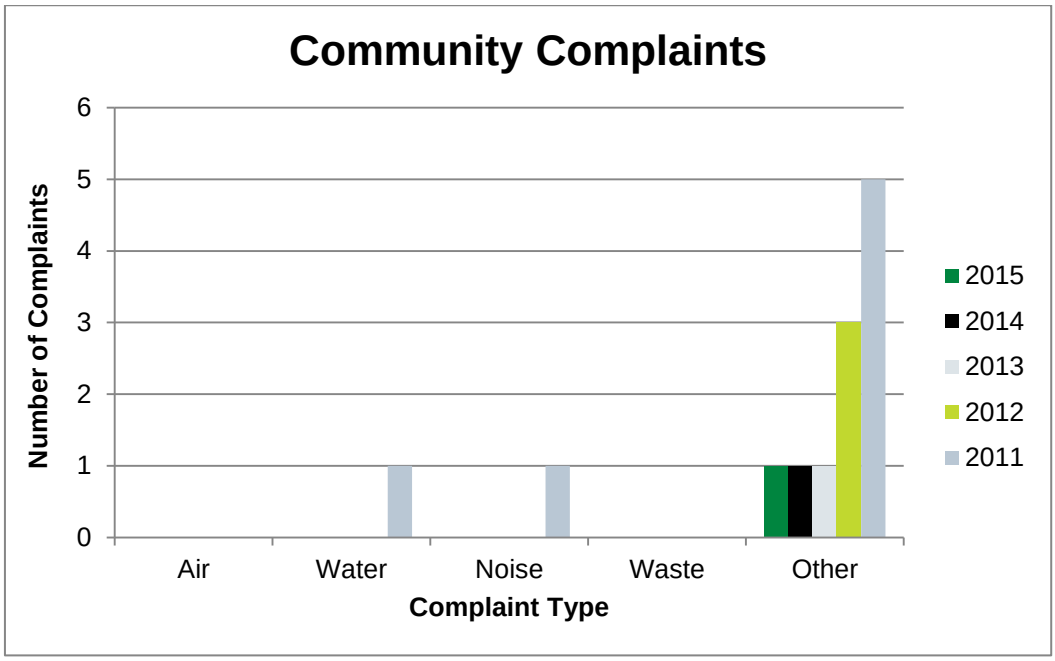


Figure 16: Annual community complaints

10 INDEPENDENT ENVIRONMENTAL AUDIT

An Independent Environmental Audit of Mandalong's operations was completed by URS in May 2013. The audit report is publically available on the Centennial Mandalong website, and a copy was provided to CCC members and the DPE in June 2013.

An action plan was prepared in response to the recommendations listed in the 2013 Independent Environmental Audit and was also provided to DPE in June 2013.

The next Independent Environmental Audit of the Mandalong Mine operations in accordance with SSD-5144 Schedule 6 Condition 13 and DA97/800 (MOD10) Condition 108 is required to be commissioned prior to March 31, 2016. The audit has been scheduled to commence on 4 April 2016.

11 NON-COMPLIANCES DURING THE REPORTING PERIOD

Table 38: Non-Compliance 1

Nature of the incident/non-compliance	Non-compliance with EPL365 Condition M2.4 as a result of not collecting a grab sample for a discharge from LDP001 at Cooranbong on 4 April 2015.
Date of incident/ non-compliance (if known; if not known state not known)	4 April 2015
The location of the incident/ non-compliance (include a figure if appropriate), if known	Cooranbong Entry Site LDP001
Detail the cause of the incident/non-compliance	A daily water sample was unable to be collected at LDP001 as required by M2.4 due to flooding of the adjacent creek, which prevented safe access for the sampling contractor. The Bureau of Meteorology Cooranbong weather station recorded 117.2mm of rain between 4 and 5 April 2015.
Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance	In 2015 an engineering design and tendering process was completed for the LDP001 upgrade to relocate the discharge point out of the adjacent creek.
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	In 2016 the LDP001 upgrade will be completed to remove the discharge point from the creek. Construction is expected to be completed in 2016.

Table 39: Non-Compliance 2

Nature of the incident/non-compliance	A noise criteria exceedance (EPL 365 L5.1 & DA97/800 Condition 44) was recorded at M9 (Mandalong Mine – Gimberts Road monitoring location) where an exceedance of the 45dBa LA (1 minute) night-time sleep disturbance criteria occurred due to a measured level of 57dBa being recorded.
Date of incident/ non-compliance (if known; if not known state not known)	11 August 2015
The location of the incident/ non-compliance (include a figure if appropriate), if known	Noise Monitoring Location M9, Gimberts Road, Morisset.
Detail the cause of the incident/non-compliance	Following the exceedance, it was determined that the source of the noise was from an on-site reversing alarm at the Mandalong Mine site.
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	In response to the noise exceedance, the Mandalong Mine replaced the tonal reversing alarms with squawker reversing alarms for all forklifts operating on the site on 26 September 2015.

Table 40: Non-Compliance 3

Nature of the incident/non-compliance	Non-compliance with EPL 365 Condition M2.4, as a result of not collecting grab samples at LDP001 between 25 and 28 December 2015. Mandalong had planned to cease pumping and discharge from LDP001 during this period. A Warning Letter was issued by the EPA in relation to this incident on 12 February 2016.
Date of incident/ non-compliance (if known; if not known state not known)	25 – 28 December 2015
The location of the incident/ non-compliance (include a figure if appropriate), if known	Cooranbong Entry Site LDP001
Detail the cause of the incident/non-compliance	Water samples were not collected due to the Borehole pump not being turned off as planned, due to a miscommunication between Mandalong staff.
Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance	This technical non-compliance is unlikely to result in any environmental harm. Discharge occurred from LDP001 on 301 days in 2015 with no exceedances of EPL365 limits recorded.
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	An automated notification system has been implemented for the Borehole Pump. This system will automatically notify the relevant Mandalong staff when the Borehole pump is operational so that sampling can be arranged.

12 ACTIVITES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Table 41: Forecast Operations for 2016

Centennial Mandalong
Revision of Heritage Management Plan. Development of Historic Heritage Management Plan. Development of Biodiversity Management Plan. Revision & update to Water Management Plan. Revision & update to Air Quality & Greenhouse Gas Management Plan. Revision & update to Noise Management Plan. Development of Mine-Water Discharges Management Plan. Development of Rehabilitation Management Plan / Mining Operation Plan Extraction Plan LW22-24A
Mandalong Mine Access Site
Complete Mandalong Mine Dam expansion.
Cooranbong Entry Site
Complete LDP001 monitoring upgrade.
Delta Entry Site
Nil major targets for 2016.
Mandalong South Services Site
Develop Construction Environmental Management Plans

13 BIBLIOGRAPHY

AGE. (2015). *Mandalong Longwall Coal Mine Groundwater Monitoring Review for AEMR 2014, Project No. G1455C.* Australian Groundwater& Environmental Consultants Pty Ltd.

AGE. (2016). *Mandalong Longwall Annual Groundwater Monitoring Review 2015.*

ANZECC. (1990). *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration.* Australian and New Zealand Environmental Councils.

Centennial Mandalong. (2013). *Annual Environmental Management Report 2012.*

Centennial Mandalong. (2014a). *Response to Submissions.*

Centennial Mandalong. (2014b). *Response to RTS Submissions.*

Centennial Mandalong. (2015a). *Annual Environmental Management Report 2014.*

Centennial Mandalong. (2015b). *Mandalong Mine Flood Path Condition Report 2014.*

Centennial Mandalong. (2016). *Mandalong Mine Flood Path Condition Report 2015.*

DRE. (2013). *ESG3: Mining Operations Plan (MOP) Guidelines September 2013.* NSW Trade & Investment - Division of Resources & Energy.

GHD. (2015). *2014 Water Balance Mandalong Mine.*

GHD. (2016). *2015 Water Balance Mandalong Mine.*

GSS Environmental. (2012). *Cooranbong Distribution Project Environmental Assessment.*

Hunter Eco. (2011). *Mandalong Mine Ventilation Air Methane Abatement Demonstration Project - Ecology Report.*

Hunter Eco. (2013a). *Centennial Mandalong Mine Wetland Management Plan.*

Hunter Eco. (2013b). *Cooranbong-Awaba Haul Road Threatened Flora Translocation Report".*

Hunter Eco. (2013c). *Monitoring the Impact of Subsidence on Wetlands of the Mandalong Floodplain - Detection and Management of Surface Ponding.*

Hunter Eco. (2014a). *Monitoring the Impact of Subsidence on Wetlands of the Mandalong Floodplain - Wetland Monitoring Report April 2014.*

Hunter Eco. (2014b). *VAM-RAB Site Vegetation Rehabilitation Monitoring Year 2.*

Hunter Eco. (2015a). *Monitoring the Impact of Subsidence on Wetlands of the Mandalong Floodplain - Wetland Monitoring Report January 2015.*

Hunter Eco. (2015b). *Monitoring the Impact of Subsidence on Wetlands of the Mandalong Floodplain July 2015.*

Hunter Eco. (2015c). *Monitoring the Impact of Subsidence on Wetlands of the Mandalong Floodplain December 2015.*

Hunter Eco. (2015d). *VAM-RAB Site Vegetation Rehabilitation Monitoring - Year 3.*

RPS. (2012). *Cultural Heritage Assessment Mandalong SMP – Longwalls 15 to 17, Report No.111129.*

RPS. (2013a). *Cultural Heritage Assessment Mandalong SMP – Longwalls 18 to 21, Report No. PR117956.*

RPS. (2013b). *Heritage Due Diligence Assessment Mandalong Mine, Report No.117956-1.*

Seedsman Geotechnics. (2015a). *Review of Subsidence LW16 - MAND15-02.*

Seedsman Geotechnics. (2015b). *Review of Subsidence LW17 - MAND15-07.*

Seedsman Geotechnics. (2015c). *Steep Slope Assessment Mandalong Mine LW18 to LW21, MAND14-08.*

SLR. (2013a). *Mandalong Southern Extension Project EIS.*

SLR. (2013b). *Review of Environmental Factors - Modification No.3 Report – Mandalong Exploration Project Relocation of Specified Drill Sites to Olney State Forest.*

SLR. (2014a). *Blast Monitoring Mandalong Mine.*

SLR. (2014b). *Mandalong Mine Annual Compliance Noise Monitoring 2014.*

SLR. (2014c). *Northern Coal Logistics Project EIS.*

Umwelt. (1997). *Cooranbong Colliery Life Extension Project Environmental Impact Statement.* Umwelt (Australia) Pty Ltd.

Umwelt. (2004). *Delta Link Project - Statement of Environmental Effects.*

PLANS

APPENDICES

Centennial Coal

Centennial Coal Company Limited
P O Box 1000
Toronto NSW 2283
www.centennialcoal.com.au