



CENTENNIAL MANDALONG PTY LTD
Mandalong Mine
ANNUAL REVIEW

March 2023

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.
Name of holder of Development Consent/ Project Approval	Centennial Mandalong Pty Ltd
Mining Lease #	CCL 762 CCL 746 Sub-Lease Mining Purposes Lease 191 Mining Lease 1443 Mining Lease 1543 Mining Lease 1553 Mining Lease 1722 Mining Lease 1744 Mining Lease 1793
Name of Holder of Mining Lease	Centennial Mandalong Pty Ltd
Water License #	WAL39767
Name of Holder of Water License	Centennial Mandalong Pty Ltd
Annual Review Start Date	1 January 2022
Annual Review End Date	31 December 2022
<p>I, CRACK GILLARD 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 2022 and that I am authorised to make this statement on behalf of Centennial Mandalong Pty Ltd.</p> <p>Note:</p> <p>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.</p> <p>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).</p>	
Name of Authorised Reporting Officer	CRACK GILLARD
Title of Authorised Reporting Officer	MANAGING DIRECTOR & CEO
Signature of Authorised Reporting Officer	
Date	31/12/23

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Plans

Plan Reference	Plan Name
CM00310	Mandalong Mine Monthly Production 2022
CM00315d	Mandalong Mine Location of Environmental Monitoring Points
CM00315c	Delta Entry Site Locations of Environmental Monitoring Points
CM00315b	Cooranbong Service Site Location of Environmental Monitoring Points
CM00315f	Mandalong South Surface Site Location of Environmental Monitoring Points
CM00317	Mandalong Surface Water and Groundwater Monitoring Locations

Appendices

Appendix No.	Appendix Name
1	Bank Guarantee – DA97/800 CC24
2	Floodpath Condition Report – 2022
3	Independent Environmental Audit Action Plan

1 STATEMENT OF COMPLIANCE

Table 1-1: Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
DA97/800 (MOD10)	Yes
DA97/800 MOD 4 Statement of Commitments	Yes
DA97/800 MOD 7 Statement of Commitments	Yes
SSD-5144 (MOD10)	Yes
SSD-5144 Mandalong Southern Extension Project Statement of Commitments	Yes
SSD-5144 MOD 1 Statement of Commitments	Yes
SSD-5144 MOD 6 Statement of Commitments	Yes
SSD-5144 MOD 7 Statement of Commitments	Yes
SSD-5145 (MOD 1)	Yes
DA35-2-2004 (MOD 1)	Yes
EPL 365	No
Mining Lease 1443	Yes
Mining Lease 1543	Yes
Mining Lease 1553	Yes
Mining Lease 1722	Yes
Mining Lease 1744	Yes
Mining Lease 1793	Yes
Mining Purposes Lease 191	Yes
Consolidated Coal Lease 762	Yes
Consolidated Coal Lease 764	Yes
WAL39767	Yes
EPBC Approval 2013/6906	Yes

Table 1-2: 2022 Non-Compliances

Relevant Approval	Condition #	Condition summary	Compliance Status	Comment	Where Addressed in Annual Review
EPL365	L1	Pollution of Waters	Non-Compliant	Discharge from MSSS Stockpile Dam – March 2022.	Table 11-1
EPL365	L1	Pollution of Waters	Non-Compliant	Discharge from MSSS Stockpile Dam – July 2022.	Table 11-2
EPL365	L2.4	Water and / or Land Concentration Limits	Non-Compliant	Exceedance of LDP003 water quality limit criteria.	Table 11-3
EPL365	L2.4	Water and / or Land Concentration Limits	Non-Compliant	Exceedance of LDP004 water quality limit criteria.	Table 11-4
EPL365	M2.3	Water and / or Land Monitoring Requirements	Non-Compliant	Daily sample not collected on 5/7/22 at LDP004.	Table 11-5

Note: Compliance Status Key for Table 1-2

Risk Level	Colour Code	Description
High	Non-Compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-Compliant	Non-compliance with: <ul style="list-style-type: none"> Potential for serious environmental consequences, but is unlikely to occur; or Potential for moderate environmental consequences, but is likely to occur
Low	Non-Compliant	Non-compliance with: <ul style="list-style-type: none"> Potential for moderate environmental consequences, but is unlikely to occur; or Potential for low environmental consequences, but is likely to occur
Administrative	Non-Compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. 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').

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 6.5 million tonnes of coal to the domestic power and export markets (**Figure 2-1**).

The 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 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 6.5 million tonnes per annum of coal from the West Wallarah Seam and Wallarah-Great Northern 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 10 million tonnes of coal per annum. These sites are maintained under current mine leases as detailed in **Table 3-1**.

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 and agreed with the Secretary of the Department of Planning & Environment (DPE) on 16 September 2016 in accordance with Section 104A of the Environmental Planning and Assessment Act 1979 (EP&A Act) Centennial Mandalong shall surrender DA97/800 by 30 September 2022. A Notice of Consent Surrender was submitted by Centennial Mandalong to the DPE (via the major project portal) on 10 August 2022.

2.1 Scope

This Annual Review details the progress of environmental management covering Mandalong Mine, Mandalong South Surface Site, Cooranbong Entry Site and the Delta Entry Site collectively, for the period 1 January 2022 to 31 December 2022.

The Annual Review has been prepared in accordance with the Mandalong Mine conditions of consent as detailed in SSD-5144 and DA 97/800. The Annual Review has also been prepared in accordance with the requirements of Schedule 3, Condition 4 of DA35-2-2004 (Mandalong Coal Delivery System – Delta Link Project).

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 other operations covered by SSD-5145 are described in the Newstan Annual Review required by SSD-5145.

2.2 Mine Contacts

The contact details for the personnel responsible for environmental management and community relations at Centennial Site are provided in **Table 2-1**.

Table 2-1: Centennial Site Environmental Contact Details

Name	Position	Phone
Justin Peterkin	Mine Manager	T: 02 4973 0911
		E: justin.peterkin@centennialcoal.com.au
Jeffrey Dunwoodie	Environment & Community Superintendent	T: 02 4973 0947
		E: jeffrey.dunwoodie@centennialcoal.com.au
Clint Allen	Approvals Coordinator	T: 02 4973 0948
		E: clint.allen@centennialcoal.com.au

3 APPROVALS

A summary of Project Approvals, Mining Leases, and other Licences relevant to Centennial Site is provided in **Table 3-1**. Current Project Approvals, EPBC Approvals, Exploration Licences, and Mining Leases are available at <https://www.centennialcoal.com.au/operations/mandalong/>

Table 3-1: Environmental Approvals held by Centennial Mandalong.

Approval	Description	Expiry Date	Change to Approval during Reporting Period
Project Approval – NSW Department of Planning and Environment			
Mandalong Mine Development Consent No.97/800	Permits development and works to occur as described in the EIS.	October 2020	Nil
Mandalong Mine Development Consent No. DA 35-2-2004	Permits construction and operation of the Delta Coal Handling Facility	31/12/2040	Nil
Mandalong Mine Development Consent SSD-5144	Extension of underground operations into the Mandalong Southern Extension Area.	31/12/2040	Modification 10 for the addition of LW34.
Centennial Northern 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.	31/12/2045	Modification 3 for the rehabilitation reforms.
Extraction Plans – NSW Department to Planning and Environment			
Extraction Plan LW25-31	Secondary Extraction of LW25-31	NA	Nil
Extraction Plan LW30-31	Secondary extraction of LW30 and LW31	NA	Nil
Extraction Plan LW32	Secondary extraction of LW32	NA	Variation with a reduction of coal extracted in Longwall 32 to protect natural surface features.

Approval	Description	Expiry Date	Change to Approval during Reporting Period
Extraction Plan LW34	Secondary extraction of LW34	NA	Nil
Environmental Protection Licence – NSW Environment Protection Agency			
Environmental Protection Licence 365	Permits scheduled activity “coal mining” and discharge of water from licensed discharge points.	Perpetual	Nil
Radiation Licence – NSW Environment Protection Agency			
Radiation Licence 5064217	Radiation management	26/6/2023	Nil
Mining Lease – NSW Department of Regional NSW – Resources Regulator			
Consolidated Coal Lease 762	Title to Cooranbong Workings includes some surface land, some environmental conditions	13/10/2043	Lease renewed Standard Conditions
Consolidated Coal Lease 746 (sublease)	Title for Cooranbong Workings includes some surface land – some environmental conditions (Managed by Centennial Newstan)	31/12/2028	Instrument of Variation for Standard Conditions
Mining Purposes Lease 191	Title to surface land for water tanks at Cooranbong – requires annual environmental management report on anniversary	24/02/2044	Lease renewed Standard Conditions
Mining Lease 1443	Mandalong Project Mining Lease – includes some surface land	01/03/2020#	Instrument of Variation for Standard Conditions
Mining Lease 1543	Mining Lease – Mandalong Mine Project	25/11/2024	Instrument of Variation for Standard Conditions
Mining Lease 1553	Mining Lease Delta Link Project – includes surface land	07/09/2025	Instrument of Variation for Standard Conditions
Mining Lease 1722	Mining Lease –Southern Extension Area	17/12/2036	Instrument of Variation for Standard Conditions

Approval	Description	Expiry Date	Change to Approval during Reporting Period
Mining Lease 1744	Mining lease associated with proposed mining operations in the Olney State Forest areas within the Southern Extension Area	06/10/2037	Instrument of Variation for Standard Conditions
Mining Lease 1793	Ancillary mining activities at the Cooranbong Entry Site.	16/07/2040	Instrument of Variation for Standard Conditions
Exploration Licences – NSW Department of Regional NSW –Resources Regulator			
Exploration Licence 4443	Exploration Licence	23/10/2017#	Nil
Exploration Licence 4969	Exploration Licence	31/07/2017#	Nil
Exploration Licence 5892	Exploration Licence	31/07/2017#	Nil
Exploration Licence 6317	Exploration Licence	08/08/2019#	Nil
Authorisation 404	Exploration Licence	31/07/2017#	Nil
Environment Protection and Biodiversity Conservation – Commonwealth Department of Agriculture, Water and the Environment			
Northern Coal Logistics EPBC Approval 2013/6906	To upgrade coal preparation, handling infrastructure, transport and water management activities at the existing Northern Coal Services Site	31/12/2055	Nil
Water Licences – NSW Department of Planning, Industry and Environment – Water			
Cooranbong Borehole WAL39767	Dewatering of Mine Workings	Water access licence continues to be in force until it is cancelled	Nil

Note # Renewal applications have been lodged and acknowledged for these titles however, no renewal offers have been received at the time of writing of this Annual Review.

3.1 ANNUAL REPORTING

Table 3-2 provides a checklist of reporting requirements and performance conditions addresses within the AR.

Table 3-2: Annual Review Requirements

Approval	Condition No	Requirement	Where addressed in Annual Review
SSD-5144	Schedule 6 Condition 12	By the end of March each year, or as otherwise agreed by the Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development, to the satisfaction of the Secretary. This review must:	
		a) describe the development (including any rehabilitation) that was carried out in the last calendar year, and the development that is proposed to be carried out over the current calendar year;	Section 2, Section 3, Section 8 & Section 12
		b) include a comprehensive review of the monitoring results and complaints records of the development over the past calendar year, which includes a comparison of these results against the: <ul style="list-style-type: none"> • relevant statutory requirements, limits or performance measures/criteria; • requirements of any plan or program required under this consent; • monitoring results of previous years; and • relevant predictions in the documents identified in condition 2(a) and (b) of Schedule 2; 	Section 6, Section 7, & Section 9.3.
		c) Identify any non-compliance over the past calendar year, and describe what actions were (or are being) taken to ensure compliance;	Table 1-1, Table 1-2, & Section 11.
		d) identify any trends in the monitoring data over the life of the development;	Section 6, Section 7, & Section 9.3.
		e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies;	Section 6, Section 7, & Section 9.3.

Approval	Condition No	Requirement	Where addressed in Annual Review
		f) describe what measures will be implemented over the current calendar year to improve the environmental performance of the development.	Section 12
SSD-5145	Schedule 5 Condition 11	By the end of March each year, or as otherwise agreed by the Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development to the satisfaction of the Secretary. This review must:	
		a) describe the development (including any rehabilitation) that was carried out in the past calendar year, and the development that is proposed to be carried out over the current calendar year;	Section 2, Section 3, Section 8 & Section 12
		b) include a comprehensive review of the monitoring results and complaints records of the development over the past calendar year, which includes a comparison of these results against the: <ul style="list-style-type: none"> • relevant statutory requirements, limits or performance measures/criteria; • requirements of any plan or program required under this consent; • monitoring results of previous years; and • relevant predictions in the documents identified in condition 2(a) of Schedule 2; 	Section 6, Section 7, & Section 9.3.
		c) identify any non-compliance over the past calendar year, and describe what actions were (or are being) taken to ensure compliance;	Table 1-1, Table 1-2, & Table 11-1.
		d) identify any trends in the monitoring data over the life of the development;	Section 6, Section 7, & Section 9.3.
		e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and	Section 6, Section 7, & Section 9.3.
		f) describe what measures will be implemented over the current calendar year to improve the environmental performance of the development.	Section 12

Approval	Condition No	Requirement	Where addressed in Annual Review
DA97/800	Condition 105	The Applicant shall through out the life of the mine and for a period of at least five years after the completion of mining, prepare and submit an Annual Environmental Management Report (AEMR) to the satisfaction of the Director General. The AEMR shall review the performance of the mine against the Environmental Strategy and the relevant Mining Operations Plans, the conditions of consent, and other licences and approvals relating to the mine. To enable ready comparison with the EIS predictions, diagrams and tables the report shall include, but not be limited to, the following matters:	
		i. An annual compliance audit of the performance of the project against the conditions of this consent and statutory approvals;	Table 1-1
		ii. A review of the effectiveness of the environmental management of the mine in terms of EPA, OEH, NOW, DRE and council requirements;	Table 1-1
		iii. Results of all environmental monitoring required under this consent or other approvals, including interpretations and discussion by a suitably qualified person;	Section 6, Section 7, & Section 9.3.
		iv. An assessment of any changes to agricultural land suitability resulting from the mining operations, including cumulative changes;	Section 6.8
		v. A listing of any variations obtained to approvals applicable to the subject area during the previous year;	Section 3
		vi. The outcome of the water budget for the year, the quantity of water used from water storages and details of discharge of any water from the site;	Section 7.3
		vii. Rehabilitation report; and	Section 8
		viii. Environmental management targets and strategies for the next year.	Section 12
	Condition 106	In preparing the AEMR the applicant shall:	
		I. Consult with the Director General during the preparation of each report for any additional requirements;	Section 5
		II. Comply with any requirements of the Director General or other relevant Government Agency; and	Section 5
		III. Ensure that the first report is completed and submitted within	N/A

Approval	Condition No	Requirement	Where addressed in Annual Review
		twelve months of this consent, or at a date determined by the Director General in consultation with the DRE, EPA and OEH.	
	Condition 107	The applicant shall ensure that copies of each AEMR are submitted at the same time to the Department, EPA, OEH, NOW, Council and the Community consultative Committee, and made available for public information at Council within fourteen days of submission to these authorities.	Section 3.1
DA 35-2-2004	Schedule 3 Condition 1	The Applicant may incorporate any plan, audit or Annual Review required by this consent with the plans, audits or Annual Review required for the Mandalong Mine or any other adjoining operation in common ownership or under common management.	Noted.
	Schedule 3 Condition 4	By the end of March each year, or other timing as may be agreed by the Secretary, the Applicant must submit a report to the Department reviewing the environmental performance of the development, to the satisfaction of the Secretary. This review must:	
		a) provide monthly records of the amount of coal transported on the MCDS;	Table 4-1
		b) include a comprehensive review of the groundwater monitoring results of the development over the previous calendar year, which includes a comparison of these results against the: <ul style="list-style-type: none"> • relevant statutory requirements, limits or performance measures/criteria; • requirements of any plan or program required under this consent; • monitoring results of years prior; and • relevant predictions in the documents listed in condition 2(a) of Schedule 2; 	Section 7.4
		c) evaluate and report on the compliance with the performance measures, criteria and operating conditions in this consent;	Section 6, Section 7, & Section 9.3.
		d) detail any non-compliance over the past calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence;	Table 1-1, Table 1-2, & Section 11.

Approval	Condition No	Requirement	Where addressed in Annual Review
		e) identify any trends in the monitoring data over the life of the development;	Section 6, Section 7, & Section 9.3.
		f) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies;	Section 6, Section 7, & Section 9.3.
		g) describe the measures to be implemented over the current calendar year to improve the environmental performance of the development; and	Section 12.
		h) be prepared in accordance with the Department's <i>Annual Review Guideline (2015)</i> .	Noted.

The 2021 Annual Review (Centennial Mandalong, 2022) was provided to DPE, NSW Resources Regulator, LMCC, Central Coast Council, DPE-Water, EPA, BCD and the Mandalong Mine CCC consistent with DA97/800 condition 107.

3.1.1 Centennial Mandalong Security Arrangements

A summary of the status of the Mandalong security arrangements held by the Department of Planning & Environment required under SSD-5144 and DA97/800 is provided in **Table 3-3**.

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 2022 Bank Guarantee is included in **Appendix 1**.

Table 3-3: Status of Mandalong Security Arrangements

Project Approval	Relevant Condition	Security Required	Bank Guarantee Reference	Notes
Mandalong Coal – Cooranbong Colliery (DA97/800)	Schedule 2, Condition 24. Compensation & Bank Guarantee	\$2,000,000	BG Ref: GI75002200090	Issued and provided to DPE 5 December 2022 for \$2,000,000
Mandalong Mine Extension (SSD-5144)	Schedule 3, Condition 20. Conservation Bond	\$388,385	BG Ref: GI75002200080	Issued and provided to DPE 5 December 2022 for \$388,385

4 OPERATIONS SUMMARY

Details of production and associated waste generated by the site for the report period and next reporting is provided in **Table 4-1**.

Table 4-1: 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	6.5 MTPA	3,800,677 TPA	2,782,153 TPA	2,426,000 TPA
Coarse reject	N/A			
Fine reject (Tailings)	N/A			
Saleable product	6.5 MTPA	3,669,410 TPA	2,680,812 TPA	2,028,454 TPA

4.1 OTHER OPERATIONS

Table 4-2: Operations Summary

	Approved Limit	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	464,192 TPA	644,040 TPA	
Mandalong to Cooranbong	6 MTPA	3,348,335 TPA	2,146,212 TPA	
Product to Eraring PS	6 MTPA	1,948,190 TPA	813,458 TPA	
Cooranbong to Newstan for Washing	6 MTPA	1,511,119 TPA	1,332,754 TPA	

There were no inconsistencies between the approved limit and actual production for the reporting period.

Table 4-3: Coal Processing, Handling and Transport Summary

Month	Product to Vales Point PS (4 Mtpa limit)
January 2022	57,049
February 2022	27,306
March 2022	115,676
April 2022	100,512
May 2022	82,735
June 2022	1,871
July 2022	60,102
August 2022	30,545
September 2022	113,210
October 2022	42,737
November 2022	12,297
December 2022	0
Total 2022 CY	644,040

4.2 EXPLORATION

There were three surface exploration boreholes drilled by Centennial Mandalong in 2022. All borehole sites drilled in prior years have been rehabilitated. Applications for additional boreholes will be ongoing as potential sites are identified.

5 ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

Table 5-1 summarises the outcomes of the 2021 Annual Review, including actions issued by Regulators.

Table 5-1: Actions from Previous Annual Review

Action Required	Requested By	Action Taken	Where addressed in Annual Review
<p>Biodiversity offsets</p> <p>The Department requires that the Annual Review include a report on the status of the long-term security arrangement for biodiversity offsets required by the development consent for the mine. Please include information on the type(s) of long-term security arrangements that have been implemented and/or are to be implemented for the mine.</p>	DPE	<p>Table 3-3 has been developed to include a summary of the long-term security arrangements required by the development consents for the Mandalong Mine.</p>	Table 3-3
<p>Greenhouse gas</p> <p>The Department requires that the Annual Review include a Report on greenhouse gas emissions for the reporting period and include a comparison of actual greenhouse gas emissions against the predictions in the environmental assessment(s) for the mine. Please ensure that the method used to calculate the environmental assessment prediction(s) and annual emissions are calculated the same.</p> <p>Report all reasonable and feasible steps undertaken during the reporting period to improve energy efficiency and reduce greenhouse gas emissions generated by the mine.</p>	DPE	<p>Section 6.4.10 has been updated to include a summary of greenhouse gas emissions compared to the predictions in the environmental assessment for the Mandalong Mine.</p> <p>Section 6.4.11 includes a summary of the greenhouse gas abatement investigations and actions implemented for the Mandalong Mine.</p>	<p>Section 6.4.10</p> <p>Section 6.4.11</p>

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, 2023b) estimated 464 ML of water from the underground mine and surface water was discharged via LDP001 in 2022 which is higher than the water volume discharged in 2021 (150 ML). The higher discharge volume in 2022 is due to the Cooranbong Borehole Pump returning to operation in 2022, after being out of service in 2021.

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 and 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 a 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 using 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 2022, a total of 574.234 tonnes of scrap steel was recycled. This is a decrease compared to 2021 during which a total of 582.703 tonnes of scrap steel was recycled.

General refuse and non-recyclable materials are sorted and stored in 30m³ steel bins at Mandalong and the Cooranbong Entry Site. The material was collected by a licenced waste management contractor for disposal. In 2022, 786.130 tonnes of refuse material was taken off-site which is a decrease compared with 852.425 tonnes of refuse material in 2021.

Of the total waste collected at Mandalong in 2022, 84.32% 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 86.86% in 2021.

6 ENVIRONMENTAL PERFORMANCE

Centennial Mandalong implements an Environmental Management Strategy, including management plans, procedures and monitoring programs that provide a framework for managing environment and community risks and impacts. To measure compliance with site approvals and licences, Centennial Mandalong undertakes a comprehensive monitoring program. The environmental monitoring program is shown in Plans (CM00315b, CM00315c, CM00315d, CM00315f and CM00317).

Condition 12 of Schedule 6 of SSD-5144, Condition 11 of Schedule 5 of SSD-5145, Condition 4 of Schedule 3 of DA35-2-2004 and Condition 105(iii) of DA97/800 require the presentation and discussion on all monitoring required under the Development Consents and other approvals. **Table 6-1** includes a summary of the monitoring required by the Development Consents, current status and report section in the Annual Review.

Table 6-1: Summary of Monitoring Requirements

Monitoring Type	Status	Report Section
Meteorological Monitoring	Ongoing	Section 6.1
Noise Monitoring	Quarterly monitoring	Section 6.2
Blast Monitoring	As required	Section 6.3
Air Quality Monitoring	Ongoing	Section 6.4
Independent Noise and Dust Monitoring	Not Requested	N/A
Greenhouse Gas reporting and abatement measures	Ongoing	Section 6.4.10
Biodiversity Monitoring	Ongoing	Section 6.5
Cultural Heritage Monitoring	Ongoing	Section 6.6
Surface Water Monitoring	Ongoing	Section 7.2
Groundwater Monitoring	Ongoing	Section 7.4
Rehabilitation Monitoring	Ongoing	Section 8

6.1 METEROLOGICAL MONITORING

The total monthly rainfall data is shown below in **Table 6-2** and in **Figure 6-1**.

Table 6-2: Rainfall at Mandalong Mine and the Cooranbong Entry Site for the Period January 2022 to December 2022.

2022 Month	Mandalong Mine Total Rainfall (mm)	Cooranbong Entry Site Total Rainfall (mm)
January	130.6	135.4
February	171.4	150.2
March	429.4	391.8
April	113.4	146
May	91.8	111
June	9.4	12.4
July	377	387.4
August	37.8	36.2
September	129.8	142.8
October	189	194.2
November	38.2	58.6
December	24.4	30
Total	1742.2	1796.0

For Mandalong Mine, a total of 1742.2 mm of rainfall was recorded at the site during the reporting period. The total annual rainfall for 2022 was higher than the annual average rainfall (1,124 mm) recorded at the Cooranbong Station (BOM station number 61012) from 1889 to 2016. The wettest monthly period in 2022 was March recording 429.4 mm.

For Cooranbong Entry Site, a total of 1796 mm of rainfall was recorded at the site during the reporting period. The total annual rainfall for 2022 was higher than the annual average rainfall (1,124 mm) recorded at the Cooranbong Station (BOM station number 61012) from 1889 to 2016. The wettest recorded monthly period at the Cooranbong Entry Site in 2022 was March recording 391.8 mm.

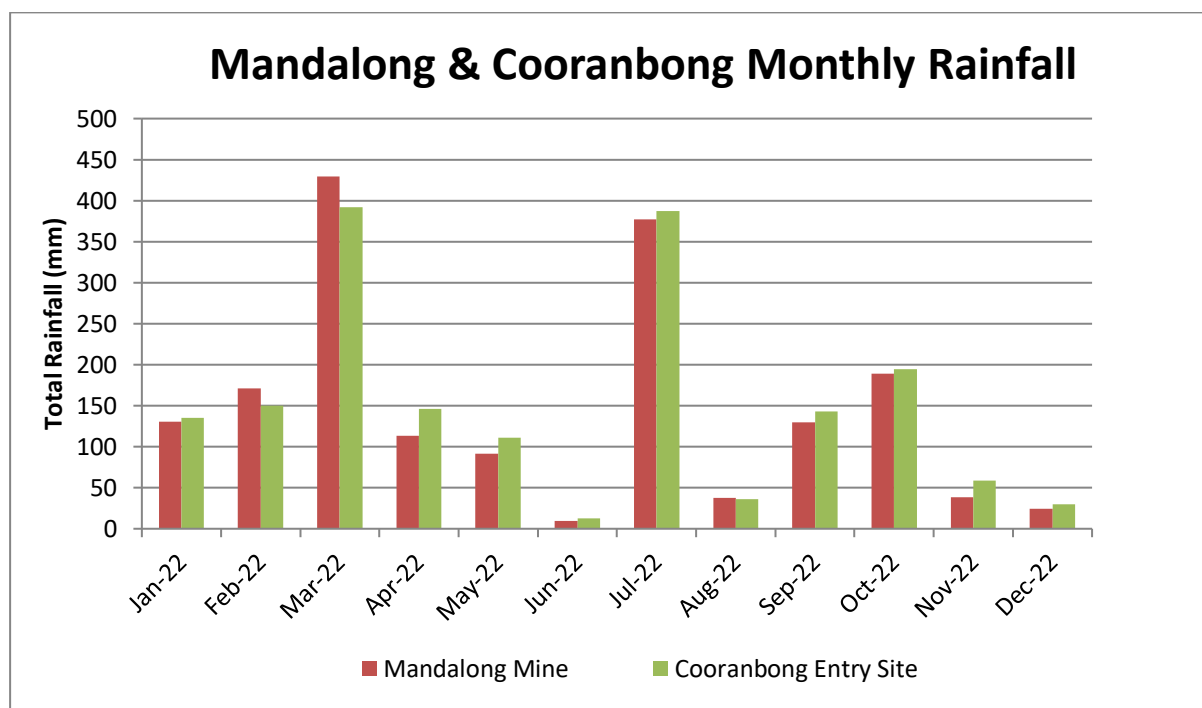


Figure 6-1: Mandalong Mine & Cooranbong Entry Site Monthly Rainfall

6.2 NOISE MONITORING

Noise monitoring was conducted to assess operational noise levels compared to the noise limits specified by SSD-5144, SSD-5145 and EPL 365 in accordance with the requirements of the Northern Region Noise Management Plan (GHD, 2022d). The Mandalong Mine Noise Monitoring Program now requires Centennial Mandalong to survey noise from the operations

at the Mandalong Mine and the Cooranbong Entry Site (shown in [Figure 6-2](#) and



Figure 6-3: Cooranbong Entry Site Noise Monitoring Locations

) on a quarterly basis and at the Mandalong South Surface Site ([Figure 6-4](#)) on a monthly basis.

Measurements were conducted during typical worst-case operational conditions for both the Mandalong Mine and Cooranbong Entry Sites in order to capture associated typical worst-case noise emission levels. Noise monitoring during the construction of the Mandalong South Surface Site (MSSS) commenced in March 2017 on a quarterly basis, however from April 2022 monitoring has been undertaken on a monthly basis for operational activities in accordance with the Northern Region Noise Management Plan (GHD, 2022d).

The Mandalong Southern Extension Project Environmental Impact Statement (SLR, 2013) described the results of operational noise modelling for the Mandalong Mine Access Site and indicated that the relevant intrusive and amenity noise criteria will be achieved at all the nearest sensitive receivers. The noise impact assessment completed as part of the Northern Coal Logistics Project Environmental Impact Statement (SLR, 2014) predicted that operational noise levels at the Cooranbong Entry Site will meet the project-specific noise criteria at all nominated residential locations.

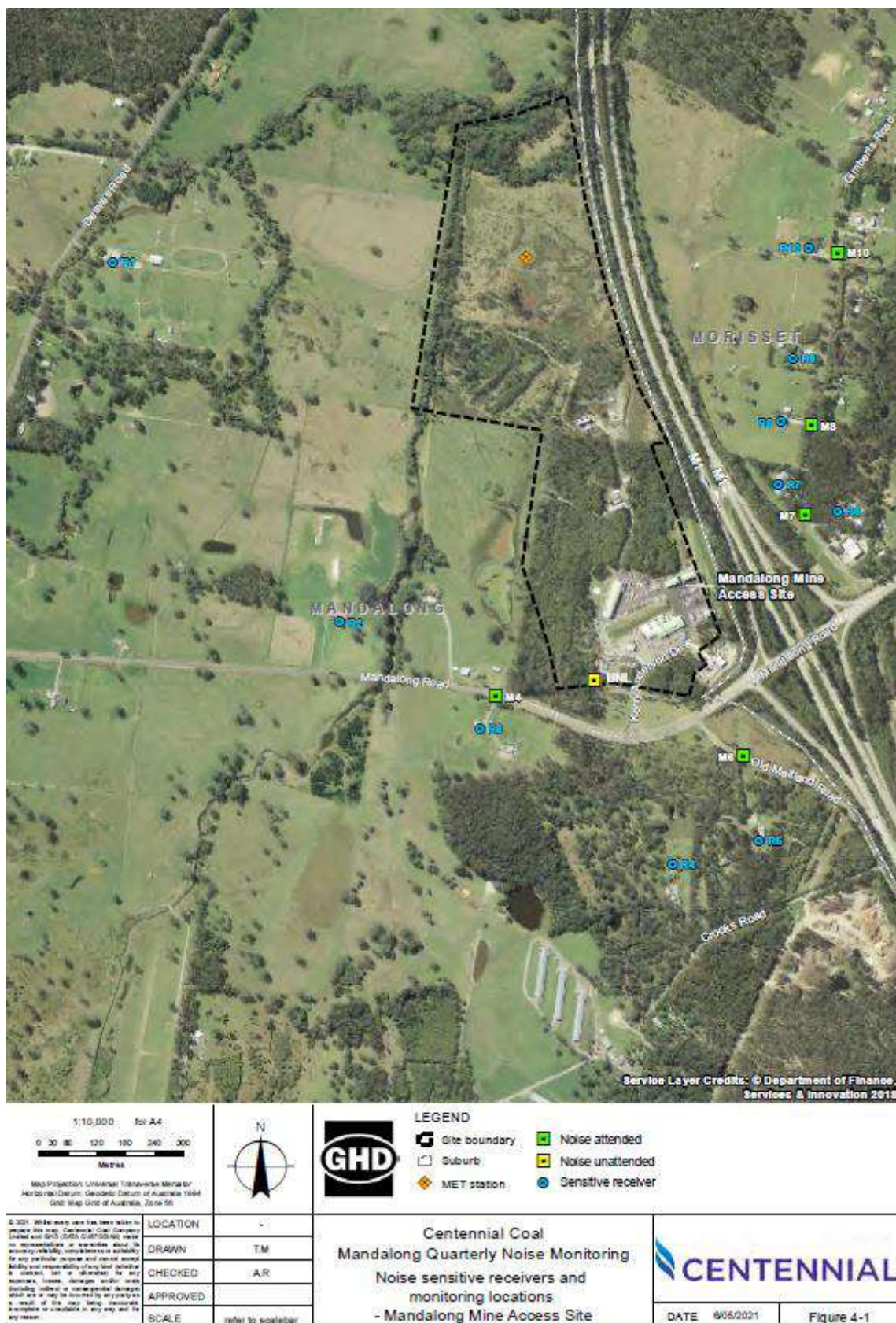


Figure 6-2: Mandalong Mine Noise Monitoring Locations

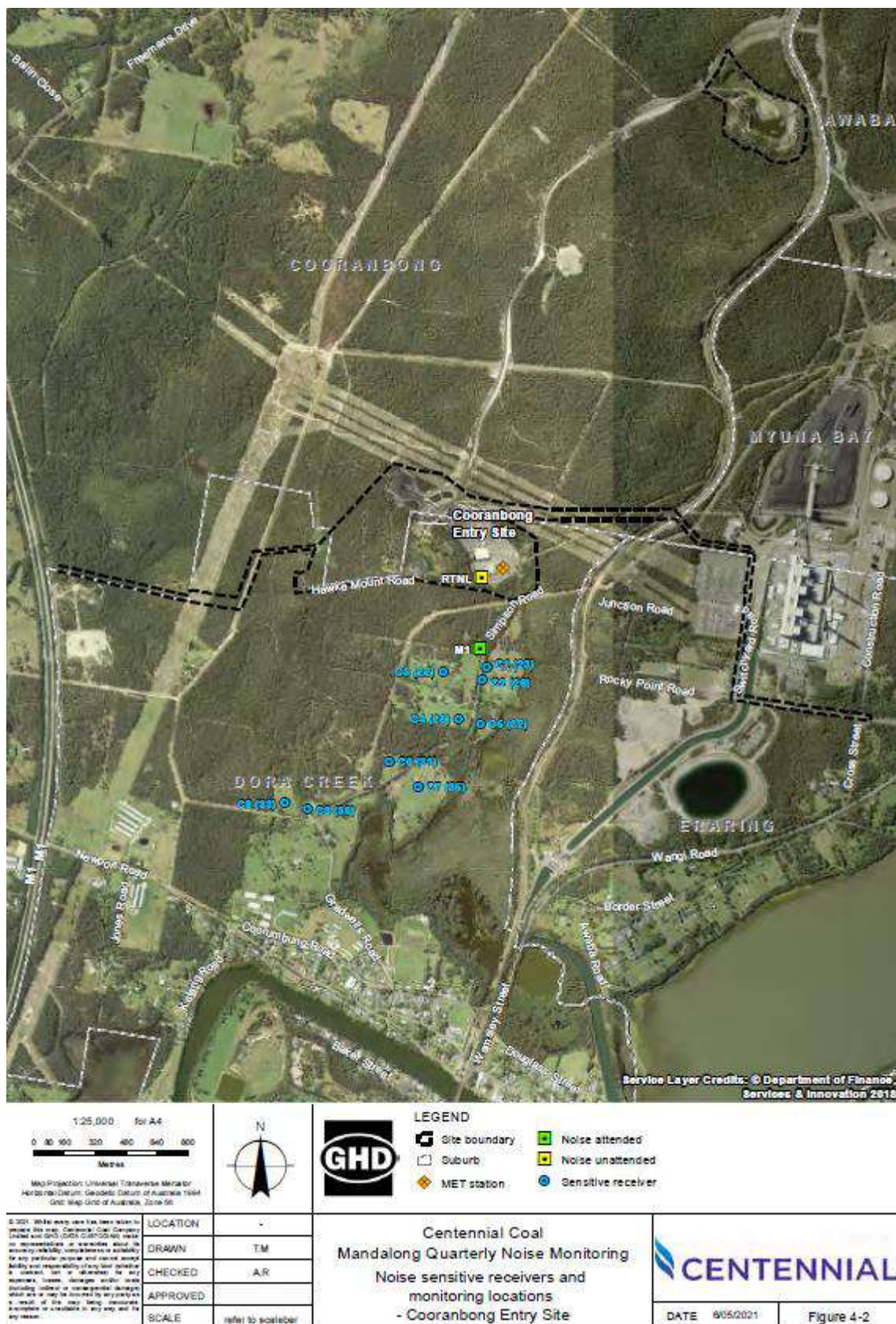


Figure 6-3: Cooranbong Entry Site Noise Monitoring Locations

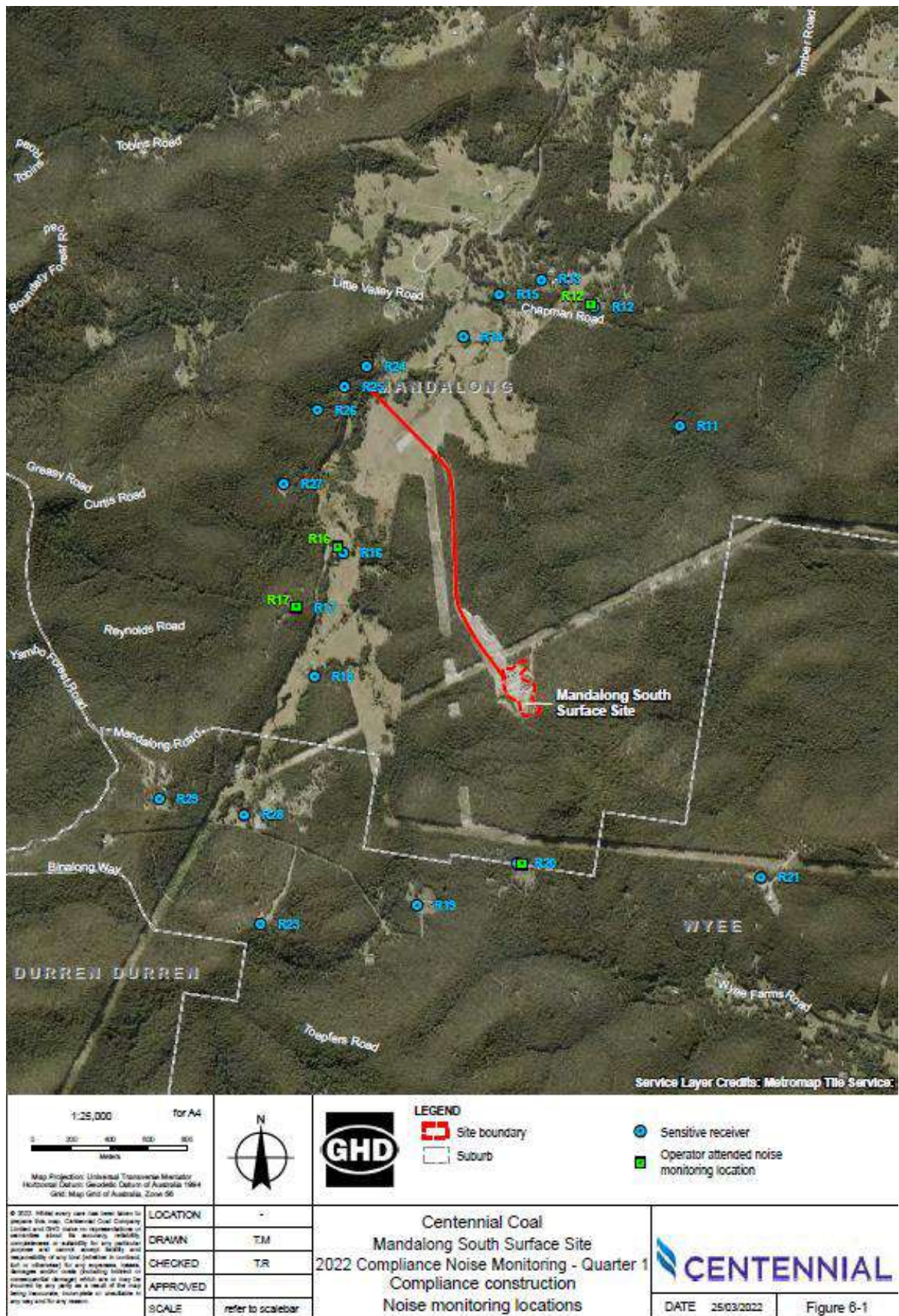


Figure 6-4: MSSS Noise Monitoring Locations

6.2.1 Environmental Performance

6.2.1.1 Attended Noise Monitoring – Mandalong Mine & Cooranbong Entry Site

GHD was engaged by Centennial Mandalong to conduct noise compliance assessments for the Mandalong Mine and Cooranbong Entry Site in accordance with the Northern Region Noise Management Plan (GHD, 2022d).

Operator attended noise measurements for the quarterly operator attended noise surveys were conducted on 14-15 March 2022, 29-30 June 2022, 26-27 September 2022 and 5-6 December 2022 at each of the six locations specified in the Noise Management Plan night-time period for 15 minutes. **Table 6-3** below compares the results of the operator attended noise monitoring with relevant noise goals.

Table 6-3: Noise Monitoring Results Summary 2022

Location	Q1	Q2	Q3	Q4	Criteria Limit
Night (LAeq (15 minute) dBA)					
M1	35	37	36	Not discernible	37
M4	Not discernible	38	39	Not discernible	42
M6	Not discernible	Not discernible	Not discernible	Not discernible	41
M7	26	40	Not discernible	Not discernible	43
M8 [#]	26	40	42	38	43
M10 [#]	36	38	Not discernible	44	39
Night (LA1 (1 minute) dBA)					
M1	35	40	36	Not discernible	45
M4	Not discernible	42	39	Not discernible	52
M6	Not discernible	Not discernible	Not discernible	Not discernible	61
M7	53	40	Not discernible	Not discernible	61
M8 [#]	53	40	42	38	61
M10 [#]	45	44	Not discernible	44	61

Residences at monitoring locations M8 and M10 no longer exist. Construction works are currently occurring across this location for an expansion to the Morisset industrial area.

The operator attended operational noise monitoring showed that the noise contributions from the Mandalong Mine and Cooranbong Entry Site comply with the EPL 365, SSD-5144 and SSD-5145 noise criteria at all monitoring locations. However, there was a marginal (as per defined in the NPI) ≤ 5 dBA elevated noise level at monitoring location M10 on 5 December 2022 during the night-time period potentially due to the operation of the gas plant. However, it should be noted that the residence at this location has been demolished as part of a new development being constructed at this location and therefore a non-compliance has not been recorded. The land between Mandalong Mine and this location has also been completely cleared of all vegetation removing any potential natural noise barriers. It should also be noted that this land has been rezoned for industrial use as per the Lake Macquarie Development Control Plan (2014) Section 12.9 Gimberts Road, Morisset Precinct Area Plan (adopted by Council August 2021).

The operator attended sleep disturbance noise monitoring results showed that the noise contributions from Mandalong Mine and Cooranbong Entry Site comply with the EPL 365, Development Consent SSD-5144 and SSD-5145 relevant sleep disturbance noise criteria at all monitoring locations.

6.2.1.2 Mandalong South Surface Site

GHD was engaged by Centennial Mandalong to conduct noise compliance monitoring for the operational activities at the Mandalong South Surface Site in accordance with the Northern Region Noise Management Plan (GHD, 2022d). The noise monitoring network locations at the Mandalong South Surface Site are shown in **Figure 6-4**. Since April 2022, noise monitoring has been undertaken monthly at the Mandalong South Surface Site.

Operator attended noise measurements were conducted on 14 March 2022, 26 April 2022, 18 May 2022, 29 June 2022, 12 July 2022, 29 August 2022, 26 September 2022, 27 October 2022, 24 November 2022 and 5 December 2022. The noise assessment consisted of attended monitoring to quantify construction noise levels at four noise sensitive receivers (R12, R16, R17 and R20) near the Mandalong South Surface Site. **Table 6-4** below compares the results of the operator attended noise monitoring with relevant noise goals.

Table 6-4: MSSS Noise Monitoring Results Summary 2022

Location	R12	R16	R17	R20
Day (LAeq (15 minute) dBA)				
Q1	33	32	30	27
April 2022	Not discernible	<25	<25	27
May 2022	<25	<25	Not discernible	<25
June 2022	Not discernible	26	27	29
July 2022	<25	<25	<25	<25
August 2022	Not discernible	29	30	Not discernible
September 2022	Not discernible	30	31	Not discernible
October 2022	Not discernible	30	30	30
November 2022	Not discernible	29	28	Not discernible
December 2022	Not discernible	28	26	26
Evening (LAeq (15 minute) dBA)				
Q1	<25	29	30	26
April 2022	Not discernible	28	29	28
May 2022	<25	<25	<25	<25
June 2022	Not discernible	<25	<25	27
July 2022	Not discernible	<25	<25	Not discernible
August 2022	Not discernible	30	30	Not discernible
September 2022	Not discernible	29	28	Not discernible
October 2022	Not discernible	Not discernible	Not discernible	Not discernible

November 2022	Not discernible	27	26	Not discernible
December 2022	Not discernible	28	27	Not discernible
Night (LAeq (15 minute) dBA)				
Q1	28	33	31	28
April 2022	Not discernible	28	28	Not discernible
May 2022	<25	<25	<25	28
June 2022	<25	<25	<25	26
July 2022	<25	<25	<25	Not discernible
August 2022	Not discernible	28	27	27
September 2022	Not discernible	29	27	Not discernible
October 2022	Not discernible	Not discernible	Not discernible	Not discernible
November 2022	Not discernible	28	26	Not discernible
December 2022	32	26	23	Not discernible
Criteria Limit	35	35	35	35

The results of the Mandalong South Surface Site 2022 noise monitoring indicates that operational noise levels were below the relevant noise management levels at the assessment monitoring locations R12, R16, R17 and R20.

Centennial Mandalong has developed an action plan following the completion of noise investigations and will now progress with noise mitigation options for the MSSS ventilation fans. The design and manufacture for new outlet silencers for Fans 1 and 2 will be completed in February 2023 and installation will take place in March 2023. The installation of Fan 3 outlet silencer will be complete in May 2023.

The monthly noise monitoring of the MSSS operations will continue in 2023. The development consent SSD-5144 specifies noise limit criteria for operational noise generated by the development including maintenance activities, shaft construction and exploration drilling.

6.3 BLAST MONITORING

Mandalong

There was no blasting carried out at the Mandalong Mine in 2022.

Delta and Cooranbong Entry Sites

There was no blasting carried out at the Delta and Cooranbong Entry sites during 2022.

6.4 AIR QUALITY MONITORING

SSD-5144 Schedule 3 Condition 8 and Consent SSD-5145 Schedule 3 Condition 7 provide criteria for dust deposition cumulative impact and incremental impact. The cumulative impact is the increase in concentrations due to the development plus background concentrations. The cumulative impact is recorded as an annual monthly average and must not exceed 4g/m²/month. The incremental impact is the increase in concentrations due to the development alone. The incremental impact calculation is the monthly average minus the pre-construction average (PCA) recorded as an annual monthly average and must not exceed 2g/m²/month.

The location description for each depositional dust gauge is provided in **Table 6-5**.

Table 6-5: Description of Depositional Dust Gauges

Dust Gauge No.	Locality
D4	41 Gradwells Road Dora Creek (near Cooranbong Entry Site)
D6	Mandalong Mine Site Eastern Boundary (Near Sediment Basin)
D8	West of main front entrance (Mandalong Site)
D9	184 Mandalong Road
D10	202 Mandalong Road West of Mandalong Mine
D12	Mandalong South Surface Site
D14	North of Mandalong South entrance road (near wetland)

6.4.1 Mandalong Mine

Depositional dust monitoring results are shown in **Table 6-6**. The results are presented as:

- Long-term average (all data since the commencement of monitoring at its present location - Sept 1999 to present);
- Annual Average during the report period (January 2022 to December 2022); and
- Pre-construction average (September 1999 to August 2000).

Table 6-6: Summary of depositional dust results between January 2022 and December 2022 surrounding Mandalong Mine.

	Insoluble Solids (Combustible Matter + Ash) g/m ² /month			
	DG6	DG8	DG9	DG10
Long Term Average	1.3	0.7	1.1	1.6
Annual Average (2022 Reporting Period)	1.1	0.7	0.3	2.2
Pre-Construction Average	0.8	0.8	0.9	*
Limit Criteria	4.0	4.0	4.0	4.0

* Not available. Dust gauges installed after commencing construction.

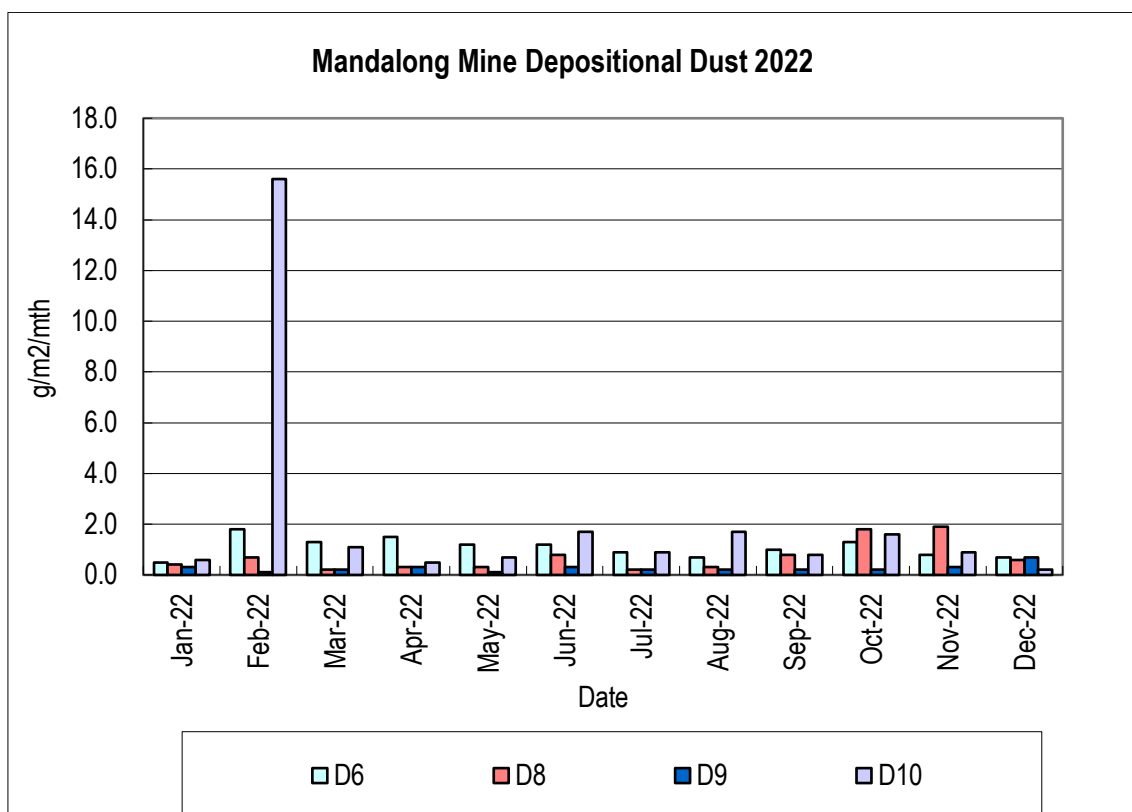


Figure 6-5: Monthly Depositional Dust Results 2022 Mandalong Mine

The cumulative impact result is shown in [Table 6-7](#) and [Table 6-8](#) as an annual average. All dust gauges were compliant with the condition for the reporting period. The maximum cumulative impact was 2.53 recorded at DG10. The incremental impact result is shown in [Table 6-7](#) as the change from PCA. All dust gauges were compliant with the condition for the reporting period. The maximum incremental impact for DG6 is 0.4, DG8 is - 0.1 and DG9 is - 0.3.

Table 6-7: 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	Annual Average	Change from PCA	Monitored Dust	Annual Average	Change from PCA	Monitored Dust	Annual Average	Change from PCA
17/01/2022	0.5	0.87	0.1	0.4	0.40	-0.4	0.3	0.55	-0.3
18/02/2022	1.8	0.84	0.0	0.7	0.41	-0.4	0.1	0.50	-0.4
21/03/2022	1.3	0.82	0.0	0.2	0.39	-0.4	0.2	0.47	-0.4
21/04/2022	1.5	0.87	0.1	0.3	0.41	-0.4	0.3	0.36	-0.5
20/05/2022	1.2	0.96	0.2	0.3	0.40	-0.4	0.1	0.29	-0.6
20/06/2022	1.2	1.02	0.2	0.8	0.44	-0.4	0.3	0.20	-0.7
21/07/2022	0.9	1.07	0.3	0.2	0.43	-0.4	0.2	0.21	-0.7
18/08/2022	0.7	1.11	0.3	0.3	0.43	-0.4	0.2	0.22	-0.7
19/09/2022	1	1.12	0.3	0.8	0.45	-0.4	0.2	0.21	-0.7
20/10/2022	1.3	1.15	0.4	1.8	0.55	-0.3	0.2	0.21	-0.7
21/11/2022	0.8	1.11	0.3	1.9	0.67	-0.1	0.3	0.22	-0.7
22/12/2022	0.7	1.075	0.3	0.6	0.69	-0.1	0.7	0.26	-0.6

Table 6-8 Detailed Dust Monitoring and Analysis showing the Annual Rolling Average for Dust Gauge 10

	DG10		
Date	Monitored Dust	Annual Average	Change from PCA
17/01/2022	0.6	0.81	N/A
18/02/2022	15.6	2.06	N/A
21/03/2022	1.1	2.06	N/A
21/04/2022	0.5	2.08	N/A
20/05/2022	0.7	2.04	N/A
20/06/2022	1.7	2.16	N/A
21/07/2022	0.9	2.23	N/A
18/08/2022	1.7	2.34	N/A
19/09/2022	0.8	2.38	N/A
20/10/2022	1.6	2.48	N/A
21/11/2022	0.9	2.53	N/A
22/12/2022	0.2	2.19	N/A

6.4.2 Delta Entry Site

Three dust deposition gauges were installed at the Delta Entry Site in July 2004. These gauges were positioned to monitor depositional dust around the Delta Entry Site as per the conditions of EPL365.

The depositional dust gauges at the Delta Entry Site were removed from EPL365 in October 2018. The depositional dust gauges at the Delta Entry site were removed from the monitoring program in December 2018.

6.4.3 Cooranbong Entry Site

The Cooranbong Colliery Life Extension Project EIS predicted that dust emissions from the operational phase of the Cooranbong Preparation Plant 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/m²/month and 4g/m²/month (assuming a background rate of 1.2 g/m²/month) at the nearest surrounding residences.

Annual average depositional dust results for 2022 and the LTA are provided in **Table 6-6** and **Table 6-7**. The complete monthly dust monitoring data is provided in **Figure 6-6**.

The cumulative impact result for DG4 is shown in **Table 6-10** as an annual average. DG4 was compliant with the condition for the report period. The maximum cumulative impact was 0.43.

The incremental impact result for DG4 is shown in **Table 6-10** as the change from PCA. DG4 was compliant with the condition for the reporting period. The maximum incremental impact for DG4 is -0.8.

Table 6-9: Summary of Depositional Dust Results between January 2022 and December 2022 surrounding the Cooranbong Entry Site.

	Insoluble Solids (Combustible Matter + Ash) g/m ² /month
	DG4
Long Term Average	1.2
Average 2022 (Reporting Period)	0.4
Limit criteria (annual average)	4.0

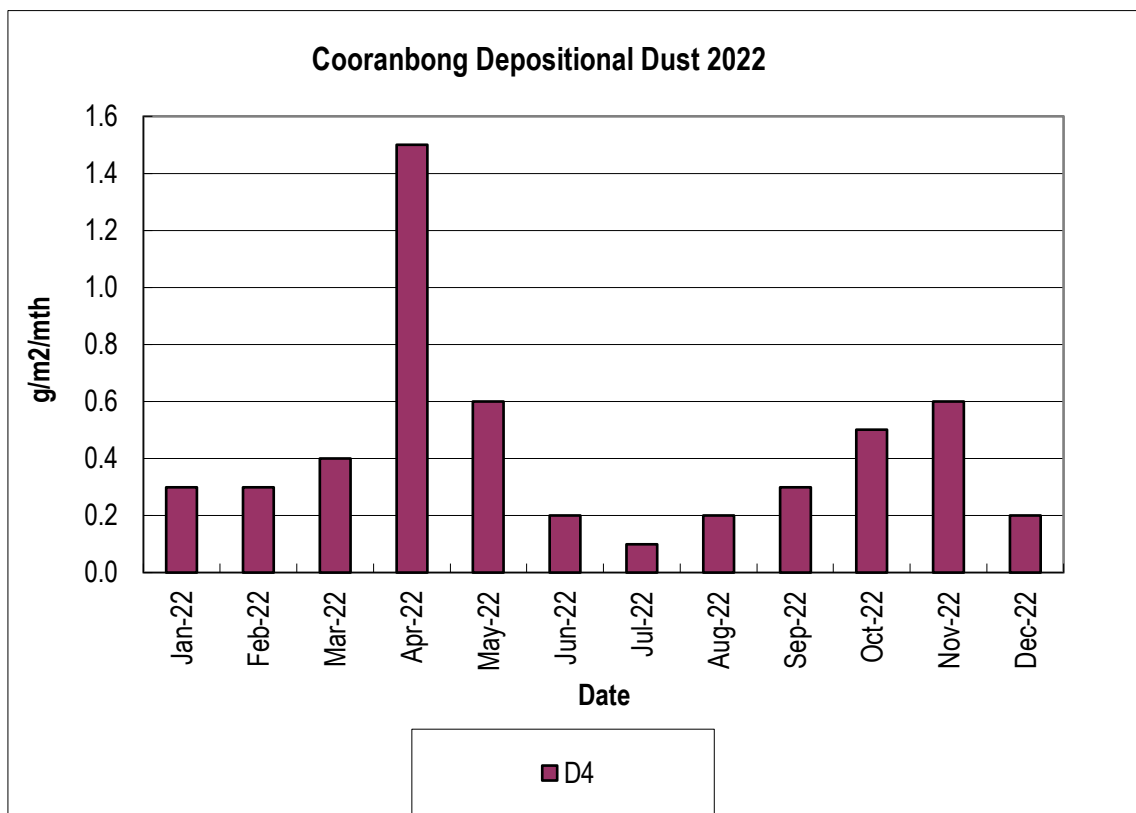


Figure 6-6: Monthly Depositional Results 2022 CES

Table 6-10 Detailed Dust Monitoring and Analysis showing the Annual Rolling Average and Change in Deposition from the Pre-construction Average (PCA) for Dust Gauge 4

	DG4		
Date	Monitored Dust	Annual Average	Change from PCA
17/01/2022	0.3	0.26	-0.9
18/02/2022	0.3	0.27	-0.9
21/03/2022	0.4	0.27	-0.9
21/04/2022	1.5	0.39	-0.8
20/05/2022	0.6	0.42	-0.8
20/06/2022	0.2	0.43	-0.8
21/07/2022	0.1	0.42	-0.8
18/08/2022	0.2	0.42	-0.8
19/09/2022	0.3	0.41	-0.8
20/10/2022	0.5	0.41	-0.8
21/11/2022	0.6	0.43	-0.8
22/12/2022	0.2	0.43	-0.8

6.4.4 Mandalong South Surface Site

Depositional dust gauges were installed at the Mandalong South Services Site in June 2014 for the purpose of pre-construction air quality monitoring. Construction of the Mandalong South Surface Site access road commenced in February 2017 and construction of the Surface Site commenced in July 2017. The monthly dust deposition results for DG12 and DG14 are provided in **Figure 6-7**. Annual average depositional dust results for 2022 and the consent criteria are provided in **Table 6-11**, **Table 6-12** and **Figure 6-7**.

Contaminants such as bird droppings, insects and plant material have been consistently identified in DG14 samples. The sample collected in March 2018 contained 70% organic material, April 2018, 97% organic material and May 2018, 90% organic material. Centennial Mandalong reported in November 2018 that a bird was building a nest in DG14. In order to prevent the ongoing contamination of DG14 cable ties were attached to the dust gauge to prevent birds from perching on the gauge. Following the disappearance of the cable ties and the unusually high results for DG14 a surveillance camera was installed next to DG14.

The Reconyx, Hyperfire 2 Covert, surveillance camera was installed on 14 March 2019 adjacent to DG14. The surveillance camera captured an image on 16 March 2019 of a cow with its nose on the gauge. The gauge has since been raised higher and fenced to prevent cattle from interfering with the gauge. There are a number of cattle in the paddock where DG14 is located. The cable ties were re-attached to the dust gauge to prevent interference from birds.

There have not been any further contamination issues with DG14 since May 2019. The maximum annual average recording since the protective measures were installed is 1.40g/m²/month.

Table 6-11: Summary of Depositional Dust Results between January 2022 and December 2022 surrounding the Mandalong South Surface Site.

	Insoluble Solids (Combustible Matter + Ash) g/m ² /month	
	DG12	DG14
Long Term Average	0.8	1.6
Average 2022 (Reporting Period)	0.8	0.8
Limit Criteria	4.0	4.0

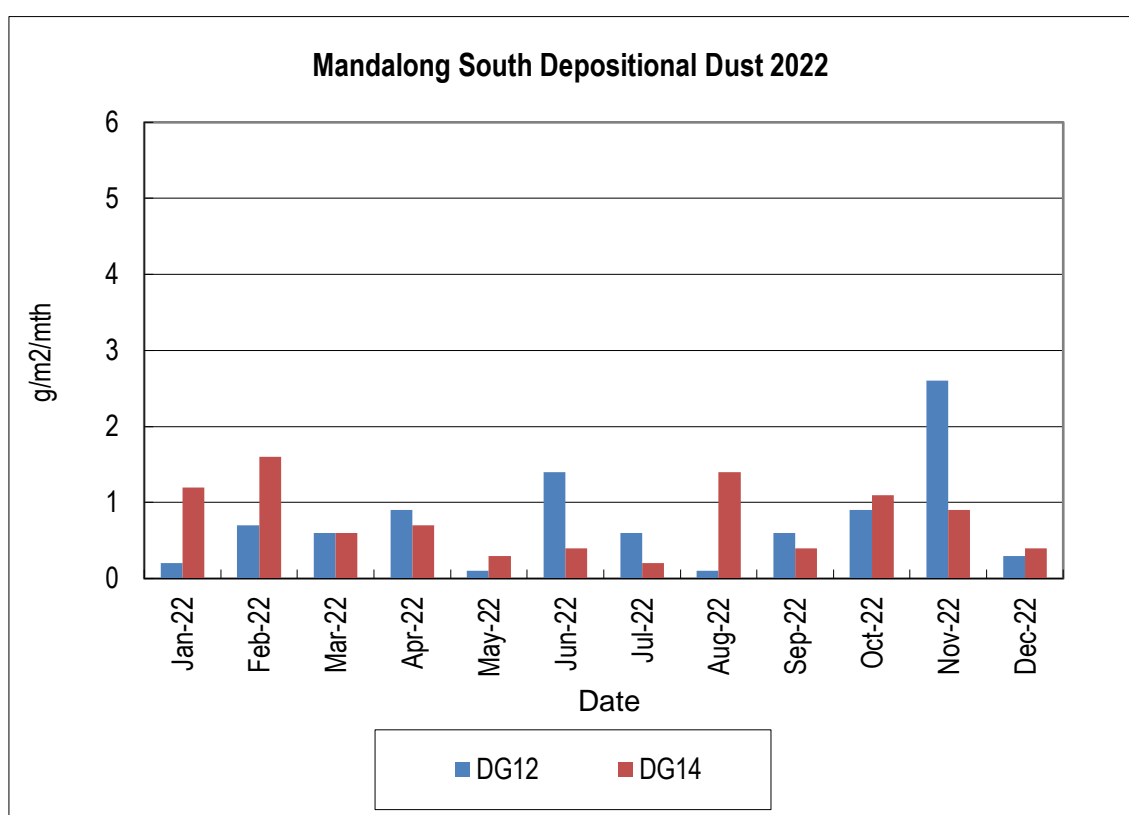


Figure 6-7: Monthly Depositional Results 2022 MSSS

The cumulative impact result is shown in **Table 6-12** as an annual average. The dust gauges were compliant with the condition for the reporting period. The maximum cumulative impact at DG12 was 0.76 and DG14 was 0.79. The incremental impact result is shown in **Table 6-12** as the change from PCA. The dust gauges were compliant with the condition for the reporting period. The maximum incremental impact for DG12 is 0.3 and DG14 is -0.8.

Table 6-12 Detailed Dust Monitoring and Analysis showing the Annual Rolling Average and Change in Deposition from the Pre-construction Average (PCA) for Dust Gauge DG12 and DG14

Date	DG12			DG14		
	Monitored Dust	Annual Average	Change from PCA	Monitored Dust	Annual Average	Change from PCA
17/01/2022	0.2	0.52	0.0	1.2	0.53	-1.1
18/02/2022	0.7	0.54	0.0	1.6	0.63	-1.0
21/03/2022	0.6	0.54	0.0	0.6	0.63	-1.0
21/04/2022	0.9	0.58	0.1	0.7	0.65	-1.0
20/05/2022	0.1	0.57	0.1	0.3	0.60	-1.0
20/06/2022	1.4	0.67	0.2	0.4	0.61	-1.0
21/07/2022	0.6	0.68	0.2	0.2	0.60	-1.0
18/08/2022	0.1	0.63	0.1	1.4	0.69	-0.9
19/09/2022	0.6	0.64	0.1	0.4	0.71	-0.9
20/10/2022	0.9	0.64	0.1	1.1	0.77	-0.8
21/11/2022	2.6	0.77	0.3	0.9	0.79	-0.8
22/12/2022	0.3	0.75	0.3	0.4	0.77	-0.8

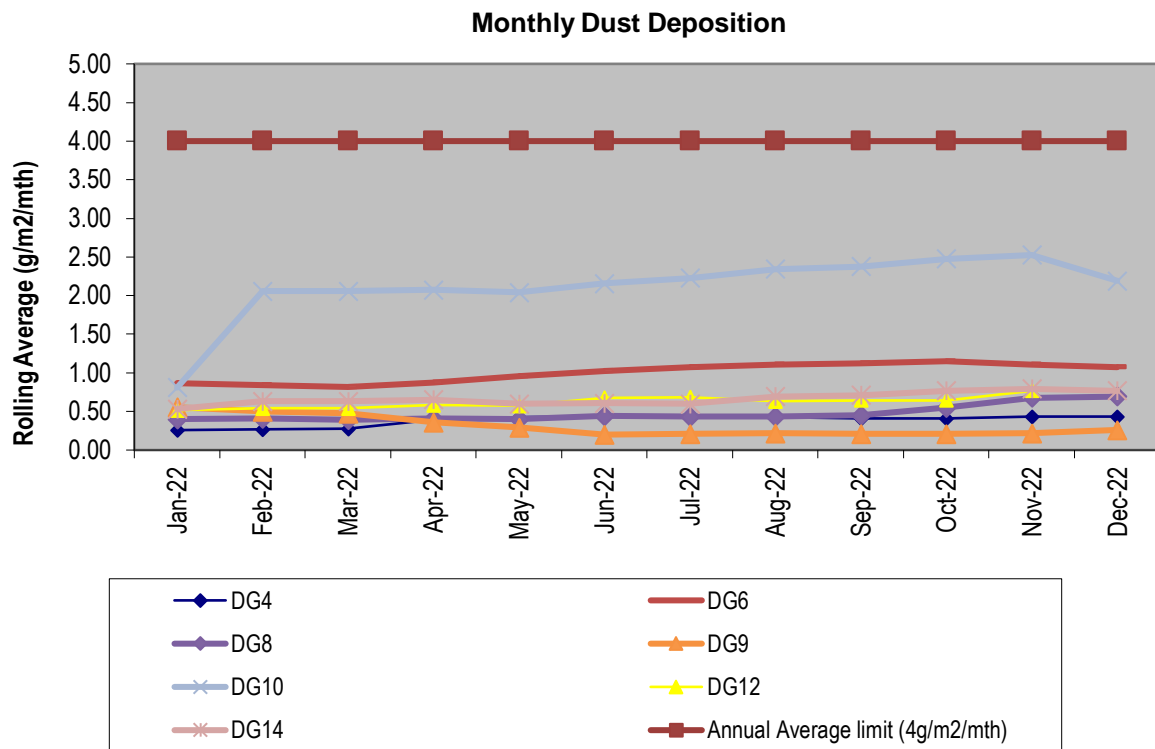


Figure 6-8 Dust Deposition Rolling Annual Average and Limit Criteria

6.4.5 Air Quality Monitoring Data Interpretation

Mandalong Mine

All dust gauges recorded results well below the dust deposition consent limit criteria of 4 g/m²/month for cumulative impacts and 2g/m²/month for incremental impacts. Dust levels at DG 6, 8 & 9 show minor or no variation to the pre-construction average, confirming that the activities had minimal impact on surrounding air quality in 2022 as predicted in the Mandalong Southern Extension Project EIS (SLR, 2013).

The annual average for each dust gauge is below the long-term average except for DG10. The greatest difference in averages was at DG10 which has a long-term average of 1.6 g/m²/month and recorded an annual average of 2.2 g/m²/month.

Cooranbong Entry Site

DG4 recorded results well below the dust deposition consent limit criteria of 4 g/m²/month for cumulative impacts and 2g/m²/month for incremental impacts.

Average annual depositional dust results for DG4 are on average 0.8g/m²/month below pre-construction average. Dust deposition levels at DG4 located at the nearest sensitive receivers and on the operational boundary at Cooranbong are below the pre-construction average, confirming that the Cooranbong operation had minimal impact on surrounding air quality in 2022 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, 2014).

The annual average for DG4 for 2022 is below the long-term average.

Mandalong South Surface Site

DG12 and DG14 recorded results well below the dust deposition consent limit criteria of 4 g/m²/month for cumulative impacts and 2g/m²/month for incremental impacts.

Dust levels at DG12 show a slight increase above the pre-construction average and DG14 is below the pre-construction average, confirming that the activities had minimal impact on surrounding air quality in 2022 as predicted in the Mandalong Southern Extension Project EIS (SLR, 2013).

DG12 recorded an annual average similar to the long-term average. DG14 recorded an annual average lower than the long-term average due to the implementation of measures to prevent contamination as described in [Section 6.4.4](#). DG14 was affected by contamination from birds and cattle in 2018 and early in 2019. The previous ongoing contamination may have inflated the previous results recorded at DG14.

6.4.6 Particulate Matter

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. The limit criterion for PM10 annual average concentrations was reduced to 25ug/m³ when the Northern Coal Services consent SSD-5145 was approved 29th September 2015. The consent SSD-5145 requires that air quality impacts at the Cooranbong Entry Site do not exceed the limit criteria of:

- 90ug/m³ annual average for TSP;
- 25ug/m³ annual average for PM10; and
- 50ug/m³ 24-hour average for PM10.

There were no exceedances of the PM10 and TSP annual average limit criteria for the reporting period. The 2022 annual average for PM10 was 10.68ug/m³. The 2022 annual average for TSP was 11.43ug/m³.

There were no exceedances of the 24-hr average PM10 concentration SSD-5145 24-hr criterion of 50µg/m3 in 2022.

The Maximum PM10 concentration 22.31 µg/m³ was recorded on 23 March 2022. The maximum TSP recording was 24.31 µg/m3 which occurred on 6 January 2022. There is no maximum 24hr concentration limit for TSP.

6.4.7 Air Quality Monitoring Data Interpretation

TSP and PM10 monitoring results are shown in **Figure 6-9**, **Figure 6-10**, **Figure 6-11** and **Figure 6-12**. The results are presented as an annual average for the reporting period (January 2022 to December 2022). The monitoring results for the TSP and PM10 annual and 24 hour average from January to December 2022 are in accordance with the predictions from the air quality impact assessment for the Cooranbong Distribution Project EA (GSS Environmental, 2012) and the predictions from the air quality impact assessment for the Northern Coal Logistics Project EIS (SLR, 2014).

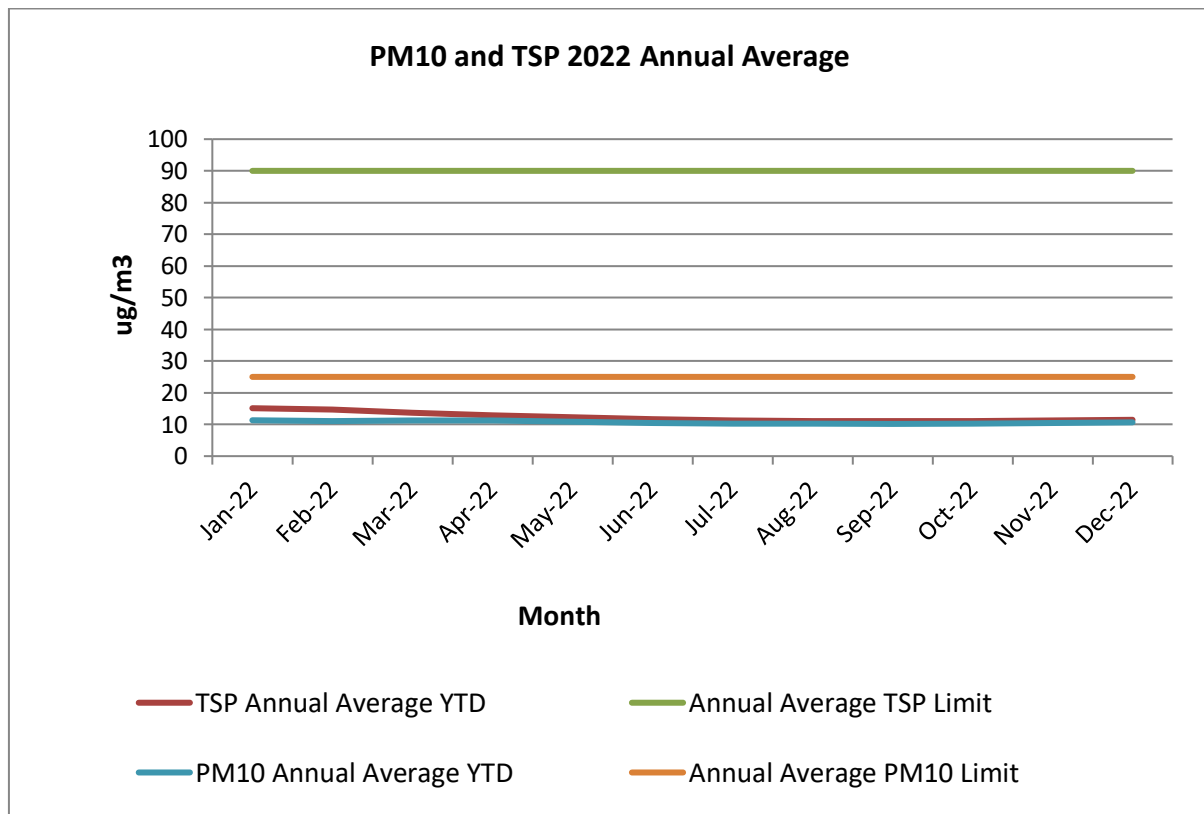


Figure 6-9: PM10 and TSP 2022 Annual Rolling Average and Limit Criteria

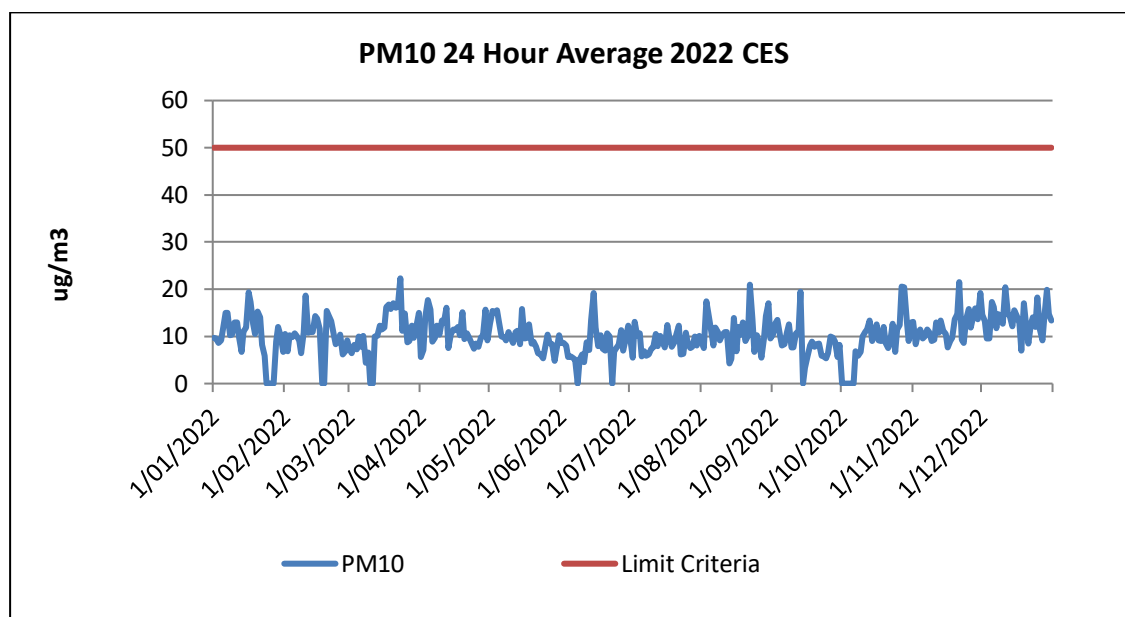


Figure 6-10: PM10 24 Hour Average 2022

6.4.8 HVAS (High Volume Air Samplers)

PM₁₀ and PM_{2.5} high volume air samplers were installed in January 2014 at Mandalong to monitor fine particles from the Mandalong Mine Access Site. The limit criterion for PM₁₀ annual average concentrations was reduced from 30ug/m³ to 25ug/m³ with approval of Modification 6 of Consent SSD-5144 in April 2019. SSD-5144 requires that air quality impacts at the Mandalong Mine Access Site do not exceed the limit criteria of:

- 90ug/m³ annual average for TSP;
- 25ug/m³ annual average for PM₁₀; and
- 50ug/m³ 24-hour average for PM₁₀.

There were no exceedances of the PM₁₀ and TSP annual average limit criteria for the report period. The 2022 annual average for PM₁₀ was 7.30 ug/m³. The 2022 annual average for TSP was 8.29ug/m³. The annual average for TSP is calculated using the HVAS PM₁₀ data. The 2022 annual average for PM_{2.5} was 4ug/m³.

The 24-hr average PM₁₀ concentrations recorded nil exceedances of the Development Consent SSD-5144 24-hr criterion of 50ug/m³ in the 2022 monitoring period.

The maximum PM₁₀ concentration of 30.8µg/m³ and TSP concentration of 34.96µg/m³ were recorded on 18 December 2022. The maximum PM_{2.5} concentration of 15.3µg/m³ was recorded on 30 November 2022. There is no maximum 24hr concentration limit for TSP and PM_{2.5}.

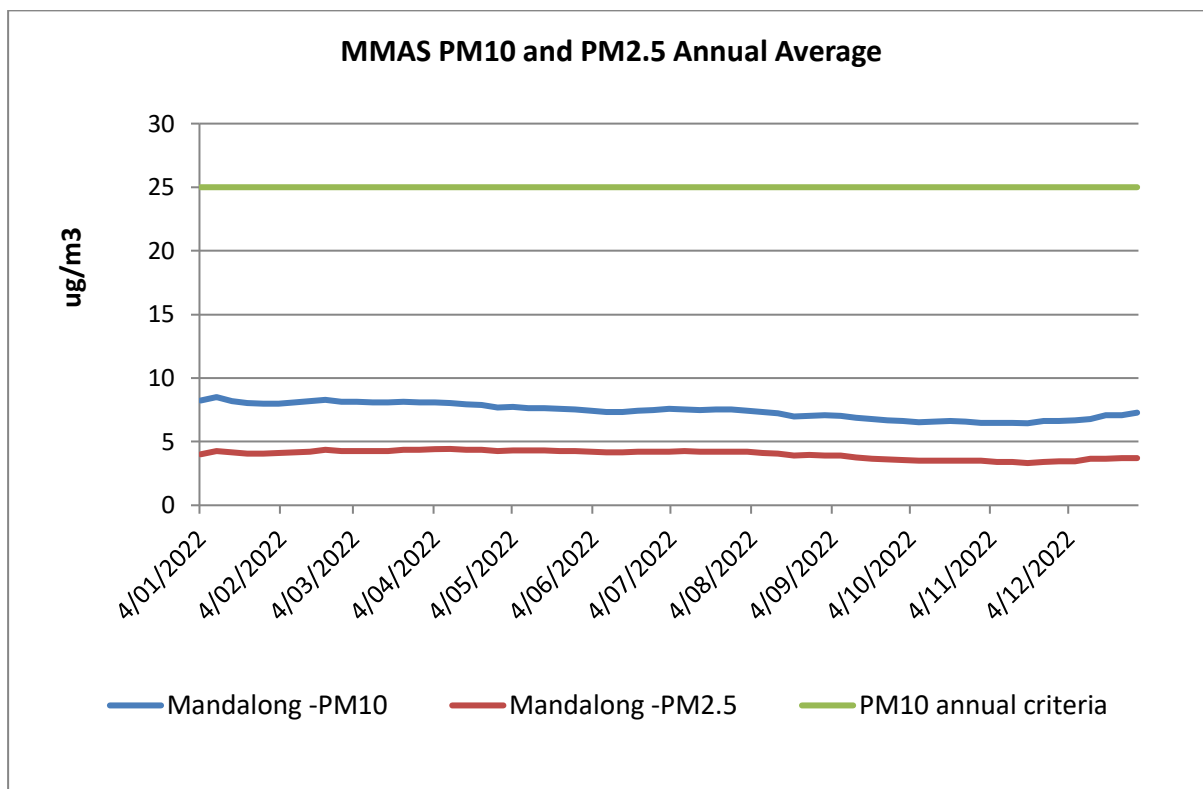


Figure 6-11: MMAS PM10 and PM2.5 Annual Average Monitoring Results and Limit Criteria

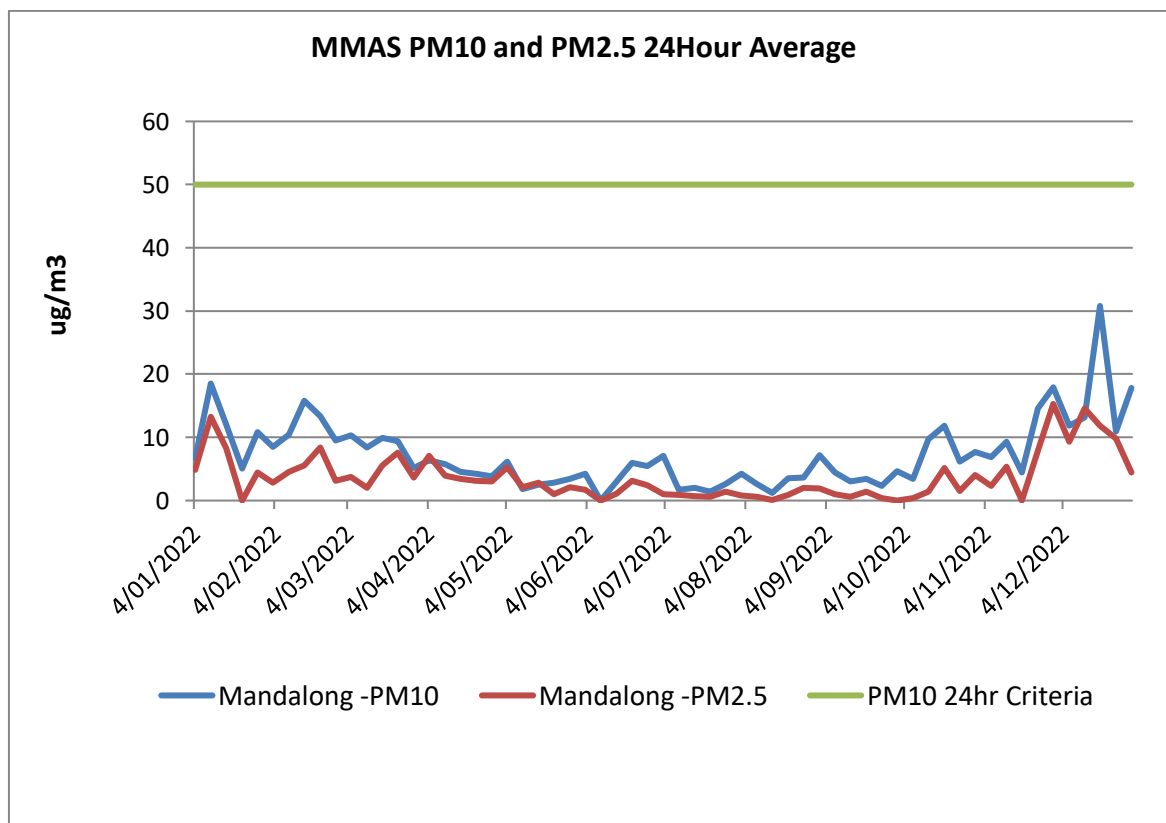


Figure 6-12: MMAS PM10 and PM2.5 24Hour Average Monitoring Results and Limit Criteria

6.4.9 Air Quality Monitoring Data Interpretation

PM10 and PM2.5 monitoring results are shown in **Figure 6-11** and **Figure 6-12**. The results are presented as an annual average for the report period (January 2022 to December 2022). The monitoring results for the TSP and PM10 annual and 24-hour average from January to December 2022 are in accordance with the predictions from the air quality impact assessment for the Mandalong Southern Extension Project EIS (SLR, 2013).

6.4.10 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 2022 financial year (FY 1 July 2021 to 30 June 2022), emissions in CO2 equivalent tonnes (Co2-eT) as defined in the *National Greenhouse and Energy Reporting Act 2007* are provided in **Table 6-13**. **Table 6-13** also includes a comparison against the maximum annual emissions included in the Mandalong Southern Extension Project EIS (SLR, 2013). Total GHG emissions for the 2022 FY period were 1,471,834 CO2-eT, which is higher than the 2021 FY emissions of 1,249,672 CO2-eT.

The majority of GHG emissions in 2022 were caused by fugitive methane contributing to 90.37% of all GHG emissions. Mandalong Mine as discussed below is currently working towards GHG reduction measures to abate fugitive methane emissions.

During the 2022 financial year, Mandalong's Stage 1 Gas Flares abated 45.6% of the amount of mine waste gas captured in the drainage system. This resulted in 241,598 CO2-eT of abatement or the equivalent of 15.4% of the total fugitive emissions from the Mandalong Mine.

Table 6-13: Total GHG Emissions from Mandalong Mine in 2022 Financial Year

Emissions Summary (CO2-eT) July 2021 to June 2022	Total	EIS Maximum Annual Emissions (CO2-eT)
Electricity	69,939	107,152
Diesel	5,174*	29,424 [#]
Petroleum Based Oils and Greases (PBOG)	280	
SF6	6	
Coal Extraction (Fugitives)	1,330,222	1,703,872
Surface Fugitive - Post Mining	66,213	
TOTAL	1,471,834	1,813,664

* Includes Cooranbong Entry Site coal handling / haulage diesel combustion.

[#] Includes 24,144 Co2-eT for Cooranbong haul truck diesel consumption as per NCLP EIS.

6.4.11 Greenhouse Gas Abatement Investigations Measures

As reported in previous Annual Reviews, Centennial Coal has invested in technologies to reduce fugitive methane GHG emissions from the Mandalong Mine. A four-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 flares has assisted with abating drainage gas emissions of up to 2,000 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 (m³/s) of the mine's total Ventilation Air Methane (VAM). The VAM is 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.

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 2016.

The VAM RAB® plant is currently impacted by technical issues. From a technical perspective, refinements are required for the VAM RAB® to reach a suitable temperature profile to allow trial abatement of methane. Over the project life, a number of test procedures have been conducted resulting in significant changes to the design and structure of the plant. These have included a rebuild of the VAM RAB® core.

The current status of the Project is that it is on hold in its commissioning phase. It has not progressed to, or completed, the formal experiment Stage 1 (6-week VAM simulation) or Stage 2 (12 months on VAM).

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.

In 2018, Centennial Mandalong commenced planning and design works for the Gas Engines project. Construction of the Gas Engines was completed in 2021, with commissioning and operation expected in 2023.

Stage 4 - Mandalong is currently investigating options to improve methane gas capture from the underground mine. This would then allow increased methane abatement through the Stage 1 Gas Flares or the Stage 3 Gas Engines. If the projects are viable, they are expected to commence in 2023.

6.5 BIODIVERSITY MONITORING

6.5.1 LW25-29 Extraction Plan Area

The monitoring of sensitive environments subject to potential subsidence impacts is a requirement as per Schedule 4 Condition 6 of SSD-5144. This monitoring is to be performed in accordance with the relevant approved Extraction Plan and associated BMP sub-plan. Approved BMPs for LW25-29 define the monitoring methods for threatened flora and Endangered Ecological Communities (EECs) that may be potentially influenced by subsidence-related impacts arising from the secondary extraction of LW25-29.

The baseline monitoring report was undertaken in 2018, with the current report prepared by RPS presenting results from the third annual monitoring effort in 2022. The 'impact area' for the monitoring program for LW25-29, as referred to in the present report, is shown in **Figure 6-13**. The impact area is defined as the area within the LW25-29 boundary. Boundary changes have occurred throughout the duration of the project for various reasons. The 'previous area LW25-31' boundary was shortened due to an igneous sill that could not be undermined, with extraction to encompass LW25-29 only.

The 2022 monitoring results indicate that the mining of LW25-29 has not had a substantial negative impact on sensitive vegetation communities. Species richness within predicted impact plots and control plots was generally consistent between the baseline survey in 2018 and the monitoring year in 2022 for all three of the sensitive ecological communities. Although there were some slight decreases in species richness, these measures were also observed within control plots in 2022, suggesting differences amongst years are likely due to observer bias or natural processes. Moreover, changes in composition of understory species assemblages were negligible for those plots displaying lower richness scores in 2022, despite this stratum being the most likely to initially respond to any hydrological changes, such as those associated with mining-related ponding (RPS, 2023a).

There were no notable differences in BAM condition scores (composition, structure, function and vegetation integrity) between baseline (2018) and 2022. This suggests no detectable change in vegetation condition since commencement of LW25-29 extraction (RPS, 2023a).

Total stems for *Melaleuca biconvexa* count decreased between baseline (i.e., 2018 and 2019) and 2022 in plots 2 and 3, whilst the distribution of size classes within these plots was largely comparable between these years. The decreased stem count in these plots can be attributed to recent flood/storm damage due to the location of plots being situated on low-lying flood-prone areas. Significant debris and scouring were evident within and nearby the plots, which contributed to the loss of individuals in all size classes. Individuals grouped in maturity classes appeared to vary between 2022 and baseline (2018), however this trend has been present throughout the entire monitoring program and are not indicative of mining-related impacts (RPS, 2023a). Such changes in size class frequencies are more likely to be attributed to natural processes, including La Niña conditions shifting in 2020 and prevailing through 2021 and 2022.

Attributes of *Rhodamnia rubescens* (i.e., individual counts, tree canopy and tree height) were comparable between the baseline and 2022 surveys for all predicted impact plots, suggesting there was unlikely to be any impacts of mining experienced. Additionally, in all cases where this species was detected (both predicted impact and control plots), myrtle rust was present both during baseline surveys and in 2022. As with *M. biconvexa*, any observed variations in the *R. rubescens* survey data is more likely attributed to natural processes, including La Niña conditions shifting in 2020 and prevailing through 2021 and 2022 (RPS, 2023a).

Asperula asthenes abundance and cover decreased substantially during 2022, which can be attributed to trampling (AA Plot 1) and inundation due to the location of plots within low-lying riparian areas. Whilst no control plots were established for this species, similar trends were observed in adjacent monitoring programs (i.e., LW57-60). No flowering has been observed since the establishment of these plots in 2021 (RPS, 2023a).

Nine common species of native frogs were detected. None of these species are listed as threatened under the BC Act or EPBC Act. As such no further investigations were required in the 2022 monitoring period (RPS, 2023a).

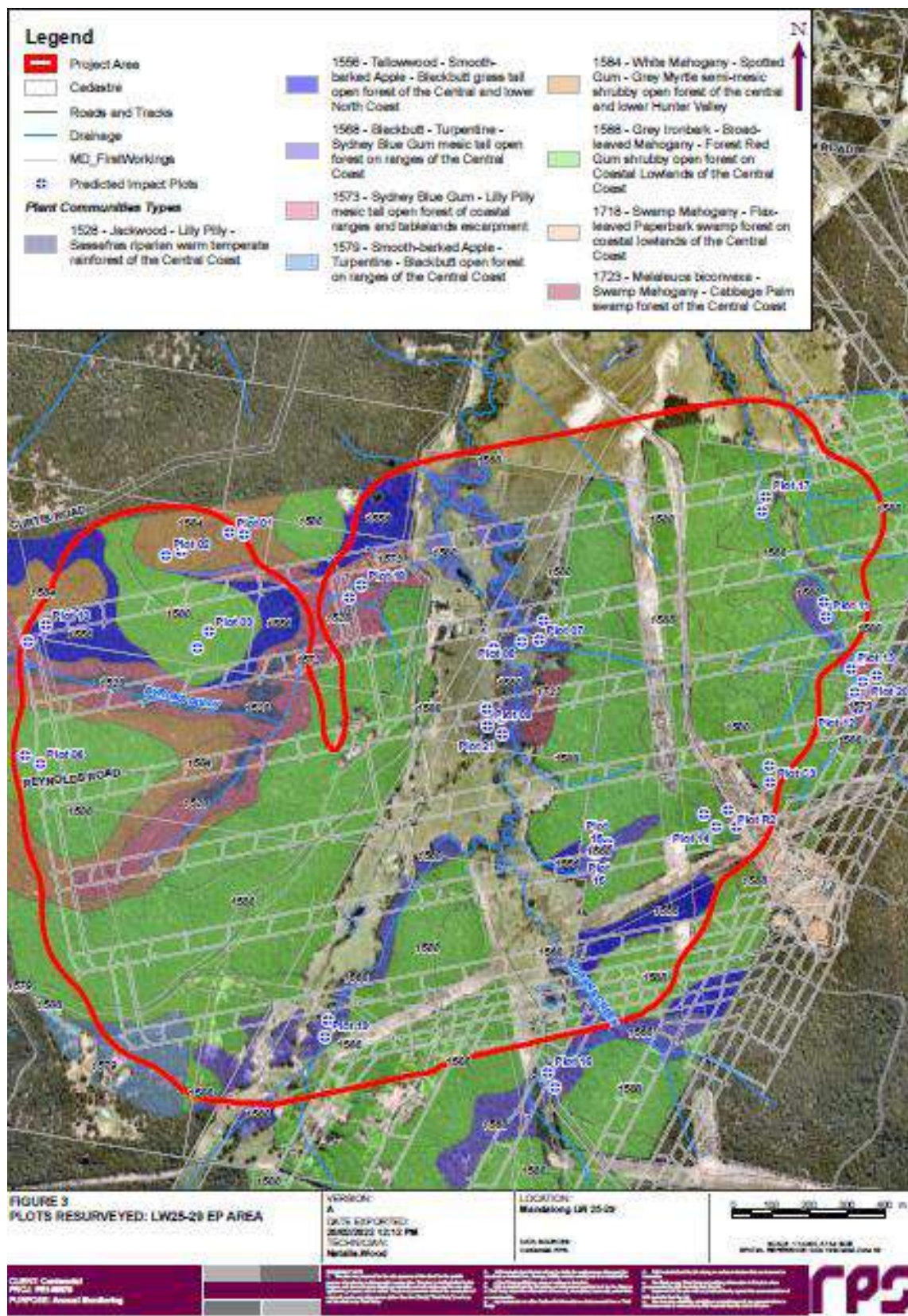


Figure 6-13: Floristic Plots LW25-29 Sites

6.5.2 LW30-31 Extraction Plan Areas

A Biodiversity Monitoring Program (BMP) is required for Mandalong Mine Longwalls 30-31 under the Development Consent SSD-5144, as outlined in the LW30-31 Extraction Plan BMP (RPS 2020).

RPS have completed a 2022 monitoring report (RPS, 2023b) for Longwalls 30-31 which concerns the terrestrial biodiversity monitoring, which includes sensitive vegetation communities and threatened species (including threatened flora, amphibians, cave-associated microbats, and the brush-tailed rock wallaby).

Baseline monitoring efforts were undertaken by RPS in 2019 and 2020, with data collected in 2021 and 2022 representing the initial survey effort following the extraction within the Longwall 30-31 EP Area. Accordingly, the 'impact area' for the monitoring program for Longwall 30-31 is defined as the area within the Longwall 30-31 EP Area boundary (as shown in **Figure 6-14**). At the time of the RPS surveys (September 2022), Longwall 30 was partially completed.

Baseline surveys were undertaken by RPS prior to mining in 2019 and 2020 to initiate the monitoring of sensitive vegetation communities and habitat condition. This monitoring occurred at impact and control sites with the data collected referred to as 'before' data. This data was used to characterise the likely variation in these communities for future post mining comparisons.

The 2022 survey campaign focused on resurveying all plots within the Longwall 30-31 EP Area. This included plots in the EP Area where increases in ponding are predicted due to mining to date (i.e. predicted impact plots), plots in the EP Area outside of areas where increases in ponding are expected or in areas not subject to mining to date (i.e. non-predicted impact plots) and corresponding control plots (in an area away from impacts from mining).

The 2022 survey suggests that mining of LW30-31 has not had a substantial negative impact on sensitive vegetation communities. Species richness within predicted impact plots and control plots was generally consistent or decreased between the baseline surveys (2019/2020) and 2022 (post-mining) for all four of these sensitive ecological communities (RPS, 2023b).

Despite a general decrease in species richness within undermined plots, equally lower richness measures in control plots in 2022 suggest differences amongst years are likely due to observer bias or broader influences (e.g., climatic shifts). Moreover, changes in composition of understory species assemblages were negligible for those plots displaying lower richness scores in 2022, despite this stratum being the most likely to initially respond to any hydrological changes, such as those associated with mining related ponding.

There were no notable differences in BAM condition scores (composition, structure, function and vegetation integrity) between baseline measures in 2019/2020 and following completion of extraction of LW30-31 in 2022. This suggests no detectable change in vegetation condition since completion of LW30-31 extraction (RPS, 2023b).

Monitoring of *R. rubescens* in baseline (2019 and 2020) and post-mining (2021 and 2022) within the EP Area revealed no notable changes in plant persistence over this period, suggesting there are no declines in populations that may be associated with mining. Impact plot 2 had less individuals than during baseline, however this was attributed to overgrowth of *Lantana camera* in the plot, which may have outcompeted/smothered these smaller size classes, rather than mine subsidence related impacts since ground disturbance was not apparent.

Myrtle rust infection on *R. rubescens* was greater in control plots than impact plots in 2022, which has been a consistent trend since the baseline surveys were started. This may be due to more mature trees (>3 m high) in the control than predicted impact plots. Moreover, there was no increase in infection for plants in the EP Area observed in 2022 compared to the prior two years. Hence, underground mining of LW30-31 does appear to have had an impact on the health or persistence of *R. rubescens* (RPS, 2023b).

Three patches of *Corybas dowlingii* (Red Helmet Orchid) were established in August 2021 within the Longwall 30-31 EP Area. These locations were resurveyed in 2022. There were no notable differences of cover, abundance or health of *Corybas dowlingii* between predicted impact and control sites within 2022.

No threatened frogs were detected during surveys conducted in summer during baseline (2019 and 2020) or post-mining (2021 and 2022). In 2022, 12 relatively common frog species were detected during field surveys (RPS, 2023b).

Seven microbat species were recorded in the LW30-31 EP Area. Of the cave-roosting species, a potential roost for *Rhinolophus megaphyllus* (Horseshoe bat) was identified near the EP Area. This was indicated in 2022 by considerably high call frequencies (i.e., >50 calls/night) of Horseshoe bats. *Chalinolobus dwyeri* (Large-eared Pied Bat) was detected in low numbers at impact site 12 in 2022 (<24 calls/night), which was not found in the EP Area during 2021. *Miniopterus australis* (Little Bent-wing Bat) was also detected in 2022.

Despite species richness being lower in 2022 than 2021, results were still consistently higher than baseline (2020) and is therefore unlikely to be attributed to mining and rather seasonal influences and macro-influences within the Mandalong Valley (e.g., availability of food, shelter and climatic influences). Notably, less guano was observed throughout all sites (control and impact), indicating less activity than previous years (RPS, 2023b).

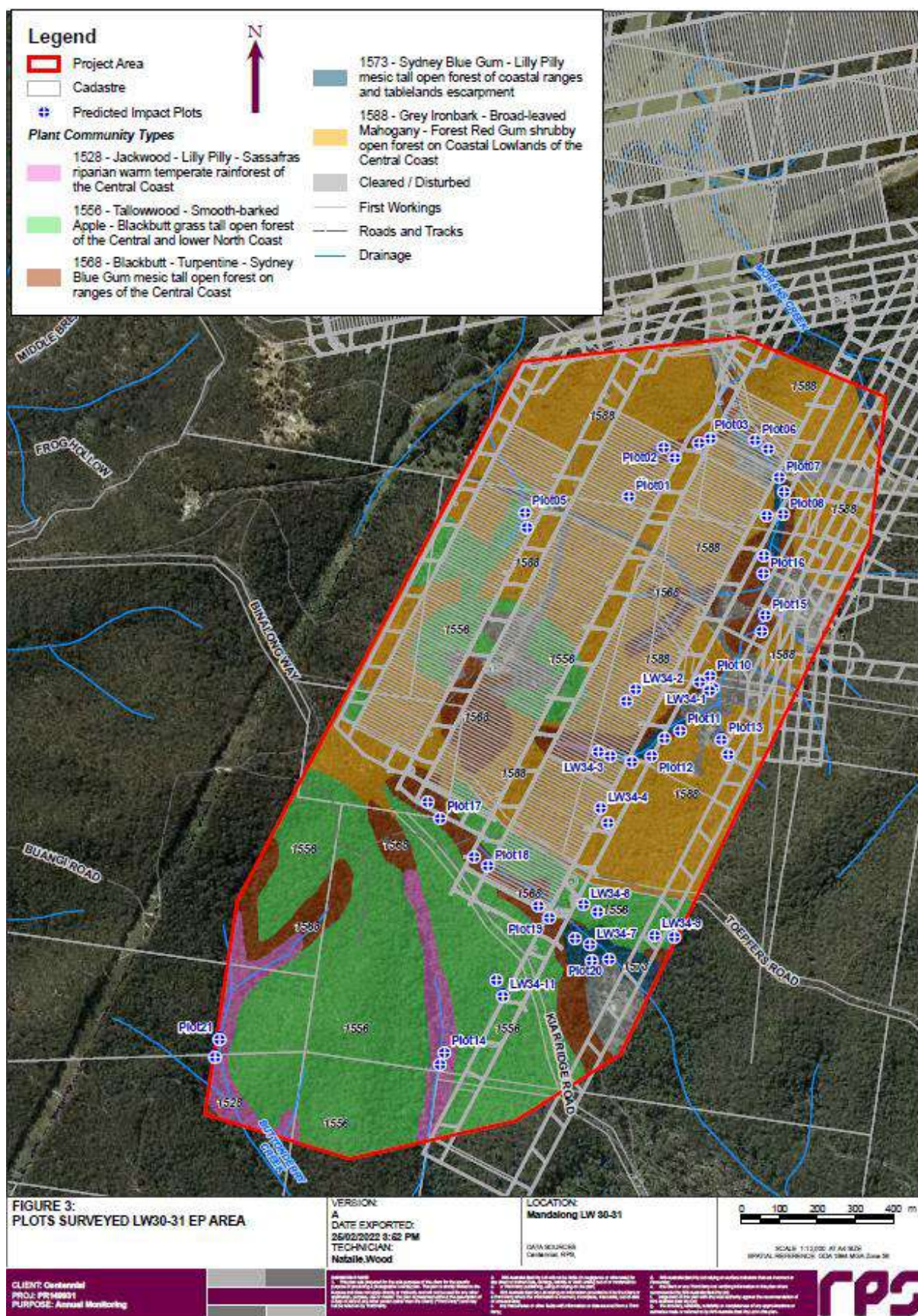
No *P. penicillata* (Brush-tailed Rock Wallaby) were detected by camera trap in either the impact area (i.e., LW30-31 EP Area) or control sites in the Olney State Forest.

RPS (2023b) have presented the results for the 2022 biodiversity monitoring event for the LW30-31 EP area. Biodiversity data collected during 2022 was compared to baseline data (i.e., collected in 2019 and 2020) to determine if a non-negligible impact to biodiversity outcomes has occurred since commencement of mining, as required by the consent conditions for Schedule 4 Condition 6(j) of SSD-5144.

No non-negligible changes were detected for the following measured biodiversity outcomes:

- Sensitive ecological communities;
- Threatened species: *R. rubescens* and *C. dowlingii*;
- Threatened amphibians; or
- Threatened cave-associated microbats

As per the above summary, a TARP under the LW30-31 BMP was not triggered. Monitoring is to continue until biodiversity monitoring can be finished two years after completion of mining in the adjacent longwall panel in sensitive environments (which includes floodplains and GDEs) (RPS, 2023b).



6.5.3 LW32 Extraction Plan Area

A Biodiversity Monitoring Program (BMP) is required for Mandalong Mine Longwall 32 under the Development Consent SSD-5144, as outlined in the LW32 Extraction Plan BMP.

RPS have completed a 2022 monitoring report for Longwall 32 which concerns the terrestrial biodiversity monitoring, which includes sensitive vegetation communities and threatened species (including threatened flora, amphibians, cave-associated microbats, and the brush-tailed rock wallaby).

Baseline monitoring efforts were undertaken in 2020 and 2021 with data collected in 2022 representing the initial survey effort following extraction within this EP Area. Accordingly, the 'impact area' for the monitoring program for LW32 is defined as the area within the LW32 EP Area boundary (as shown in **Figure 6-15**).

At the time of RPS surveys (September 2022), extraction of LW32a was completed and extraction had commenced for LW32b.

From the 2022 results, RPS (2023c) suggest that mining of LW32 has not had a substantial negative impact on sensitive vegetation communities. Species richness within both predicted impact plots and control plots was generally decreased between the baseline survey (2020/2021) and the subsequent monitoring year in 2022 for both of the sensitive ecological communities. This suggests differences amongst years are likely due to observer bias or broader influences (e.g., climatic shifts). Moreover, changes in composition of understory species assemblages were negligible for those plots displaying lower richness scores in 2022, despite this stratum being the most likely to initially respond to any hydrological changes, such as those associated with mining-related ponding.

There were no notable differences in BAM condition scores (composition, structure, function and vegetation integrity) between baseline measures in 2020/2021 and following completion of extraction of LW30-31 in 2022. This suggests no detectable change in vegetation condition since completion of LW32 extraction (RPS, 2023c).

Three patches of *Corybas dowlingii* (Red Helmet Orchid) (1 predicted impact, 2 control) were surveyed throughout 2022. There were no notable differences of cover, abundance nor health of *C. dowlingii* between control and impact sites within 2022. Furthermore, there are negligible differences between 2021 and 2022 results, indicating that the monitored populations of *C. dowlingii* have not been impacted by mining (RPS, 2023c).

Nine common species of native frogs were detected during 2022 amphibian surveys. None of these species are listed as threatened under the BC Act or EPBC Act. As such no further investigations were required in the 2022 monitoring period (RPS, 2023c).

Despite detection of six microbat species in the EP Area, activity levels were not high enough to indicate a potential roost for any threatened cave-associated species. However, high activity levels of the common species *Rhinolophus megaphyllus* (Horseshoe bat) suggest a roost is present in or nearby the EP Area (RPS, 2023c).

RPS (2023c) have reviewed the biodiversity data collected during 2022 and compared to baseline data (i.e., collected in 2020 and 2021) to determine if a non-negligible impact to biodiversity outcomes has occurred since commencement of mining, as required by the consent conditions for Schedule 4 Condition 6(j) of SSD-5144.

No non-negligible changes were detected for the following measured biodiversity outcomes:

- Sensitive ecological communities;
- Threatened species: *R. rubescens* and *C. dowlingii*;
- Threatened amphibians; or
- Threatened cave-associated microbats

Legend

- Project Area
- Cadastre
- Predicted Impact Plots
- Roads and Tracks
- Drainage
- First Workings

Plant Community Types

- 1556 - Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
- 1568 - Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast
- 1588 - Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast
- Cleared / Disturbed

BAM PLOTS RESURVEYED – LW32 EP AREA

CLIENT: Centennial
PROJ: AU21-3005953
LOCATION: Mandalong LW32

DATA SOURCES
Centennial 2019, 2020

MAP: Figure 3
VERSION: 1
DATE EXPORTED: 27/02/2023
TECHNICIAN: Natalie Wood

0 100 200 300 400 m

Scale: 1:10,000
Map Date: 27/02/2023

FIGURE 3

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6.5.4 LW34 and LW57-60 Extraction Plan Areas

During 2022 baseline ecological monitoring has continued for the LW34 and LW57-60 Extraction Plan areas. The monitoring of sensitive environments subject to potential subsidence impacts is a requirement as per Schedule 4 Condition 6 of SSD-5144. This monitoring is to be performed in accordance with the relevant approved Extraction Plan and associated BMP sub-plan. The BMP for LW34 defines the monitoring methods for threatened flora and Endangered Ecological Communities (EECs) that may be potentially influenced by subsidence-related impacts arising from the secondary extraction of LW34.

With mining expected to be undertaken within LW34 and LW57-60 in 2023, ecological monitoring and potential subsidence impacts will be reported within the 2023 Annual Review.

6.5.5 Aquatic Ecology Monitoring

The objectives of the monitoring conducted by RPS in the Spring of 2021 were to build upon an understanding of the macroinvertebrate communities within the downstream receiving environment of LW25-29, LW30-31 and LW32 Extraction Plan areas, and to collect baseline data for LW34, LW39-43 and LW57-60. The report identifies spatial and temporal changes in macroinvertebrate community structure; identify any potential key impacting processes resulting in changes to aquatic ecosystems health; and provide recommendations for the improvement of future monitoring rounds (RPS, 2023d).

RPS was responsible for conducting the spring sampling event at multiple sites (**Figure 6-16**) in accordance with the Biodiversity Management Plan (BMP).

Key results were from the 2022 monitoring were:

- pH and EC were within ANZECC (2000) guidelines at all test sites;
- DO was below the ANZECC (2000) guidelines across all treatment sites, but was substantially greater;
- Turbidity was above the upper limit of the ANZECC (2000) guidelines for all sites (except for MA-M03T). Reference and baseline sites exceeded test sites, and were overall greater than previous monitoring years;
- Ammonia was at or above the ANZECC (2000) guidelines for tests sites and below for baseline and reference sites;
- Family richness was comparable across all treatment sites and monitoring years ($p = >0.05$) with the exception of MA-FT2R between 2019 and 2018 ($p = 0.03$); and
- Taxa richness was generally comparable to across all treatment sites and monitoring years (RPS, 2023d).

Overall, the 2022 monitoring campaign indicates no significant impact to aquatic ecosystem health resulting from activities related to EP Areas LW25-29, LW30-31, LW32 and LW34. While there were fluctuations in the physical-chemical water quality parameters measured (particularly in increased DO and turbidity), these were largely a function of the La Niña Southern Oscillation event experienced throughout 2022. The La Niña weather event likely improved water quality and habitat conditions within all sites resulting in the increased representation of sensitive macroinvertebrate taxa (RPS, 2023d).

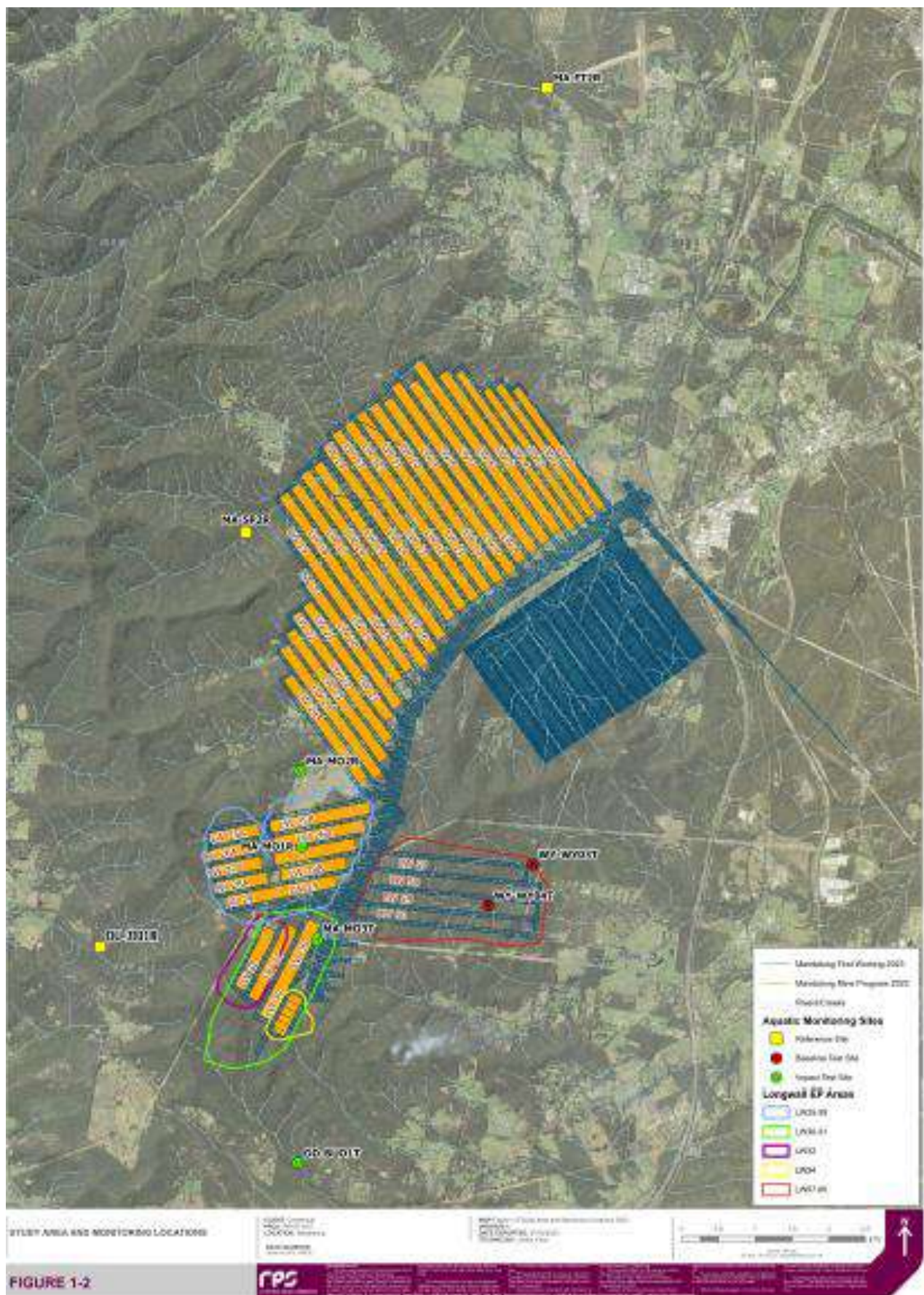


Figure 6-16: Aquatic Ecology Monitoring Locations

6.5.6 Land Management Strategy for the MSSS and TL24 Offset Areas

The construction of the MSSS and access road which was completed in 2017 resulted in the clearing of approximately 11.3 ha of MU 15: Coastal Foothills Spotted Gum – Ironbark Forest, which is not commensurate with any threatened ecological community listed under the Threatened Species Conservation Act (TSC Act 1995) or Environmental Protection and Biodiversity Conservation Act (EPBC Act 1999) (SLR, 2013a).

MU 15 is very common and widespread in the locality, occupying approximately 2,502 hectares within the Study Area and approximately 21,094 hectares between Ourimbah and Beresfield (NPWS 2003, cited in (SLR, 2013a). The proposed approved clearing area (which was 15.6 ha), therefore, amounts to approximately 0.6 percent of the total available vegetation community within the immediate area and approximately 0.07 percent of the total available vegetation community within the region. None of the land proposed to be cleared contains threatened flora species or endangered ecological communities.

For these reasons, Centennial Mandalong did not propose to provide a direct offset strategy. Rather, as a substantial landholder in the Mandalong Valley, Centennial Mandalong has developed a Land Management Strategy for land owned by Centennial in the Valley.

In addition, the relocation of TL24 has also resulted in 8.03 ha of vegetation clearing for the establishment of the new easement. Centennial Mandalong has also included in the Land Management Strategy an additional area of 73.6 ha in order to compensate for the loss of vegetation communities.

The Land Management Strategy provides for four lots identified in **Table 6-14**. The four lots form two sites referred to as Mandalong Road and Chapman Road. The two sites have been placed under a Conservation Property Vegetation Plan (PVP) under Native Vegetation Regulation 2013 (Clause 9(1)) in 2017.

Table 6-14: Land Management Strategy Site Locations

Approval Reference	LMS Site Reference	Lot	DP	Ownership	LGA	Area (ha)
SSD-5144	Mandalong Road Northern Lot	580	733227	Centennial Fassifern Pty Ltd	LMCC	18.37
	Mandalong Road Southern Lots	Lot A	110119	Centennial Fassifern Pty Ltd	LMCC	106.52
		902	541065	Centennial Fassifern Pty Ltd	LMCC	
SSD-5144 (MOD 1)	Chapman Road	152	755238	Centennial Fassifern Pty Ltd	LMCC	72.3

The objective of land management at Mandalong Road and Chapman Road are as follows - **Mandalong Road Objective** - coexistence of conservation and agricultural practices that retain or improve habitat.

Chapman Road Objective - retain/maintain or improve ecological diversity of land to a self-sustaining system/environment.

RPS Australia East Pty Ltd (RPS) was engaged by Centennial Mandalong Pty Ltd to undertake the 2022 annual ecological monitoring of the land management sites as described in the Mandalong Land Management Strategy (LMS). These sites comprise land described as Lot 580 DP733227; Lot A DP110119; Lot 902, DP541065 and Lot 152, DP755238 as shown in **Figure 6-17** and **Figure 6-18** and their total areas indicated in **Table 6-14**.

Baseline flora and fauna surveys were undertaken by RPS ecologists from 9-12, 16-20 and 23-27 March 2015. Repeat annual monitoring surveys of 22 BioMetric plots were undertaken by RPS ecologists in August, September, October and November 2022. Habitat assessment has been completed to determine condition of floristics within the Habitat Enhancement Map Units of the land management sites. Native and exotic plant species were recorded within a 20m x 20m (400 m²) plot nested within the 50m x 20m (1,000 m²) Cover abundance for each plant species was estimated and recorded. Species composition, condition and photographic data was also recorded.

BioMetric (Gibbons et al. 2009), as amended by the NSW BioBanking Assessment Methodology 2014 (BBAM 2014) (Office of Environment and Heritage, OEH 2014), was used as the monitoring method. Calculations were performed using the online NSW BioBanking Credit Calculator (BBCC) to compare monitoring data. The NSW Vegetation Information System (VIS) was interrogated to extract current benchmark data for BioMetric Vegetation Types (BVTs) used to classify each vegetation community examined in the monitoring program.

Within the Mandalong Farm Block Management area, native plant species richness (NPSR) has significantly increased in the Habitat Enhancement Management Unit (MU) in both Plant Community Types (PCTs) 1619 and 1598. Attribute scores have significantly increased in PCT 1716 in both Habitat Enhancement and Grazing MUs. This suggests that within these MUs habitat is being retained and enhanced. No significant changes have been noted in other MUs, therefore habitat is being retained. Within the Chapman Road Bush Block area generally no significant changes in NPSR or attribute scores, therefore habitat is being retained (RPS, 2023e).

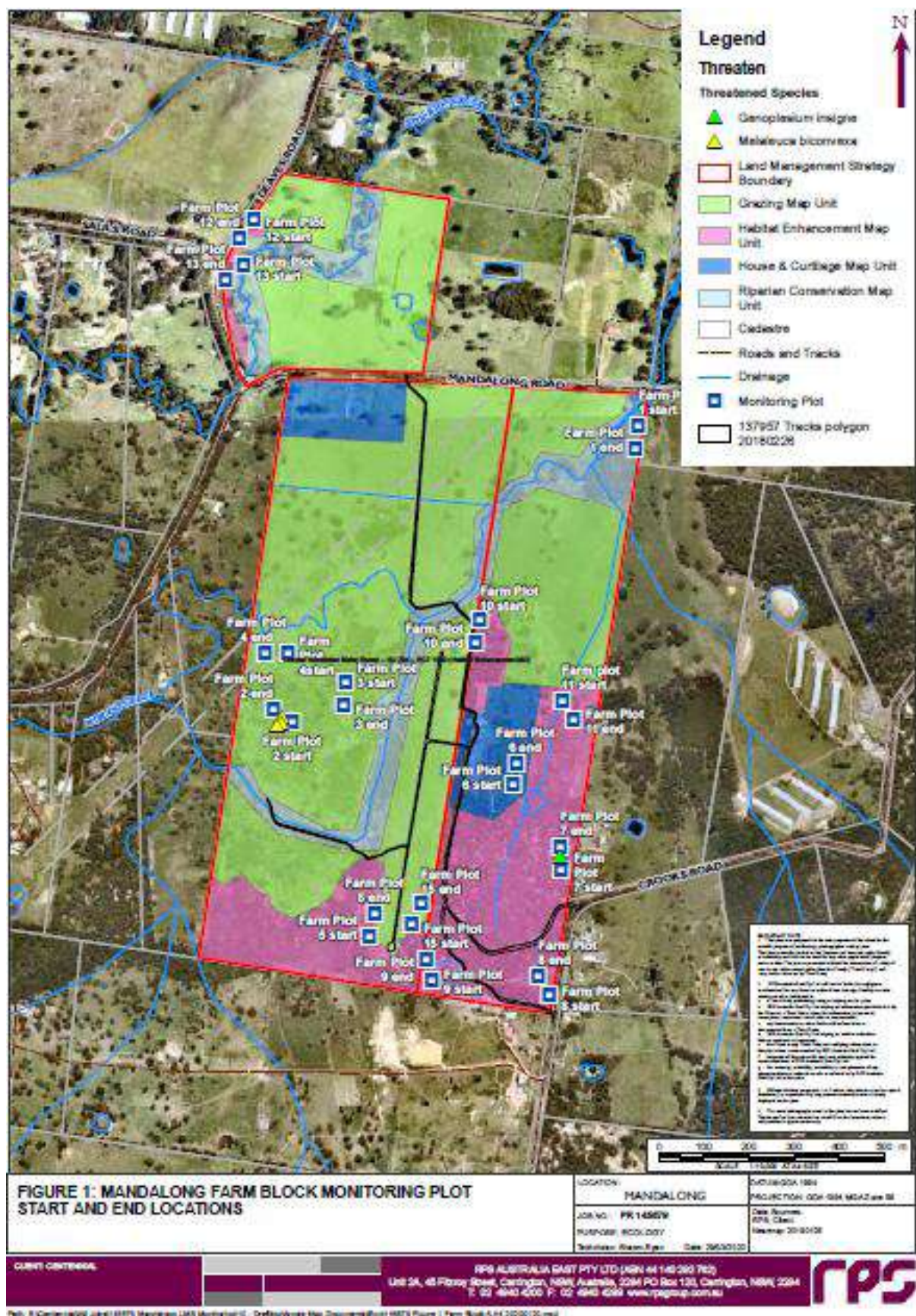
Eight baseline monitoring plots were assessed in 2022 after being established in 2021 for the following threatened flora species:

- *Melaleuca biconvexa* (BC Act: Vulnerable);
- *Rhodamnia rubescens* (BC Act: Critically Endangered; EPBC Act: Critically Endangered);
- *Genoplesium insigne* (BC Act: Critically Endangered; EPBC Act: Critically Endangered); and
- *Asperula asthenes* (BC Act: Vulnerable; EPBC Act: Vulnerable).

Key findings from threatened flora monitoring include:

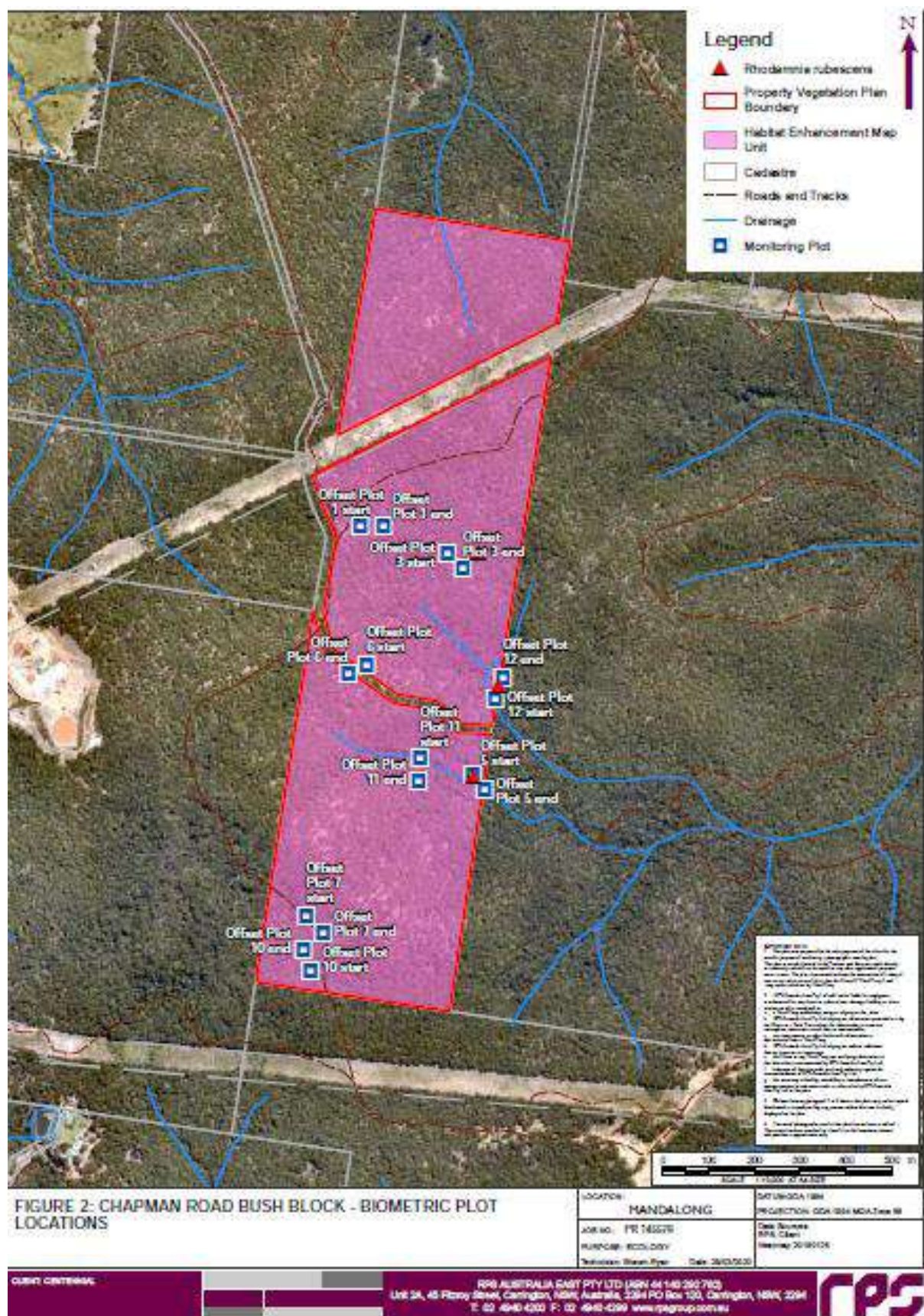
- The *Melaleuca biconvexa* population has increased since 2021.
- The *Rhodamnia rubescens* population has declined, with significant declines in height and diameter at breast height (DBH) since 2021 with Offset Plots 11 and 12 being major contributors to this trend. It is likely that Myrtle Rust infection is the leading cause of population decline.
- Eighteen *Genoplesium insigne* individuals were detected in the 2022 monitoring period after the survey was conducted during peak flowering period. This is the highest count recorded thus far. All threatened species are to be monitored into the future (RPS, 2023e).

Overall, the condition measures within the Mandalong Farm Blocks suggest that the objective of the LMS for this site are being met, which is 'Coexistence of conservation and agricultural practices that retain or improve habitat'. Moreover, the condition measures within the Chapman Road Bush Block demonstrated that the objective of this site was met, which was 'Conservation management of land through practices that retain or improve habitat' (RPS, 2023e).



Source: (RPS, 2022e)

Figure 6-17: Mandalong Farm Offset Area



Source: (RPS, 2022e)

Figure 6-18 : Chapman Road Bush Block Offset Area

6.5.7 MSSS & TL24 Nest Box Monitoring

In June and December 2022 RPS ecologists undertook the bi-annual monitoring of 328 nest boxes. The nest boxes were installed because of hollow-bearing tree loss associated with the Mandalong South Surface Site and associated Access Road, the TL24 Relocation Project and the 33kV powerline project.

This nest box monitoring program consists of the following sites:

- 128 nest boxes installed for the Transmission Line off-set (TL24-13 to TL24-139).
- 30 nest boxes previously installed for the Mandalong South Surface Site and Transmission Line offset (MSSS-01 to MSSS-18 and TL24-1 to TL24-12).
- 170 nest boxes installed in September 2021 as a mitigation measure following the loss of hollow-bearing trees associated with the 7.7 km, 33kV powerline from Mandalong Mine Access Site (MMAS) to the Mandalong South Surface Site (MSSS) (33. 1 - 170).

All nest boxes were inspected using a wireless nest box inspection camera to minimise disturbance to any fauna potentially occupying the nest boxes whilst also minimising personal safety risks involved with climbing ladders.

Results from the Winter 2022 monitoring event suggest a stabilizing in nest box occupancy. However, much of the occupancy was explained by usage by microbats. The presence of nesting material suggests that arboreal mammals may be present at higher rates than implied by results. This indicates that nest boxes may be supporting the persistence of local arboreal mammals, which concurrently utilize other habitat in the peripheral landscape.

Results from the Summer 2022 monitoring event demonstrate a decrease in nest box occupancy by both arboreal mammals and microbats. Although no arboreal mammals and microbats were detected, detection rates for summer monitoring events are consistently low. The diamond python (*Morelia spilota*) occupying a glider nest box may have some correlation of the reduced microbat/mammal occupancy, but only on a localized scale.

The next box monitoring program which will continue in June and December 2023.

6.5.8 VAM-RAB Rehabilitation Off-Set Monitoring

Centennial Mandalong received approval in 2011 (DA97/800 Modification 7) 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, the consent also required that the progress of the rehabilitation be monitored annually for five years. Centennial Mandalong has opted to continue monitoring beyond the required five years. The current document is a report of the condition of the rehabilitation in February 2023, the tenth year (Hunter Eco, 2023a).

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 m² 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 was collected on 6 February 2023. Hunter Eco has conducted similarity analysis which clearly indicates that the rehabilitation composition is moving towards the reference sites. A lot of the differences between the reference and rehabilitation sites is due to greater native species diversity in the rehabilitation sites and this is a consequence of both lower canopy density allowing more light and higher water table due to low tree density (Hunter Eco, 2023a).

Hunter Eco (2023a) have identified that while there are a number of weed species present most are in low abundance. The following weed species need controlling:

- the tall tussock Vasey Grass (*Paspalum urvillei*) is the most abundant weed across all reference plots;
- the high threat weed Noogoora Burr (*Xanthium occidentale*) in Plots 3, 4 and 5 needs destroying before it can fruit;
- there are a number of Tick Bush (*Kunzea ambigua*) growing inside and just outside the southern gate and should be destroyed before they can spread further inside (Hunter Eco, 2023a).



Source: (Hunter Eco, 2021)

Figure 6-19: Location of Floristic Sample Plots

6.5.9 Green & Golden Bell Frog Research Program

In 2016 Centennial Mandalong commenced the preparation and implementation of a research and monitoring program for the Green and Golden Bell Frog (GGBF) in accordance with EPBC approval (2013/6906) conditions of the Northern Coal Logistics Project.

As part of current operations at the Cooranbong Entry Site, underground mine water is pumped from the existing Mandalong Mine underground workings at an average rate of 0.6 to 4.0 ML/day and is discharged into an unnamed creek from Licensed Discharge Point 001 (LDP001) at the Cooranbong Entry Site. The unnamed creek flows into Muddy Lake which is also connected to Lake Macquarie via Lake Eraring.

Ecological surveys were first undertaken at Muddy Lake in October 2015. During these surveys, approximately five Green and Golden Bell Frog *Litoria aurea* (GGBF) individuals were identified. The Green and Golden Bell Frog is listed as an endangered species under the NSW *Threatened Species Conservation Act* 1995 (TSC Act) and as a vulnerable species under the Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

The GGBFs identified at Muddy Lake are the only known records of the species within a 10 km radius of the Cooranbong Entry Site.

The research project will monitor GGBF populations and habitat quality within Muddy Lake in conjunction with reference populations to fulfil the relevant EPBC approval conditions. Monitoring commenced in late 2016, with approval received from the Department of Environment & Energy on 30 November 2016 for Professor Michael Mahoney to act as an independent peer reviewer for the purpose of reviewing the Green and Golden Bell Frog Research Program's methodology and final report.

Surveys were conducted by GHD within the study area over a two-week period in January - February 2017 and also in Spring 2017 and Summer 2017 / 18. Adult males, adult females and juvenile Green and Golden Bell Frogs were captured during the surveys. The size of the juveniles indicated that breeding has occurred either within the study area or within adjacent habitat in the past twelve months. At this stage, this suggests that the population is viable, although further surveys will be required to examine trends in population structure. The presence of a viable population on the Central Coast, a large distance from the two known key populations, is likely to be important for the conservation of the species in the region.

Further surveys were conducted by GHD in December 2018 and in total, around 150 Green and Golden Bell Frog individuals were recorded during surveys across the lake. In the December 2018 surveys, 37 individuals were captured and released during the targeted surveys, an additional 85 individuals recorded as a result of canoe based surveys, and 25 individuals observed or heard during spotlighting surveys. Canoe-based surveys have shown to be a successful technique at Muddy Lake for assessing occupancy and population numbers (GHD, 2019b).

Green and Golden Bell Frogs were recorded at all six sites surveyed at Muddy Lake in the summer 2020-2021 program, with a total of 109 individuals recorded, including many juveniles. This is a substantial increase in numbers from December 2019, likely to be a result of improved climatic conditions associated with the 2020-2021 La Nina event and recent breeding (increased numbers of juveniles present) (GHD, 2021c).

Green and Golden Bell Frogs were recorded at five of the six sites surveyed at Muddy Lake in February 2022, with a total of 60 individuals recorded, including 10 juveniles. This comprises lower numbers from March 2021, likely to be a result of inclement weather hampering

detection during surveys, and differences in microhabitats present at different sites (GHD, 2022e).

Higher numbers of individuals were generally observed in habitat in the western and eastern portion of the lake where there are a variety of microhabitats, including emergent reeds, trees and pools or open water. Fewer frogs were observed in the central section and southern side of the eastern portion. This may be due to dense *Salvinia* infestation and fewer emergent reeds, although the *Salvinia* impeded surveys and lower numbers may also be due to the difficulty of surveying these areas (GHD, 2022e).

There have been no discharges from CES into Muddy Lake over the last year due to issues with the borehole pump. The impact of lack of discharges from CES is uncertain, however the macroinvertebrate community at the unnamed creek was in good condition and did not appear to be affected by the lack of discharges. The macroinvertebrate community elsewhere at Muddy Lake shows some impairment, and this may be due to high levels of organic matter, water weeds and anoxic conditions. Previously it was supposed that mine discharges may be contributing to habitat quality by providing permanent water. La Nina conditions over the past two summers have resulted in high rainfall, which has also likely contributed to habitat values, and counterbalanced lack of flows from the discharge.

There is no evidence of a decline in the extent, quality or availability of Green and Golden Bell Frog habitat downstream of the discharge locations and resulting from the lack of discharges over the last year. Good quality habitat remains throughout the western portion of the lake, and good numbers of frogs were recorded during surveys in these areas (GHD, 2022e).

6.6 CULTURAL HERITAGE

6.6.1 Aboriginal Archaeology – LW30-31, LW32 & LW34 Extraction Plan Areas

Umwelt has prepared Heritage Management Plans to support Extraction Plans for the extraction of coal from Mandalong Mine Longwalls 30-31, Longwall 32 and Longwall 34.

The Study Area for the Heritage Management Plans encompassed the 26.5 degree angle of draw around the secondary extraction areas of Longwalls 30-31, Longwall 32 and Longwall 34. Twenty-one (21) Aboriginal heritage sites/items are located inside the Longwall 30-31, Longwall 32 and Longwall 34 Extraction Plan Areas as shown in **Table 6-15**. These twenty-one Aboriginal heritage sites/items are located within the mine workings area and thus may be impacted by subsidence.

In 2022, initial post-mining inspections (Phase 2) were undertaken for sites associated with Longwalls 30-31 and Longwall 32. Final post-mining inspections (Phase 3) will be undertaken for these sites in 2023.

Baseline inspections (Phase 1) were also completed for sites associated with Longwall 34 in 2022.

Table 6-15: Aboriginal Cultural Heritage Sites (LW30-31, LW32 & LW34).

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence (m)	Actual Subsidence (m)	Comment
45-3-1228	Moran's Creek	Art (Pigment/ Engraved), Habitation Structure	LW30 / LW34 AOD	0.09	Final subsidence to be measured in 2023.	Baseline site inspection was conducted on 20 April 2021. Phase 2 initial post-mining inspection was conducted on 22 August 2022.
45-3-4552	MS9-GG-2	Grinding Groove	LW31	1.21	Final subsidence to be measured in 2023.	Baseline site inspection was conducted on 13 October 2021. Phase 2 initial post-mining inspection was conducted on 22 August 2022.
45-3-4545	MS9-GG-3	Grinding Groove	LW30 / LW34	0.84	Final subsidence to be measured in 2024.	Baseline site inspection was conducted on 20 April 2021. Phase 2 initial post-mining inspection was conducted on 22 August 2022.

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence (m)	Actual Subsidence (m)	Comment
45-3-4546	MS9-RS-2	Habitation Structure	LW30 / LW34 AOD	0.19	Final subsidence to be measured in 2024.	Baseline site inspection was conducted on 20 April 2021. Phase 2 initial post-mining inspection was conducted on 22 August 2022.
45-3-4544	MS9-RS-3	Habitation Structure	LW30 / LW34 AOD	0.09	Final subsidence to be measured in 2024.	Baseline site inspection was conducted on 20 April 2021. Phase 2 initial post-mining inspection was conducted on 22 August 2022.
45-3-3492	RPS MAND STH CYL05	Grinding Groove	LW30 / LW34 AOD	0.29	Final subsidence to be measured in 2024.	Baseline site inspection was conducted on 20 April 2021. Phase 2 initial post-mining inspection was conducted on 22 August 2022.
45-3-3586	RPS MAND STH PS01	Habitation Structure (with no deposit or objects)	LW31	1.23	Final subsidence to be measured in 2023.	Baseline site inspection was conducted on 13 October 2021. Phase 2 initial post-mining inspection was conducted on 2 December 2022.
45-3-3639	RPS MAND STH PS02	Aboriginal Resource and Gathering (rock overhang)	LW31	0.79	Final subsidence to be measured in 2023.	Baseline site inspection was conducted on 13 October 2021. Phase 2 initial post-mining inspection was conducted on 2 December 2022.

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence (m)	Actual Subsidence (m)	Comment
45-3-3640	RPS MAND STH PS03	Aboriginal Resource and Gathering (rock overhang)	LW31	0.86	Final subsidence to be measured in 2023.	Baseline site inspection was conducted on 13 October 2021. Phase 2 initial post-mining inspection was conducted on 2 December 2022.
45-3-3641	RPS MAND STH PS04	Aboriginal Resource and Gathering (rock overhang)	LW32	0.86	Final subsidence to be measured in 2023.	Baseline site inspection was conducted on 13 October 2021. Phase 2 initial post-mining inspection was conducted on 2 December 2022.
45-3-3642	RPS MAND STH PS05	Aboriginal Resource and Gathering (rock overhang)	LW32	0.77	Final subsidence to be measured in 2023.	Baseline site inspection was conducted on 13 October 2021. Phase 2 initial post-mining inspection was conducted on 2 December 2022.
45-3-3511	RPS MAND STH PS25	Artefact	LW31	0.93	Final subsidence to be measured in 2023.	Baseline site inspection was conducted on 13 October 2021. Phase 2 initial post-mining inspection was conducted on 22 August 2022.

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence (m)	Actual Subsidence (m)	Comment
45-3-3512	RPS MAND STH PS26	Grinding Groove	LW30 / LW34	0.52	Final subsidence to be measured in 2024.	Baseline site inspection was conducted on 20 April 2021. Phase 2 initial post-mining inspection was conducted on 22 August 2022.
45-3-3594	RPS MAND STH PS27	Habitation Structure (with no deposit or objects)	LW30 / LW34 AOD	0.39	Final subsidence to be measured in 2024.	Baseline site inspection was conducted on 20 April 2021. Phase 2 initial post-mining inspection was conducted on 22 August 2022.
45-3-3513	RPS MAND STH PS28	Potential Archaeological Deposit (PAD)	LW30 / 34 AOD	0.02	Final subsidence to be measured in 2024.	Baseline site inspection was conducted on 20 April 2021. Phase 2 initial post-mining inspection was conducted on 22 August 2022.
45-3-3595	RPS MAND STH PS29	Habitation Structure (with no deposit or objects)	LW31 AOD	0.00	Final subsidence to be measured in 2023	Baseline site inspection was conducted on 13 October 2021. Phase 2 initial post-mining inspection was conducted on 22 August 2022.
45-3-3596	RPS MAND STH PS30	Habitation Structure (with no deposit or objects)	LW34 AOD	0.62m	Final subsidence to be measured in 2024.	Baseline site inspection was conducted on 20 April 2021. Phase 2 initial post-mining inspection was conducted on 2 December 2022.

AHIMS Number	Artefact No.	Aboriginal Cultural Heritage Site	Mining Location	Predicted Subsidence (m)	Actual Subsidence (m)	Comment
45-3-3514	RPS MAND STH PS32	Potential Archaeological Deposit (PAD)	LW32	0.10	Final subsidence to be measured in 2023	Baseline site inspection was conducted on 13 October 2021. Phase 2 initial post-mining inspection was conducted on 2 December 2022.
45-3-3536	RPS TBM29	Artefact Scatter	LW31 South-West Headings	0.01	Final subsidence to be measured in 2023	Baseline site inspection was conducted on 13 October 2021. Site was not located.
45-3-1223	Morans Creek	Artefact Scatter	LW30	0.00	Final subsidence to be measured in 2023	Baseline site inspection was conducted on 20 April 2021. Site was not located.
45-3-3643	RPS PS07	Habitation Structure (with no deposit or objects)	LW34 AOD	0.10	Final subsidence to be measured in 2024.	Baseline site inspection was conducted on 2 December 2022.

6.6.2 European Heritage

A Historic Heritage Management Plan was developed for Mandalong in 2016 to address European Heritage items located within the Mandalong lease boundary. The archival recording of the Landing Skid 2 which is located within the Mandalong South Surface Site disturbance boundary was completed by RPS in 2016 (RPS, 2017b). Landing Skid 2 was subsequently demolished in 2017 during the construction of the Mandalong South Surface Site. There were no further impacts to European Heritage items in 2022.

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 DRG.

6.7 MINE SUBSIDENCE

Subsidence monitoring programs are developed, or active subsidence monitoring programs extended for each subsequent Extraction Plan submission. The intent of the Subsidence Monitoring Program(s) is to confirm subsidence performance is in accordance with the predictions and impacts as outlined in the approved Extraction Plan(s). Where measured subsidence is exceeded or impacts experienced during mining differ from that predicted in the approved Extraction Plan, Trigger Action Response Plans (TARPs) are activated to manage the potential non-compliance.

The Subsidence Monitoring Program includes provisions for all relevant built features including private dwellings, public roads, Telstra communications networks, Ausgrid powerlines, TransGrid 330kV transmission towers, and natural features such as wetlands, creeks, flood paths, steep slopes and key heritage features.

6.7.1 Subsidence Performance Measures and Reporting

All mining undertaken in 2022 was within mining leases ML1443, ML1722 and ML1744 and as per approved Development Consent SSD-5144. The approved subsidence performance measures are included in Schedule 4, Condition 1, Table 6, and Condition 4, Table 7 of Development Consent SSD-5144 and are included below as **Table 6-16** and **Table 6-17**.

The current development consent also includes provisions for Incident Reporting, and Non-compliance Notifications under Schedule 6, Clauses 10 and 10A, as well as Regular Reporting on Centennial's website, and an Annual Review (as per this document) under Schedule 6, Clauses 11 and 12.

Table 6-16: SSD-5144 Subsidence Performance Measures – Natural and Heritage Features

Watercourses	
3 rd Order and above streams Groundwater-dependent Ecosystems	<ul style="list-style-type: none"> No connective cracking between the surface, or the base of the alluvium, and the underground workings. No subsidence impact or environmental consequence greater than minor.
1 st and 2 nd Order streams	<ul style="list-style-type: none"> No subsidence impact or environmental consequences greater than predicted in the documents listed in condition 2(b) of Schedule 2. No connective cracking between the surface and the underground workings.
Aquatic and riparian ecosystems, including affected sections of Morans Creek, Wyee Creek, Tobins Creek and Mannering Creek	<ul style="list-style-type: none"> Maintain or improve baseline channel stability. Develop site-specific in-stream water quality objectives in accordance with ANZECC 2000 and Using the ANZECC Guidelines and Water Quality Objectives in NSW procedures (DECC 2006), or their latest versions.
Land	
Steep slopes and rock outcrops	<ul style="list-style-type: none"> No subsidence impact or environmental consequence greater than predicted in the documents listed in condition 2(b) of Schedule 2.
Agriculture	<ul style="list-style-type: none"> No loss of agricultural productivity greater than minor.
Biodiversity	
Threatened species, threatened populations and endangered ecological communities	<ul style="list-style-type: none"> Negligible environmental consequences.

Heritage sites	
Stone Arrangement RPS TBM 32	<ul style="list-style-type: none"> Negligible subsidence impacts or environmental consequences
All other Aboriginal Cultural Heritage sites/items at the site	<ul style="list-style-type: none"> No subsidence impact or environmental consequence greater than predicted in the documents listed in condition 2(b) of Schedule 2.
Mine workings	
First workings under an approved Extraction Plan beneath any feature where performance measures in this table require negligible subsidence impacts or negligible environmental consequences	<ul style="list-style-type: none"> To remain long-term stable and non-subsiding.
Second workings	<ul style="list-style-type: none"> To be carried out only within the approved mine plan, in accordance only with an approved Extraction Plan.

Table 6-17: SSD-5144 Subsidence Performance Measures – Built Features

Key Public Infrastructure	
M1 Motorway	Always safe and serviceable. Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.
Main Northern Railway	
330 kV power supply infrastructure	
Other Built Infrastructure	
Power lines and power poles	Always safe. Serviceability should be maintained wherever practicable.
Telecommunications infrastructure	
Privately-owned residences	
Local Roads	Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.
Other built features and improvements, (including access roads, farm dams, swimming pools, tracks and fences)	
Public Safety	
Public Safety	Negligible additional risk.

6.7.2 Secondary Extraction Summary

During the 2022 calendar year, secondary extraction was undertaken via longwall mining including the outbye portion of LW30, the entirety of LW31, LW32A and LW32B. Secondary extraction of Longwalls 30 and 31 was covered by the LW30-31 Extraction Plan approved by DPIE in 2021, and the extraction of the split Longwall 32 (LW32A & 32B), by the LW32 Extraction Plan variation approved in May 2022, (refer [Table 6-18](#) for details).

Table 6-18: Longwall Extraction during 2022

Longwall	Commencement	Completion
LW30	03/08/2021	16/02/2022
LW31	10/03/2022	06/11/2022
LW32A	10/07/2022	13/08/2022
LW32B	04/09/2022	10/11/2022

6.7.3 Subsidence Performance Results

Subsidence predictions were developed by Ditton Geotechnical Services in both 2021 and 2022, with the most recent assessment undertaken as part of the LW34 Extraction Plan which incorporates all mine plan variations up to Modification 10. The latest predictions include a review of subsidence performance for the last 33 longwalls (i.e., LWs 1-32 and LW24A inclusive) (Ditton Geotechnical Services, 2022).

During 2022, vertical subsidence, tilt and strain were monitored on private properties, TransGrid towers on TL25/26, and the four following crosslines:

- Crossline 23 (TL25/26 transmission line, and LWs 28B,29 and 30)
- Crossline 24 (Toepfers Road, and LWs 30 to 32 & LW34).
- Crossline 25 (Binalong way and LWs 31-32); and
- Crossline 26 (Toepfers Road).

In conjunction with the above, visual inspections were undertaken on relevant steep slopes, Crown Roads, private access roads, and along easements incorporating the Telstra Communications Network, and Ausgrid Powerlines as per the Subsidence Monitoring Program.

The following tables taken from Ditton Geotechnical Serviced (2021) summarises the predicted v. measured subsidence, tilt and strain performance for LWs 28B and 29 based on the reorientated LW30-31 mine layout (SSD-5144 MOD9).

Table 6-19 - Summary of Predicted v. Measured First Maximum Subsidence

LW #	Survey Line (CS)	Panel Width W (m)	Cover Depth H (m)	Panel W/H	Face Height T (m)	SRP	First Panel S _{max} (m)		First Chain Pillar S _p (m)	
							Predicted mean - U95%CL	Measured	Predicted mean - U95%CL	Meas.
25b	22	180	295	0.61	4.3	M	0.62 - 0.84	0.63	0.39 - 0.49	0.28
26b	22	180	320	0.56	4.3	M	0.68 - 0.95	0.94	0.50 - 0.71	0.28
27b	22	180	330	0.55	4.2	M	0.69 - 0.94	0.81	0.45 - 0.65	0.25
28b	22-23	180	286	0.63	4.0	M	0.82 - 1.04	1.01	0.31 - 0.41	0.19
29	23	180	280	0.64	4.0	M	0.79 - 1.02	<i>1.11</i>	-	-
29	23	180	280	0.64	4.0	L	1.22 - 1.46	1.11	-	-
30	23	200	300	0.67	3.8	L	1.03 - 1.26	0.99	0.36 - 0.64	-

italics - measured value < 15% above predicted value; **bold** - measured value > 15% above predicted value; **dark shaded** - LW29 re-predictions in this study based on 'Low' SRP.

Table 6-20 - Summary of Predicted v. Measured Tilt

LW #	Survey Line (CS)	Panel Width W (m)	Cover Depth H (m)	Panel W/H	Mining Height T (m)	SRP	Final Panel S _{max} (m)		Final Chain Pillar S _p (m)	
							Predicted mean - U95%CL	Measured	Predicted mean - U95%CL	Meas.
25b	22	180	295	0.61	4.3	M	0.93 - 1.16	0.88	0.47 - 0.57	0.32
26b	22	180	320	0.56	4.3	M	1.12 - 1.39	1.29	0.61 - 0.81	0.52
27b	22	180	330	0.55	4.2	M	1.07 - 1.32	1.04	0.54 - 0.74	0.35
28b	22-23	180	286	0.63	4.0	M	1.04 - 1.26	1.18	0.37 - 0.47	0.26
29	23	180	280	0.64	4.0	M	0.82 - 1.04	1.24	-	-
29	23	180	280	0.64	4.0	L	1.24 - 1.48	1.24	-	-
30	23	200	300	0.67	3.8	L	1.30 - 1.53	-	0.43 - 0.53	-

italics - measured value < 15% above predicted value; **bold** - measured value > 15% above predicted value. %;
dark shaded - LW29 re-predictions in this study based on 'Low' SRP.

Table 6-21 - Summary of Predicted v. Measured Tensile Strain

LW #	Survey Line (CS)	Panel Width W (m)	Cover Depth H (m)	Panel W/H	Mining Height T (m)	SRP	Maximum Tensile Strain E_{max} (mm/m)			
							Predicted		Measured	
							<i>mean</i>	<i>U95%CL</i>	<i>Panel Side1</i>	<i>Panel Side2</i>
Modified Prediction Model (based on LW25b to 29 survey data)										
25b	22	180	295	0.61	4.3	M	5	7	2.0	4.6
26b	22	180	320	0.56	4.3	M	2	4	3.3	4.3
27b	22	180	330	0.55	4.2	M	3	5	3.4	-
28b	22-23	180	286	0.63	4.0	M	4	6	1.5	2.8
29	23	180	280	0.64	4.0	M	4	6	2.7	5.1
29	23	180	280	0.64	4.0	L	6	9	2.7	5.1
30	23	200	300	0.67	3.8	L	5	8	3.3	-

italics - Measured value exceeded predicted U95%CL value by < 15%; **Bold** - Measured value exceeded predicted U95%CL value by > 15%; dark shaded - LW29 re-predictions in this study based on 'Low' SRP.

Table 6-22 - Summary of Predicted v. Measured Compressive Strain

LW #	Survey Line (CS)	Panel Width W (m)	Cover Depth H (m)	Panel W/H	Mining Height T (m)	SRP	Maximum Compressive Strain E_{max} (mm/m)		
							Predicted		Measured
							<i>mean</i>	<i>U95%CL</i>	<i>Central Panel</i>
25b	22	180	295	0.61	4.3	M	6	9	4.6
26b	22	180	320	0.56	4.3	M	3	5	5.0
27b	22	180	330	0.55	4.2	M	4	6	4.9
28b	22-23	180	286	0.63	4.0	M	5	8	5.6
29	23	180	280	0.64	4.0	M	5	8	5.3
29	23	180	280	0.64	4.0	L	7	11	5.3
30	23	200	300	0.67	3.8	L	6	10	9.8

italics - Measured value exceeded predicted U95%CL value by < 15%; **Bold** - Measured value exceeded predicted U95%CL value by > 15%; dark shaded - LW29 re-predictions based on 'Low' SRP

Table 6-23: Assessment of Subsidence Performance against Performance Measures and Predicted Impacts

Feature	Subsidence Performance Measures	Predicted Subsidence Impact EP LW30-31 and EP LW32	Assessment of Performance against Predicted Impact
Private Property			
Dwellings	<i>Always safe.</i> <i>Serviceability should be maintained wherever practicable.</i> <i>Loss of serviceability must be fully compensated.</i> <i>Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.</i>	Subsidence predictions below SSR criteria, with all dwellings remaining SSR.	<i>Impact as predicted. No performance measure exceedances observed.</i>
Flood – dwelling and access	<i>Dwelling floor level to remain 0.5m above post mining 100 year ARI flood level - acquisition and compensation procedure if subsided floor level is below flood level.</i>	All dwellings freeboard remains above 100 year flood level at the maximum predicted subsidence and two times maximum predicted subsidence.	<i>Impact as predicted. No performance measure exceedances observed.</i>
Agriculture	<i>No loss of agricultural productivity greater than minor.</i>	No loss of landuse to State Forest or agricultural productivity to private property (hobby farms) and Centennial properties.	<i>Impact as predicted. No performance measure exceedances observed.</i>
Infrastructure			
Local Roads and Access	<i>Always safe.</i> <i>Serviceability should be maintained wherever practicable.</i> <i>Loss of serviceability must be fully compensated.</i> <i>Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.</i> Public Roads Management Plan LW30-31 Public Roads Management Plan LW32	Low level of damage predicted Toepfers Road, Kiar Ridge Road and Binalong Way To remain safe, serviceable and repairable. No change to flood hazard.	<i>Impact as predicted. No performance measure exceedances observed.</i>

Feature	Subsidence Performance Measures	Predicted Subsidence Impact EP LW30-31 and EP LW32	Assessment of Performance against Predicted Impact
Electricity Transmission Lines (330kV)	<p><i>Always safe and serviceable. Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.</i></p> <p>Transmission Line Management Plan LW25-31 for TL24 Towers 33X to 38X.</p> <p>Transmission Line Management Plan LW28-29 for TL25/26 Towers 39 to 42</p> <p>Transmission Line Management Plan LW32 for TL25/26 Towers 43 to 45</p>	<p>No impact to serviceability of transmission lines.</p> <p>A section of TL24 was relocated and new towers constructed from 33X to 40X.</p> <p>Concrete cruciform footings constructed on TL24 towers 33X to 38X.</p> <p>Concrete cruciform footings constructed on TL25/26 towers 39 to 42.</p>	<i>Impact as predicted. No performance measure exceedances observed.</i>
Powerlines (11kV)	<p><i>Always safe and serviceable. Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired</i></p> <p>Powerline Management Plan LW30-31 Powerline Management Plan LW32</p>	<p>No impact to serviceability of powerlines.</p> <p>Mitigation measures were installed by Ausgrid on powerlines prior to development of subsidence.</p>	<i>Impact as predicted. No performance measure exceedances observed.</i>
Communications	<p><i>Always safe and serviceable. Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired</i></p> <p>Communications Management Plan LW30-31 Communications Management Plan LW32</p>	<p>Low impact. No disruption to copper cable buried or aerial networks.</p>	<i>Impact as predicted. No performance measure exceedances observed.</i>

Feature	Subsidence Performance Measures	Predicted Subsidence Impact EP LW30-31 and EP LW32	Assessment of Performance against Predicted Impact
Natural Features			
Biodiversity	<i>Negligible environmental consequences to threatened species, threatened populations and endangered ecological communities</i>	Negligible environmental consequences.	<i>Impact as predicted. No performance measure exceedances observed.</i>
Floodplain	Floodplain inspection and monitoring	Minimal changes to creek channel flows or alignment. Predicted no surface cracking on floodplain.	<i>Impact as predicted. No performance measure exceedances observed.</i>
Remnant Ponding	Flood Modelling	Minor increase to existing ponding predicted over LW25 to LW31. Increase in existing ponding over LW32.	<i>Impact as predicted. No performance measure exceedances observed.</i>
Groundwater	Groundwater Monitoring and Management Plan	Predicted no adverse subsidence related impacts on alluvium groundwater levels and water quality.	<i>Impact as predicted. No performance measure exceedances observed.</i>
Steep Slopes and rock outcrops	<i>No subsidence impact or environmental consequence greater than predicted in the documents listed in SSD-5144 Condition 2(b) of Schedule 2.</i> Public Safety Management Plan LW30-31 Public Safety Management Plan LW32	Two dwellings potentially vulnerable to rock rollout deemed to be 'very unlikely'	<i>Impact as predicted. No performance measure exceedances observed.</i>
Heritage			
Heritage and Archaeology	<i>No subsidence impact or environmental consequence greater than predicted in the documents listed in SSD-5144 Condition 2(b) of Schedule 2.</i>	No impact to the Aboriginal cultural heritage sites identified within EP LW25-29, LW30-31 and LW32 above predictions. Widening of an existing joint in a rock bar adjacent to TBM34 (AHIMS # 45-3-3542) grinding grooves was identified by Centennial on 13 April 2021.	<i>Impact as predicted. No performance measure exceedances observed.</i>

Feature	Subsidence Performance Measures	Predicted Subsidence Impact EP LW30-31 and EP LW32	Assessment of Performance against Predicted Impact
		The cracking damage potential to site RPS TBM 34 was predicted as “possible” by Ditton Geotechnical Services.	

6.8 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).

6.8.1 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 2022.

The agricultural assessments completed in 2009 concurred with the agricultural suitability classes described in the EIS. Monitoring has confirmed that Longwalls 1 to 24A are stable. Tilts and strains have also remained unchanged over these 25 longwall panels. Agricultural assessments for the properties above these panels are unchanged from previous Annual Reviews and as such are removed from [Table 6-24](#). The properties situated above the current zone of subsidence in 2018 above Longwall 23-24A are highlighted in [Table 6-24](#) and have an agricultural classification ranging from three to five as defined above.

Table 6-24: 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
73	x	x	x	Biodynamic farming is practiced on the property including a small orchard.
80		x	x	
86	x			Farm - cattle, horses, pigs, emus, goats, lamas, alpacas.
203		x	x	Farm - cattle, horses, pigs, emus, goats, lamas, alpacas.
87	x	x		Farm - cattle, horses, pigs, emus, goats, lamas, alpacas.
88	x			Farm - cattle, horses, pigs, emus, goats, lamas, alpacas.
90	x			Cattle
221	x			
220	x			Horses
207	x			Horses
212	x	x		Farm - cattle, horses, pigs, emus, goats, lamas, alpacas
219	x	x		
Centennial 222	x		x	
213	x			Agistment
205			x	Horses
218	x			Orchards
223	x			Orchards

6.8.2 Assessment of Agricultural Suitability

Since commencing longwall mining operations, Mandalong Mine has fully extracted Longwalls 1 to 32. No additional subsidence was recorded above Longwalls 1 to 24A. As such the agricultural suitability following mining is as reported in previous Annual Reviews. 17 properties were influenced by subsidence movements on Longwalls 23 to 24A. Of these 17 as highlighted in **Table 6-24**, 13 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.

6.8.3 Agricultural Suitability Impact Assessment


Vertical subsidence levels over Longwalls 23 to 24A were generally between the maximum and up to 1.5 times the predicted maximum at a number of locations. The distribution of subsidence above Longwalls 23 to 24A indicates subsidence on the floodplain, where the majority of pasture areas are found, typically ranges up to 1.2 m. There is little evidence that these relatively low levels of subsidence have impacted on pasture condition.





A number of private and Centennial owned properties as described in **Table 6-24** 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 longwall panels in 2022.




Remnant ponding locations have been 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.


During 2022 remnant ponding rehabilitation works were completed on one private property and flood remediation works on one property. Post mining flood modelling (LW1-25) completed in 2021 along with observations confirmed that one creek crossing has been impacted by an increase in flooding hazard. Rehabilitation works are in progress to restore the serviceability of the creek crossing. **Table 6-25** provides a description of each ponding instance and what if any remediation was undertaken. The grey shaded rows highlight the remediation work conducted during 2022.


Table 6-25: Details of Ponding & Remedial Action





Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
Longwall 1 (P1)	Open grassland	No remediation required.	Negotiations with landowner finalised.	No	Yes	Completed	Ref. 6 2/557230
Longwall 2 (P2)	Open grassland	Drained	Constructed open drain and connected to nearby water course. 	Yes	Yes	Completed	Ref. 7, 8 1/557230 3/557230

Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
Longwall 3 (P3)	Open grassland	Drained	Constructed open drain and connected to nearby water course. 	Yes	Yes	Completed	Ref. 7 1/557230
Longwall 4 (P4)	Open grassland	Allowed to remain as a source of water for stock.		Yes	Yes	Completed	Ref. 7, 59 1//557230 580/733227
Longwall 5 (P5)	Open grassland	Drained	Constructed open drain and connected to nearby water course. Fenced to restrict stock access causing erosion. 	No	Yes	Completed	Ref. 59 580/733227
Longwall 6 (P6)	Open grassland	Drained	Installed sub-surface drainage and drainage to Stockton Creek. 	Yes	Yes	Completed	Ref. 56 12/582283




Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
Longwall 6 (P6A)	Open grassland	Drained	Improved existing open drainage to ponded area. 	No	Yes	Completed	Ref. 61 903/542306
Longwall 7 (P7)	Open grassland fringed with Cabbage Gums and <i>Melaleuca biconvexa</i> .	Drained	Open drain constructed and connected to nearby water course. Drainage designed to allow access across by farm machinery and stock. 	Yes	Yes	Completed	Ref. 56 12//582283
Longwall 7 (P7A)	Open grassland	Allowed to remain as extension of existing dam.	Extension of existing dam	Yes	Yes	Completed	Ref. 55 11/582283
Longwall 7 (P7B)	Open grassland		Regrade natural drainage line and open drain. 	No	Yes	Completed	Ref. 52 93/9632




Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
Longwall 8 (P8)	Expansion of an already wet area having scattered Swamp Mahogany and <i>Melaleuca biconvexa</i> .	Remain as expansion of existing freshwater wetland and fenced. Included in Wetland Monitoring Program as Wetland 9.	Following a period of monitoring and limited options for drainage, a decision was made to fence the wetland to protect from stock and allow to develop as a freshwater wetland. 	Yes	Yes	Completed	Ref. 55 11/582283
Longwall 8 (P8A)	Open grassland and <i>Melaleuca biconvexa</i> Existing wetland	Expansion of existing Wetland 8.	To remain as a wetland.	No	Yes	Completed	Ref.42 25/755238
Longwall 9 (P9)	Mixed Cabbage Gum and paperbark forest.	Remain as extension of existing freshwater wetland.	Several threatened <i>Melaleuca biconvexa</i> paperbarks are present and remediation would involve losses of these through gaining access by machinery. Consequently remediation was not undertaken.	Yes	Yes	Completed	Ref. 57 180/859434
Longwall 10 (P10)	Mixed Cabbage Gum and paperbark forest.	Remain as freshwater wetland.	Several threatened paperbarks <i>Melaleuca biconvexa</i> are present and remediation would involve losses of these through gaining access by machinery. Consequently remediation was not undertaken.	No	Yes	Completed	Ref. 57 180/859434





Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
Longwall 11 (P11)	Mixed paperbark woodland in an already periodically inundated area. Contains threatened <i>Melaleuca biconvexa</i> paperbarks. Ponding has extended an existing wetland.	Remain as freshwater wetland	To remain as a freshwater wetland.	Yes	Yes	Completed	Ref. 44 9/800491
Longwall 13 (P13)	Open grassland and Redgum Rough-barked Apple Forest	Minor increase in low lying area. No permanent ponding.	Existing ponding has been moved towards centre of longwall panel. 	No	Yes	Completed	Ref. 44 , 50 9/800491 10/800491
Longwall 13 (P13A)	Open grassland	Minor increase in low lying area. No permanent ponding.	No impact on grazing area.	Yes	Yes	Completed	Ref. 26 10/650914
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	Ref. 67, 69 16//813385 61/755238




Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
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	Constructed open drain and connected to nearby water course to return existing ponding to pre-mining levels. Quarterly ecology monitoring program completed. 	Yes	Yes	Completed	Ref. 69 61/755238
Longwall 16 (P16A)	Open grassland	Filled and drain installed to restore drainage due to increase in depth and extent of ponding.		Yes	Yes	Completed	Ref.33 861/835160
Longwall 17 (P17)	Freshwater Wetland Complex EEC and Redgum Rough-barked Apple Forest EEC	No remediation required.	Marginal increase in extent and depth of wetland as predicted. No predicted long-term impact on wetland. Wetland 4 & 5 in Wetland Management Plan – property sold and monitoring finished 	Yes	Yes	Completed	Ref. 68 22/812406
Longwall 17 (P17A)	Open grassland and Redgum Rough-barked Apple Forest EEC	Installed open drain and pipes to reduce slight increase in area and depth of existing ponding.		Yes	Yes	Completed	Ref. 70 54/755238


Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
Longwall 18 (P18)	Freshwater Wetland Complex EEC and Redgum Rough-barked Apple Forest EEC	No remediation required.	Marginal increase in extent and depth of wetland predicted. No predicted long-term impact on wetland. Wetland 4 & 5 in Wetland Management Plan. Property sold and monitoring finished	Yes	Yes	Completed	Ref. 68 22/812406
Longwall 18 (P18A)	Open grassland	Filled ponded area to restore pasture.		No	Yes	Completed	Ref. 70 54/755238
Longwall 18 (P18B)	Prickly Ridge Forest Road Hunter Valley Moist Forest Open grassland	Upgraded road and installed additional drainage lines.	Increase in length and depth of ponding along Prickly Ridge Forest Road was remediated and road upgraded as agreed by Forest Corporation NSW. 	Yes	Yes	Completed	Ref. 71, 37 45/1159229 46/755238
Longwall 18 (P18C)	Access road and open grassland	Raise access road, install pipes and regrade existing drain.		Yes	Yes	Completed	Ref. 70 54/755238
Longwall 18 (P18D)	Open grassland	Construct drain from dam overflow to the existing drain and regrade.		Yes	Yes	Completed	Ref. 70 54/755238
Longwall 18 (P18E)	Open grassland	Constructed dam at location of existing ponding site. Overflow constructed with open drain and pipes to creek.		Yes	Yes	Completed	Ref. 70 54/755238

Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
Longwall 18 (P18F)	Open grassland	Filled minor ponding with top soil.		No	Yes	Completed	Ref. 77 1/1063659
Longwall 19 (P19)	Farm dam and open grassland	No ponding occurred.	No ponding occurred due to LW18 and LW19 being shortened to protect property improvements.	Yes	No	Completed	Ref. 82 1/957458
Longwall 19 (P19A)	Open grassland and access road	Installed drainage to creek and upgraded access road.	Ponding against and along access road was remediated with sub-surface drainage. Upgraded access road. 	No	Yes	Completed	Ref. 82 1/957458
Longwall 19 (P19A)	Open grassland and access road	Upgraded access road with concrete driveway to withstand increased flooding impacts.	Flood modelling and observations determined increase in flood hazard along access road. 	No	Yes	Completed	Ref. 82 1/957458
Longwall 19 (P19B)	Open grassland and dam	No remediation required to minor increase in existing ponding near dam.		No	Yes	Completed	Ref. 82 1/957458
Longwall 19 (P19C)	Open grassland	Regraded existing drain to remove remnant ponding in paddock.		No	Yes	Completed	Ref. 70 54/755238

Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
Longwall 20 (P20)	Open grassland	Installed four pipes at existing ponding site and minor regrading of existing drainage line. Replace open drain with 350mm diameter pipes.		Yes	Yes	Completed	Ref. 82 1/957458
Longwall 21 (P21)	Open grassland and dam	Ponding did not occur. Constructed swale drain to restore dam catchment. Modify dam inlet and cleaned out sediment from dam.	Topography of dam catchment near centre of longwall affected. Constructed open drain to restore catchment 	Yes	Yes	Completed	Ref. 74 76/755238
Longwall 22 (P22)	Observation Point F Open grassland near creek	No evidence of ponding.	Photographic monitoring points established on chain pillars and centre of Longwall 22 and 23.	Yes	Yes	Completed	Ref. 73 93/755238
Longwall 22 (P22A)	Observation Point 'G' and 'N' Open grassland	Minimal change to ponding.	Predicted increase in existing ponding.	Yes	Yes	Completed	Ref. 85 4/957458
Longwall 22 (P22B)	Observation Point 'O' Channel and floodplain	Filled low lying area.	Predicted increase in existing ponding. Only observed during extended periods of wet weather.	Yes	Yes	Completed	Ref. 89 41/755238
Longwall 22 (P22C)	Open grassland and dam	Fill and construct drainage line to restore paddocks.	Construct table drain and fill low lying areas to provide access. Fill and construct access along boundary fence. 	Yes	Yes	Completed	Ref. 86 28/829792

Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
Longwall 23 (P23)	Observation Point E Dam	Construct new drainage system, fill areas, adjust dam overflow and upgrade pipe under access road	Increase in ponding between dam and raised access road. 	Yes	Yes	Completed.	Ref. 90 11/869483
Longwall 23 (P23A)	Paddock	Filled ponded area with topsoil		No	No	Completed	Ref. 220 3/168774
Longwall 23 (P23B)	Road reserve and driveway	Constructed new drainage lines, upgrade property access and filled ponded areas with topsoil.	Ponding along road reserve and property access road. 	No	Yes	Completed	Ref. 212 3/3039
Longwall 23 (P23C)	Open grassland and dam		Ponding and dam tilted. Remediation survey and design completed. Property sold, negotiation with new landowners.	No	Yes	Completed.	Ref. 221 11/869483
Longwall 23 (P23D)	Open grassland and dam	Filled low lying area near front boundary.	Ponding and dam tilted. Remediation survey and design completed. Property sold, negotiation with new landowners.	No	Yes	Completed.	Ref. 221 11/869483
Longwall 24 (P24)	Observation Point 'K' Trotting track	Constructed new drainage system around track and resurface affected sections. Upgrade dams and catchment.	Affected existing drainage around entire trotting track. Affected dams and catchment 	Yes	Yes	Completed	Ref. 213 2/755238

Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
Longwall 24 (P24A)	Observation Point L Open grassland and dam	Reinstate dam overflow, fill areas, install new drainage lines and upgrade access road.	Increase in ponding on floodplain and dam. 	Yes	Yes	Completed	Ref. 219 4/168774
Longwall 24 (P24B)	Observation Point 'M' Morans Creek		Potential increase in ponding along drainage line near Chapman Rd.	Yes	No	Monitoring	Ref. 218 17/755238
Longwall 24 (P24C)	Paddock and drainage line.	Refilled ponded area and minor adjustment to existing drain grades. Access Road repairs.	Increased ponding in paddock adjacent Mandalong Rd. 	Yes	Yes	Monitoring Reviewing post-mining flood modelling results completed in January 2021.	Ref. 220 3/168774
Longwall 24	Morans Creek Crossing		Increase in flooding at a 1-year event. Investigation works and design for remediation to bridge and approaches. 	No	No	In progress. Flood modelling and Geotech completed. Design for replacement culvert or bridge in progress. Currently preparing DA for submission.	Ref. 220 3/168774
Longwall 24A P24AA	Dam	Raised dam overflow point to restore capacity. Constructed new dam and upgrade access track.	Tilted dam and reduced capacity.	Yes	Yes	Completed	Ref. 212 3/3039

Remnant Ponding and Flooding Remediation							
Location	Description	Remediation	Remediation Comments	Ponding Predicted	Subsidence Completed	Status	Property Ref. Lot & DP
Longwall 24A P24AB	Trotting Track	Constructed new drainage system and restored dams and catchment.	Alteration of drainage system around track. Loss of catchment to horse swimming dam.	Yes	Yes	Completed	Ref. 213 7/755238
Longwall 24A (P24AC)	Dam	Dam resealed.	Opening of sandstone joints in the base of the dam.	No	Yes	Completed	Ref. 214 198/727714
Longwall 24A (P24AD)	Open grassland and access road.	Drainage remediation designs completed.	Ponding and poor drainage at property access road, parking area and garage. Detail survey and design completed. Negotiating with landowner.	No	Yes	Compensation offer provided to landholder in 2020.	Ref. 223 17/755238
Longwall 26B	Dam	One dam completed.	Repair three leaking dams. Repairs require the removal of several trees within dam walls and lowering of spillway.	No	Yes	SA NSW claim determined. Completed	Ref. MS0012 131/755238
Longwall 26B	Creek crossing	Upgrade pipes in creek crossing and access road.	Water backing-up due to small existing pipe in creek crossing. Replace pipes with appropriate size. 	Yes	Yes	Completed	Ref. MS0029 29/755238
Longwall 31	Dam	Compensation	N/A	No	Yes	Negotiation	Ref. MS0107 3/805044

Note: The rows shaded grey indicates the remediation works conducted during 2022.

6.9 FLOODPATH MONITORING

The condition of flood paths and stream channels are discussed in the Mandalong Mine “*Floodpath Condition Report 2022*” (Centennial Mandalong, 2023a) in [Appendix 2](#). DA97/800 and the LW25-29, LW30-31 and LW32 Extraction Plan – Water Management Plans require the condition of major flood paths be inspected every six months or following a flood event. This Floodpath Condition Report for 2022 has been developed to compile survey and photographic records of subsidence induced changes to Morans Creek and Byrons Gully as per the assessment methodology in [Appendix 2](#).

[Appendix 2](#) assesses the changes to the condition of flood paths along stream reaches undermined by Longwalls 25 to 32 in 2019, 2020, 2021 and 2022 and previously subsided

Longwall 23, 24 and 24A in 2018 and longwall panels 15 to 22, identifying the effects of subsidence on the flood paths.

On the basis of the information obtained from field surveys, the pre mining characteristics of Morans Creek and Tobins 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 and Tobins Creek over Longwalls 23, 24 and 24A and also Byrons Gully over LW25 to 29 are of a similar order of magnitude to the existing creek bed slopes. The levels of predicted subsidence along Morans Creek and Tobins Creek are relatively small over Longwalls 23, 24 and 24A and LW25 to 29 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.

7 WATER MANAGEMENT

7.1 WATER EXTRACTION

Mandalong Mine holds a water access licence (WAL39767) permitting the extraction of groundwater from the coal measures encountered during the process of mining. This water access licence permits the Mine to dewater the underground coal measures via a submersible dewatering pump located at Cooranbong. The WAL entitles the Mine to extract 1825 ML of groundwater annually for the period 1 July to 30 June from North Coast Fractured and Porous Rock Groundwater Sources. This mine water is subsequently discharged at LDP001.

Mandalong Mine extracted a total volume of 450ML of ground water during the annual period 1 July 2021 to 30 June 2022. There are no other conditions on the Water Access Licence.

The passive take inflow (groundwater make) for the 2022 report period was calculated to be 259ML (GHD, 2023b) which is an increase on the 230 ML for 2021 report period (GHD, 2022a).

Table 7-1: Water Take

License #	Water Sharing Plan, source and management zone (as applicable)	Entitlement	Passive take / inflows	Active pumping	TOTAL (1 July to 30 June).
WAL39767	North Coast Fractured and Porous Rock Groundwater Sources	1825 ML	259 ML	450 ML	214 ML

7.2 SURFACE WATER MONITORING

7.2.1 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 licenced discharge points LDP001 and 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 CM00315b**, **Plan CM00315C**, **Plan CM00315d**, and **Plan CM00315f** and are summarised below in **Table 7-3**.

Mandalong Mine currently holds EPL 365, with water licensed to be discharged from the CES, MMAS and MSSS through the following LDPs:

- g) LDP001 – Located at the CES and discharges into an unnamed tributary of Muddy Lake.
- h) LDP002 – Located at the CES 5 ML Dam and discharges into an unnamed tributary of Muddy Lake.
- i) LDP003 – Located at the MMAS Sediment Dam.
- j) LDP004 – Located at the MSSS Sediment Dam.

Water volume discharged off site is measured through licence discharge points (LDPs). Environmental Protection Licence 365 limits the maximum volume of water to be discharged at LDP001 to 5000 Kilolitres per day (note: Condition L3.2 of EPL365 permits the volume limit to be exceeded if a rainfall event greater than 10 mm occurred in the prior 24 hours).

The following water quality parameters pH, Total Suspended Solids (TSS mg/L), Electrical Conductivity (EC µs/cm) and Oil and Grease (mg/L) are monitored at Licenced Discharge Point LDP001, LDP003 and LDP004 daily during discharge and LDP002 is monitored weekly

during discharge in accordance with the requirements of Environmental Protection Licence 365.

An EPL365 water quality limit criterion for LDP001, LDP002, LDP003 and LDP004 is provided in **Table 7-2**.

Table 7-2 LDP Limit Criteria

Pollutant	Units of measure	100 percentile limit
Oil & Grease	mg/L	10
pH	pH	6.5-8.5
Total Suspended Solids	mg/L	50

7.2.2 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 2022 to assess the effectiveness of water treatment prior to controlled releases.

7.2.3 Surface Water Monitoring Results

Surface water quality is monitored at 22 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 average and long-term average (LTA) results are summarised in **Table 7-4**.

Table 7-3: Summary of Monitoring Locations with Respect to Position within the Catchments

Location Reference	Creek Sub-catchment
SW008	Upper Stockton Creek
SW004	Mid Stockton Creek
SW012	Lower Stockton Creek
SW011	Upper Morans Creek
SW003	Mid Morans Creek
SW006	Lower Morans Creek
SW002	At confluence of Morans Creek and Stockton Creek
SW001	Downstream confluence on Stockton Creek
SW009	South Pourmalong Creek
SW010	North Pourmalong Creek
SWMP01	Mannering Creek within Olney State Forest
SWMP02	Mannering Creek at Hue Hue Road
SWMP03	Wyee Creek at Wyee Farms Road
SWMP04	Wyee Creek at Wyee Farms Road Bridge
SWMP05	Wyee Creek at junction of Schofield Road and Manhire Road
SWMP06	Morans Creek at Mandalong Road
SWMP07	Upper catchment of Morans Creek
SW13	Muddy Lake (Unnamed tributary upstream LDP001).
SW14	Muddy Lake (Unnamed tributary upstream LDP002).
SW15	Muddy Lake (Unnamed tributary upstream LDP002).
SW16	Muddy Lake (Unnamed water body 1km downstream Simpson Rd Causeway Crossing)
SW17	Muddy Lake (North Dora Creek Village)

Table 7-4: Average Surface Water Quality for the 12 month Period from January 2022 to December 2022 ('Annual') and the Long-term Average ('LTA').

Site Location	Catchment	pH		TSS		Specific Conductance uS/cm	
		Average	LTA	Average	LTA	Average	LTA
SW008	Stockton	6.84	6.96	16.00	24.12	820	887.25
SW004		6.86	6.83	22.00	15.60	565.75	618.44
SW012		6.79	6.56	8.75	20.02	613.75	1137.875
SW011	Moran's	6.58	6.61	14.00	23.86	378.00	576.395
SW006		6.51	6.48	18.00	24.68	372.00	413.215
SW003		6.40	6.38	9.75	21.86	324.75	437.043
SWMP06		6.51	6.40	24.00	40.95	701.25	705.684
SWMP07		6.83	6.68	12.5	15.56	614	564.049
SW002	Stockton & Moran's Creek (Confluence)	6.62	6.82	14.5	11.17	269.0	11028.41
SW001		6.92	7.06	15.0	11.52	17800	26670.19
SW009	Pourmalong	6.69	6.63	13.75	17.39	403.25	322.062
SW010		6.40	6.19	8.75	28.95	724	660.946
SWMP01	Mannering Creek	6.60	6.67	14.0	5.22	589.75	464.727
SWMP02		6.50	6.54	32	16.24	579.4	454.442
SWMP03	Wyee Creek	6.66	6.62	22.67	22.21	427.5	408.171
SWMP04		6.58	6.72	13.25	13.375	786	591.787
SWMP05		6.24	6.53	15.5	24.53	531.75	393.322
SW013	Muddy Lake	7.70	7.05	2.17	7.65	2766	3289.207
SW014		6.26	6.76	14.92	17.05	859	757.756
SW015		5.41	5.63	140.0	115.52	75.92	79.06
SW016		7.89	8.26	24.4	496.29	1801.6	3248.89
SW017		6.71	8.10	103.67	29.82	765.417	2705.343

7.2.4 Surface Water Discharge Monitoring

The maximum daily volume discharged from LDP001 was 3814kL. There was no exceedance of the discharge volume limit of 5000kL per day. The total volume of water discharged from

LDP001 for the 2022 reporting period was 464ML. The average daily discharge volume was 127kL.

Table 7-5: LDP001 Discharge Volume

Frequency	No. of measurements made	Lowest result (kL)	Mean result (kL)	High result (kL)
Daily during any discharge	365	0	127	3814

There were no exceedances of the water quality limits at LDP001 for the reporting period. During the reporting period one hundred and ninety three LDP001 samples were analysed. The maximum recording for oil and grease was 4mg/L, total suspended solids was 14mg/L and pH ranged from 7.58 to 8.25. The average annual results at LDP001 are summarised in **Table 7-6**.

Table 7-6: Water Quality LDP001

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of samples	Highest sample value
Oil & Grease	milligrams per litre	182	193	0	0.186	4.0
pH	pH	182	193	7.58	7.73	8.25
Total suspended solids	milligrams per litre	182	193	0	1.787	14.0

There were no exceedances of the water quality limits at LDP002 for the reporting period. During the report period three LDP002 samples were analysed. The maximum recording for oil and grease was 2.0mg/L, total suspended solids was 26mg/L and pH 7.04. The average annual results at LDP002 are summarised in **Table 7-7**.

Table 7-7: Water Quality LDP002

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of samples	Highest sample value
Oil & Grease	milligrams per litre	3	3	0	0.667	2.0
pH	pH	3	3	6.86	7.04	7.15
Total suspended solids	milligrams per litre	3	3	12.0	17.0	26.0

There were two exceedances of the total suspended solids limit at LDP003 during the reporting period. There were no exceedances oil and grease and pH limits at LDP003 for the reporting

period. During the reporting period two LDP003 samples were analysed. The maximum recording for oil and grease was 6mg/L, total suspended solids was 104mg/L and the pH was 8.09. The average annual results at LDP003 are summarised in **Table 7-8**. The details of the non-compliances are provided in **Section 11**.

Table 7-8: Water Quality LDP003

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of samples	Highest sample value
Oil & Grease	milligrams per litre	2	2	4.0	5.0	6.0
pH	pH	2	2	7.97	8.09	8.20
Total suspended solids	milligrams per litre	2	2	74	90	104

There were two exceedances of the water quality limits at LDP004 for the reporting period. There were two exceedances of total suspended solids criteria. During the reporting period two LDP004 samples were analysed. The maximum recording for oil and grease was 0mg/L, total suspended solids was 208mg/L and pH ranged from 8.04 to 8.18. The average annual results at LDP004 are summarised in **Table 7-9**.

Table 7-9: Water Quality LDP004

Pollutant	Unit of Measure	No of samples required by licence	No. of samples collected and analysed	Lowest sample value	Mean of samples	Highest sample value
Oil & Grease	milligrams per litre	3	2	0	0	0
pH	pH	3	2	8.04	8.18	8.31
Total suspended solids	milligrams per litre	3	2	120	164	208

Table 7-10 LDP Annual Average and Long-Term Average

Site Location	pH		TSS		Oil Grease	
	Average	LTA	Average	LTA	Average	LTA
LDP001	7.73	7.83	1.79	1.96	0.19	0.15
LDP002	7.04	6.97	17.0	29.81	0.67	0.13
LDP003	8.09	7.55	90.0	71.91	5.0	2.18
LDP004	8.17	7.64	164.0	45.01	0	0.05

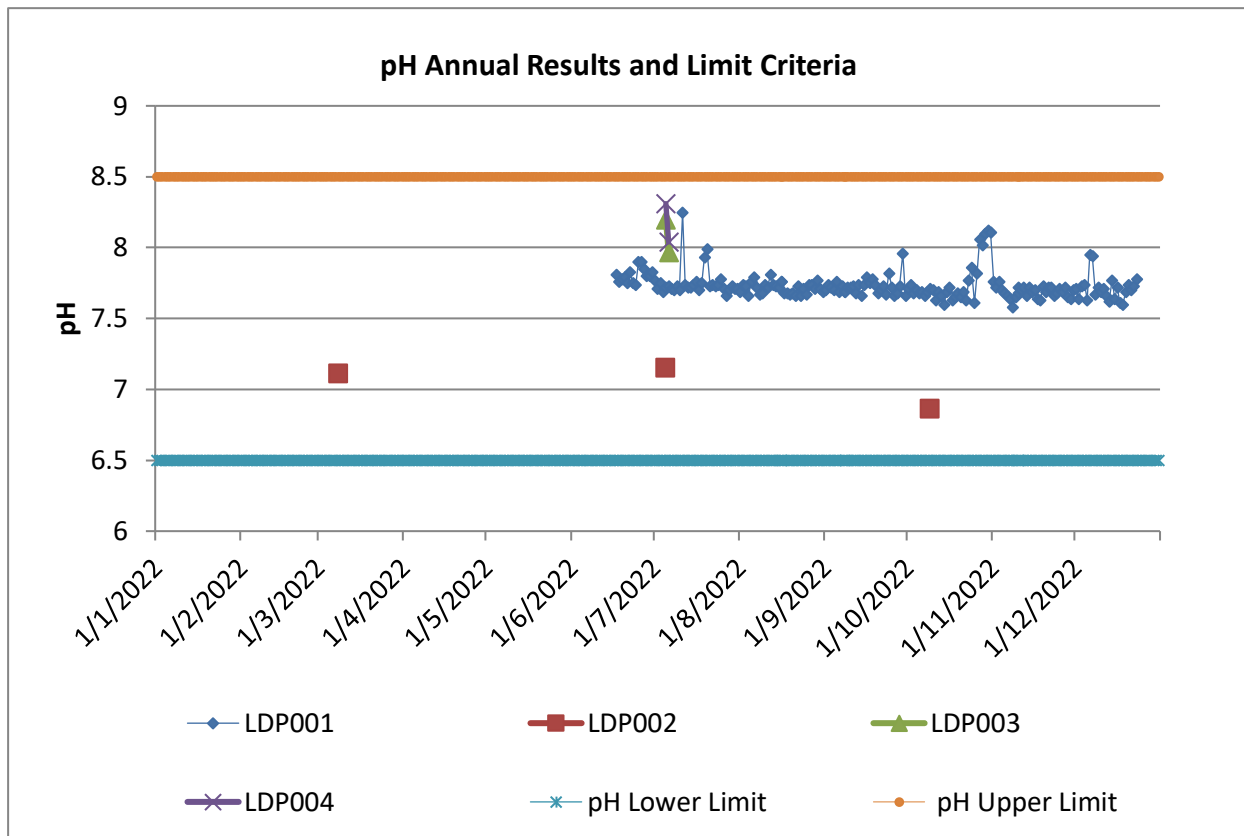


Figure 7-1 Annual pH Monitoring Results and Limit Criteria

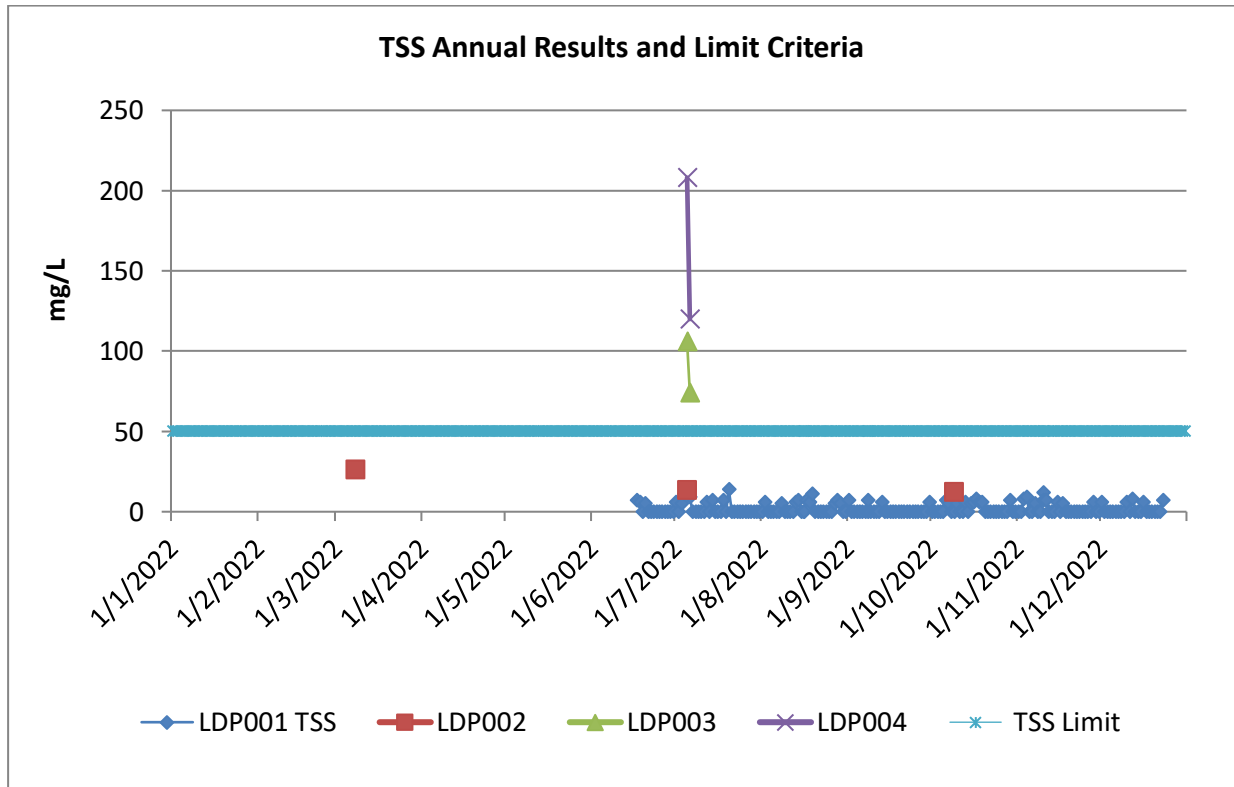


Figure 7-2 Annual TSS Monitoring Results and Limit Criteria

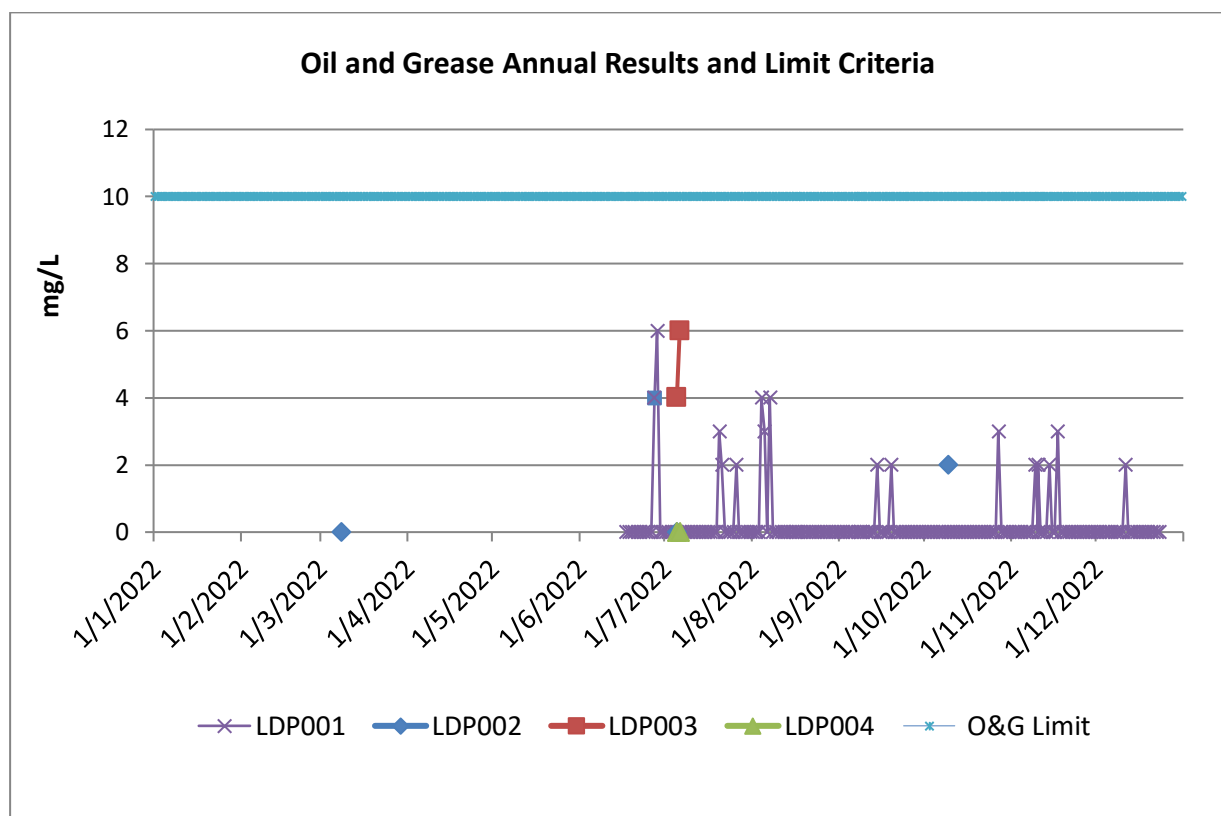


Figure 7-3 Annual Oil & Grease Monitoring Results and Limit Criteria

7.2.5 Data Interpretation

The results presented in **Table 7-4** are characteristic of the natural conditions of the area, particularly for Stockton, Moran's, Mannering & Wyee Creeks. Both Stockton and Morans Creek are the main drainage systems for the Mandalong area. Stockton Creek is located within the longwall mining area (LW1-16) and Morans Creek is also located within the current longwall mining area (LW15-34). Both Mannering and Wyee Creek are located within the Mandalong Southern Extension Area (future longwall mining).

7.2.5.1 Mandalong and Mandalong South Surface Site

Surface waters are tested for pH, TSS and EC and the annual and LTA results are summarised in **Table 7-4**. The Cooranbong Entry Site monitoring sites SW13, SW14, SW15, SW16 and SW17 were sampled monthly. The monitoring sites SW001, SW002, SW003, SW004, SW006, SW008, SW009, SW010, SW011, SW012, and SW018 were sampled quarterly during the reporting period. The Mandalong Southern Extension monitoring sites SWMP01, SWMP02, SWMP03, SWMP04, SWMP05, SWMP06, SWMP07 and SWMP08 were also sampled quarterly during the reporting period.

The EC (salt content) for the 2022 period shows a relatively consistent level compared with the long-term average for many sites.

The annual average TSS for 2022 are relatively low and are characteristic of natural surface water conditions in creeks. All sites had a 2022 annual average that was similar to the LTA. The highest annual average TSS for 2022 was recorded at 140 mg/L at SW015. The annual average was similar to the LTA (115.52mg/L).

All monitoring points recorded a pH annual average similar to the LTA. SW015 had the lowest pH annual average of 5.41 in 2022. The highest pH annual average during 2022 was 7.89 recorded at SW016.

7.2.5.2 Surface Water Discharge Trends

The water quality results for LDP001 and LDP002 (**Table 7-10**) show the 2022 annual averages for pH, TSS and oil & grease are similar to the long term averages. LDP003 and LDP004 have limited data for LTA to compare against. LDP001 has a consistent discharge water quality in early 2022 as can be seen from **Figure 7-1**, **Figure 7-2** and **Figure 7-3**. The water quality results for LDP001 shows little variation. LDP002, LDP003 and LDP004 discharges occur as a result of high rainfall events and have greater variability.

7.2.5.3 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 EPL limits prior to discharge. Prior to discharge the sediment control dams were treated by adding a flocculent to the water to remove suspended solids. The water quality of 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.

7.3 WATER BALANCE

The 2022 water balance analysis was prepared by GHD (GHD, 2023a) in the report titled “*Mandalong Mine 2022 Annual Water Balance*”. The water balance for 2022 is shown in **Table 7-11**. 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.

7.3.1 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 pipelines 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 2022 was 485 ML. A total of 420 ML was supplied via the Cooranbong Entry Site and Mandalong Mine Site to underground equipment. A total of 18.2ML was used on the surface within the Cooranbong CHP and bathhouse, 11.7 ML in the Mandalong Mine bathhouse and 10.7 ML for Mandalong Mine Surface operations.

The total potable water usage (485ML) for 2022 is similar to the water usage in 2021 (493 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.

GHD’s (2023a) water balance model reports 675 ML was discharged in the 2022 report period from the Mandalong Mine, Mandalong South Surface Site, Cooranbong Entry Site and the Delta Entry Site. The volume of water discharged for the Cooranbong Entry Site at LDP001 is 464 ML, at LDP002 is 16ML and the Construction Dam (clean water dam) is 67 ML. 125 ML of surface water run-off water was discharged from Delta Entry Site dams. 3 ML was discharged from LDP004 at the Mandalong South Surface Site and 0 ML from LDP003 at the Mandalong Mine.

Table 7-11: 2022 Summary of Water Inputs and Outputs

Element	2022 (simulated) (ML/year)
INPUTS	
Direct rainfall onto water storages	39
Catchment runoff	455
Potable water supply	485
Groundwater inflows	259
TOTAL INPUTS (rounded)	1238
OUTPUTS	
Evaporation	23
Sewage to HWC	12
Discharge through LDP001 (Cooranbong Entry Site)	464
Discharge through LDP002 (Cooranbong Entry Site)	16
Discharge from Construction Dam (Cooranbong Entry Site)	67
Discharge from LDP003 (Mandalong Mine Access Site)	0
Discharge from Delta Entry Site	125
Discharge from LDP004 (Mandalong South Surface Site)	3
Extracted ROM coal moisture	83
TOTAL OUTPUTS (rounded)	793
CHANGE IN STORAGE	
Cooranbong Underground Storage	447
Surface water storages	-2
TOTAL CHANGE IN STORAGE (rounded)	445
BALANCE	
Inputs – outputs – change in storage	0.0

7.3.2 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 M1 Motorway 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) and a sediment control dam. Water from the sediment control dam is used pumped into the Mandalong Mine underground workings. 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.

7.3.3 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 wastewater.

Dirty water contaminated with coal fines from the CHP, conveyor gantries and ROM stockpile is directed to dedicated sediment control sumps to remove coarse 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).

7.3.4 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 and the decline settling pond prior to discharge into the large 9 ML settlings ponds.

7.3.5 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 six 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.

7.3.6 Mine Water Management

7.3.6.1 Mandalong Mine

Water from the active underground mining area is pumped to a temporary settling area to reduce suspended solids. All water is then pumped to a goaf area (Cooranbong underground longwall void) 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.

7.3.6.2 Delta Site

No mine water is discharged from the Delta Entry Site, as in-seam water from the Delta underground headings and decline tunnel is pumped to the existing Mandalong Mine water system.

7.4 GROUNDWATER MANAGEMENT

7.4.1 Mandalong Mine

An annual review of the groundwater monitoring results was undertaken by GHD titled “*Centennial Mandalong Annual Groundwater Monitoring Review 2022*” (GHD, 2023a). 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 network consists of standpipe monitoring bores installed in alluvial and fractured rock groundwater sources. Locations were monitored monthly for groundwater level and limited water quality parameters (electrical conductivity and pH).

Details of the groundwater monitoring bores in the current groundwater monitoring program are summarised in .

Table 7-12. The location of the groundwater monitoring bores is shown in **Figure 7-4** (GHD, 2023a).

Table 7-12: Groundwater Monitoring Bore Details

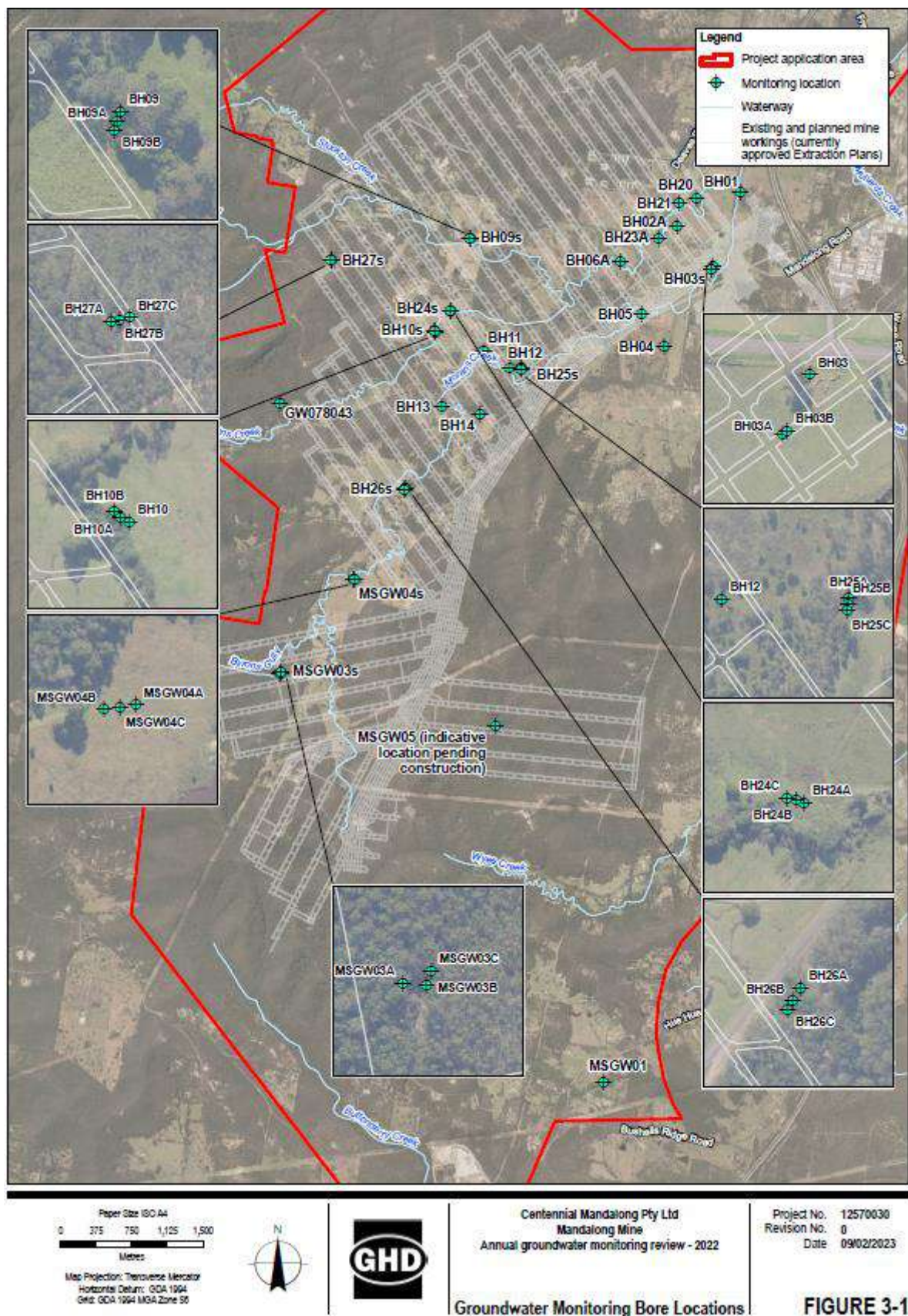
Bore	Monitoring Period	Lithology	Longwall Area
BH01	Aug 1997 – present	Alluvium	–
BH02A	Oct 2005 – present	Sandstone	LW3
BH03	Aug 1997 – present	Alluvium	–
BH03A	Nov 2005 – present	Alluvium	–
BH03B	Dec 2005 – present	Sandstone	–
BH04	Aug 1997 – present	Alluvium	–
BH05	Aug 1997 – present	Alluvium	–
BH06A	Nov 2005 – present	Sandstone	LW7
BH09	Aug 1997 – present	Alluvium	LW12
BH09A	Jun 2010 – present	Mudstone/sandstone	LW12
BH09B	July 2010 – present	Mudstone/sandstone	LW12
BH10	Aug 1997 – present	Alluvium	LW16
BH10A	Jun 2010 – present	Mudstone/sandstone	LW16
BH10B	Jun 2010 – present	Sandstone	LW16
BH11	Aug 1997 – present	Alluvium	LW15
BH12	Aug 1997 – present	Alluvium	LW14/15
BH13	Aug 1997 – present	Alluvium	LW18
BH14	Aug 1997 – present	Alluvium	LW17
BH20	Dec 2003 – present	Conglomerate	LW1

Bore	Monitoring Period	Lithology	Longwall Area
BH21	Dec 2003 –present	Conglomerate	LW2
BH23A	Jan 2006 – present	Mudstone	LW4/5
BH24A	Jun 2010 – present	Alluvium	LW15
BH24B	Jun 2010 – present	Sandstone	LW15
BH24C	Jun 2010 – present	Mudstone/sandstone	LW15
BH25A	Jun 2010 – present	Alluvium	LW14
BH25B	Jun 2010 – present	Sandstone	LW14
BH25C	Jun 2010 – present	Mudstone/sandstone	LW14
BH26A	Oct 2011 – present	Alluvium	LW22
BH26B	Oct 2011 – present	Sandstone	LW22
BH27A	Oct 2011 – present	Alluvium	LW18/19
BH27B	Oct 2011 – present	Sandstone	LW18/19
MSGW01	September 2011 – present	Alluvium	-
MSGW03A	September 2011 – present	Morans Creek alluvium	LW26
MSGW03B	September 2011 – present	Sandstone (Tuggerah)	LW26
MSGW03C	Sept 2011 – present	Conglomerate (Munmorah)	LW26
MSGW04A	Sept 2011 – present	Morans Creek alluvium	-
MSGW04B	Sept 2011 - present	Sandstone (Tuggerah)	-
MSGW04C	Sept 2011 – present	Conglomerate (Munmorah)	-
GW078043	August 2017 – present	Sandstone/Conglomerate	-

Source: (GHD, 2023a).

7.4.2 Delta Entry Site

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, in-seam groundwater make is minimal and is pumped via the existing in-seam dewatering system to the Cooranbong longwall void area and discharged via LDP001 at the Cooranbong Entry Site.



Source: (GHD, 2023a)

Figure 7-4: Mandalong Mine Groundwater Monitoring Locations.

7.4.3 Groundwater Levels

7.4.3.1 Alluvial Groundwater Sources

BH03A, BH04, BH11, BH14, BH25A, BH26A, MSGW01 and MSGW04A all have a small but statistically unreliable time trends. This is consistent with 2021 records for the same locations, apart from BH04 and BH14. All exhibit a similar trend where water levels were lower than predicted by HARTT during 2018 and 2019, and continuing decreasing trends with rainfall as would be predicted by HARTT in 2020 and 2021. For BH25A, the rainfall coefficient is slightly higher than typical and the time trend slightly lower. This variation in groundwater level at BH25A has potentially attributed to the development of shallow tensile and compressive cracks resulting in localised increases in hydraulic conductivity and porosity (GHD, 2022b). It is expected that such voids will fill over time and the hydraulic conductivity and porosity will return to pre-mining values, consistent with the behaviour previously observed at BH22A, and now also in the rising levels at BH24A. Groundwater levels at all these monitoring locations have recovered in line with above average rainfall during 2022 (GHD, 2023a).

BH24A demonstrates a recovering trend since 2014. Groundwater levels fell after undermining at BH24A from approximately 16.8 m AHD in January 2014 to 14.8 m AHD in August 2014. Recovery was observed from June 2015, with groundwater levels recorded at 16.8 m AHD in December 2022. MSGW03A is frequently dry due to shallower alluvium in the upper reaches of Morans Creek and therefore does not reflect the full range of rainfall response (GHD, 2023a).

Trigger values for alluvial groundwater levels have been defined in the Water Management Plan. There were no trigger levels exceedances recorded in 2022.

7.4.3.2 Fractured and porous rock aquifers

At the time of the assessment completed by GHD (2023a) all deeper monitoring bores had been directly undermined by longwall panels. These bores are screened within Triassic sandstone and conglomerate.

Monitoring wells BH02A, BH03B, BH06A, BH09A, BH09B, BH10A, BH10B, BH23A, BH24B, BH24C, BH25B, BH25C and BH27B are screened within the sandstone and siltstone of the Tuggerah Formation approximately 120 m to 230 m above the coal seam. A consistent drop in groundwater pressure at most of these locations has been observed post undermining. The gradual drop in groundwater pressure suggests that discontinuous fractures have developed in the rock overlying the mine workings at these locations, consistent with EIS predictions. Most locations (excepting BH27B) have had levels re-stabilise or have shown slight increases towards pre-mining levels three to five years post-undermining (GHD, 2023a).

Monitoring wells BH20, BH21 and BH27C are screened within the Munmorah Conglomerate, underlying the sandstone of the Tuggerah Formation. BH20 and BH21 have recorded stable groundwater elevations over the monitoring period fluctuating minimally between -44.4 m AHD and -46.1 m AHD. Groundwater levels at BH27C showed a decreasing pre-mining trend including a sudden drop in levels in November 2014 related to purging and sampling. BH27C was undermined in July 2015, resulting in the well becoming dry. Continued monitoring at this location has been prevented due to shortening of the well (originally 165 m BGL, now registering a depth of 125 m BGL). Most likely post-mining movement of the strata has caused damage, compressing the well. Movement of strata may explain the temporary increase in groundwater level at adjacent well BH27B following undermining.

Groundwater levels decreased thereafter until late 2020 where a significant increase in water level was recorded. The water sources monitored by these wells are approximately 100 m to 170 m above the coal seam (GHD, 2023a).

The Water Management Plan details trigger levels for alluvial well installations and only some porous and fractured rock wells as water pressure was expected to drop below the depth of most porous and fractured rock wells. This expectation was based on modelling presented in GHD (2016b) that predicted the drying of wells within 230 m vertical distance of the mine workings.

No trigger value for MSGW04B have been developed based on a continually decreasing trend since monitoring commenced and the absence of stable criteria. Current levels at MSGW04B are already below the model predicted minimum. BH26B previously showed a decreasing trend however since 2018 an increasing trend has emerged, with current levels remain above the trigger value. In mid-2019, MSGW03C was dry, consistent with model predictions, however, successful groundwater level gauging in December 2022 gave evidence of recovery. Groundwater levels at MSGW03B fell below the trigger value (based on model predictions) for the first time in December 2020 but recovered above the trigger soon after in the first quarter of 2021. No trigger exceedance has been recorded at MSGW03B in 2022 (GHD, 2023a).

7.4.4 Groundwater Quality

7.4.4.1 Alluvial Groundwater Sources

Alluvial groundwater records show wide ranging pH levels (5 to 8 pH units) although most records fall within 6 to 7 pH units. Electrical conductivity (EC) also ranges widely from fresh (<1000 µS/cm) to saline (over 10,000 µS/cm).

Prior to 2015, bailing sampling methods were used, resulting in variability in alluvial groundwater salinity that was considered unrelated to mining activity (AGE 2014). However, since January 2015, alluvial groundwater monitoring locations have been sampled by low flow techniques (i.e., peristaltic pump) with purging continuing until pH and EC parameters show stabilisation. Consequently, variability within individual location datasets has generally reduced, however different locations continue to range from fresh to saline conditions (GHD, 2023a).

Site specific trigger values for groundwater quality are presented in Table 5-2 reproduced from the relevant LW24-24A Extraction Plan WMP (GHD, 2018b).

The following Stage 1 trigger exceedances were identified in 2022:

- EC at BH26A - three consecutive exceedances of the 20/80th percentile trigger in December 2022. A short-term trend is apparent over 2022, however the EC remains with the historical range.

Overall, there were no trends of concern identified during 2022 that may result in a change in the beneficial use category of groundwater (GHD, 2023a).

7.4.4.2 Fractured and porous rock groundwater sources

Rock aquifer groundwater is generally characterised by a pH ranging neutral to slightly alkaline (7 to 8 pH units). EC values generally ranged from brackish to saline (6,000 to 10,000 $\mu\text{S}/\text{cm}$), consistent with the low potential for beneficial use of groundwater near Mandalong Mine.

Site specific trigger values for groundwater quality were updated in the draft LW57-60 Extraction Plan - Water Management Plan for BH26B, MSGW03B, and MSGW04B. The following Stage 1 trigger exceedances were identified in 2022:

- pH at MSGW03B - on three occasions, due to three consecutive exceedances of the 20th percentile trigger at MSGW03B in the last three quarters. Based on visual analysis, the pH trend at MSGW03B is decreasing and currently sits slightly below the historical range. Similar trend was observed at MSGW04B during 2018-2019, however pH has since stabilised.
- pH at BH26B – on one occasion of the 0th percentile trigger, in December 2022. This result appears to be an outlier contrasting the long-term trend. Such anomaly may be attributable to sampling error and will be confirmed following the first monitoring event of 2023.
- pH at MSGW04B – on one occasion of the 0th percentile trigger, in the fourth quarter. This result also appears to be an outlier contrasting the long-term trend. Such anomaly may be attributable to sampling error and will be confirmed following the first monitoring event of 2023.

Overall, there were no trends of concern identified during 2022 that may result in a change in the beneficial use category of groundwater (GHD, 2023a).

8 ANNUAL REHABILITATION REPORT

In 2022 a Rehabilitation Management Plan (RMP) was prepared in accordance with the Mining Exploration and Geoscience – Resources Regulator’s (RR) Form and Way: Rehabilitation Management Plan for Large Mines (RR, 2021). The RMP WAS also prepared to satisfy Schedule 3, Condition 33A of SSD 5144 which requires Mandalong to prepare and implement a Rehabilitation Management Plan in accordance with the conditions imposed on mining leases associated with the mine under the NSW Mining Act 1992.

As described in the RMP, the conceptual long term mine rehabilitation objective is to provide a low maintenance, geotechnically stable and safe landform. 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;
- 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 company and regulatory policies and guidelines.

Post-mining land use options for Mandalong (MMAS and MSSS) were assessed in the Mandalong Southern Extension Project Decommissioning and Rehabilitation Strategy which was prepared for the Mandalong Southern Extension Project EIS (SLR, 2013). Post-mining land use options for the CES were assessed in the Northern Coal Logistics Project Decommissioning and Rehabilitation (SLR, 2014) which was prepared for the Northern Coal Logistics Project EIS.

It is intended to re-develop the MMAS and CES for an industrial based land use(s). The option of leaving this infrastructure in the final landform will be discussed in consultation with RR and after discussions with potential buyers have been held.

The intended post-mining land use for the MSSS is native bushland and pasture commensurate with the pre-mining conditions.

Post-mining land use for the DES will be addressed in consultation with Delta Electricity with the intended post-mining land use being native bushland commensurate with adjacent vegetation.

As Mandalong is an underground mine, the majority of the Colliery Holding will not be disturbed. The exception to this might be areas impacted by subsidence which will be addressed and managed on an ongoing basis in accordance with an approved SMP or Extraction Plan.

8.1 PROGRESSIVE REHABILITATION AND COMPLETION

Since the Mandalong Mine is an underground mine, the relatively small disturbance footprint associated with surface infrastructure means that there are limited opportunities for progressive rehabilitation. To what extent is appropriate, rehabilitation will be undertaken progressively on areas that cease to be used for mining or mining related activities as soon as is reasonably practicable.

Forecast rehabilitation activities include:

- Maintenance and monitoring of rehabilitated areas that were disturbed during the construction of the MSSS and access road;
- Progressive rehabilitation of exploration and/or groundwater monitoring sites;

- Rehabilitation of areas affected by subsidence, as required, in accordance with an approved SMP or Extraction Plan;
- Maintenance and monitoring of the VAM-RAB offset area which was established in 2012 at the Mandalong Mine;
- Maintenance and monitoring of the MSSS and TL24 offset areas; and
- Maintenance and monitoring of areas of existing rehabilitation.

A summary of the current disturbance and rehabilitation status at the end of the annual reporting period is provided in **Table 8-1**.

Table 8-1: Status of disturbance and rehabilitation at end of reporting period

Annual reporting period	1 January 2022 to 31 December 2022
Total disturbance footprint – surface Disturbance	43.89
Underground mining area (hectares)	0
Total active disturbance (hectares)	39.15
Rehabilitation – land preparation (hectares)	0
Ecosystem and land use establishment (hectares)	4.29
Ecosystem and land use development (hectares)	0 (ecosystem and land use development) 24.81 (retained infrastructure)
Rehabilitation completion (hectares)	0

8.2 MANDALONG MINE REHABILITATION

The majority of Mandalong Mine Access 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 7) 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 February 2023 and is described in **Section 6.5.8** of the Annual Review.

8.2.1 Longwall Mining Area

The surface areas above the completed longwall mining panels are inspected as per the schedules prescribed in the LW25-29, LW30-31, LW32 and LW34 Extraction Plan Water Management Plans (WMP). The LW25-29, LW30-31, LW32 and LW34 Extraction Plan WMPs require that the floodpaths are to be inspected every six months or after a flood event (refer to [Appendix 2](#)). During the course of these inspections observations are made on the progress of remedial measures implemented to minimise subsidence related effects (refer [Table 6-25](#)).

An update on ponding remediation completed in 2022 is provided in [Table 6-25](#).

8.2.2 Exploration Sites

Three surface exploration drill sites were prepared in 2022. Progressive rehabilitation of exploration sites will continue in 2023.

8.2.3 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 2022 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 2021. 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.

8.2.4 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 2022.

8.2.5 Cooranbong Haul Road

The haul road construction resulted in approximately 18 hectares 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 Officer audited the rehabilitation on the haul road in November 2022. 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 2022 audit focused on identifying sites where remedial action or maintenance is required. The inspection was completed by surveying the length of the Haul Road to follow up on areas previously identified as needing work, and to identify additional areas requiring attention.

The six reference sites were inspected, and relevant actions were recorded. The highest priorities included maintenance of sediment and erosion controls along the Haul Road drains and at the dam inlets.

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 areas of the haul road are well established and native vegetation dominates the strata. Weed management contractors are scheduled to continue rehabilitation practices on the Haul Road in 2023. The maintenance and effectiveness of the haul road rehabilitation will be assessed in 2023 and reported in the next Annual Review.

8.2.6 Mandalong South Surface Site

The construction of the access road for the MSSS was completed in 2018. The clearing of the MSSS was completed in 2018, with shaft sinking commencing in late 2018. The construction of the access road and clearing of the MSSS resulted in approximately 11.3 hectares of disturbance.

The areas disturbed by the construction of the access road were stabilised in 2018 with the application of hydro-mulch and bark-blower mulch / seed which was applied to the road batters. Hydro-mulch and bark-blower mulch was also applied to the batters of the MSSS in 2018.

Shaping earthworks and capping were completed for the MSSS stockpile in 2022. The application of hydro-mulch and pasture seed was applied to the MSSS stockpile in 2022 following the completion of earthworks.

The weekly environmental construction inspection procedure (WP-7154) has been updated to include the rehabilitation areas around the access road, MSSS and the main stockpile area. The monitoring procedure includes a requirement for an assessment of new or increased erosion (including batters), growth improvement, weeds and remedial work if required.

Maintenance and effectiveness of the rehabilitation will be assessed in 2023 and reported in the next Annual Review.

8.2.7 Invertebrate Pest Management

There were no reports of invertebrate pests within the Mandalong operations and rehabilitation areas in 2022 and therefore no invertebrate pest management was undertaken during the reporting period.

8.3 REHABILITATION MONITORING

Centennial are required to conduct rehabilitation, following disturbance, as soon as practicable in accordance with rehabilitation objectives outlined in Schedule 3, Condition 31, and Condition 32 of the Development Consent (SSD-5144).

8.3.1 Mandalong South Surface Site

RPS Australia East Pty Ltd (RPS) was engaged by Centennial Coal Ltd (Centennial) to undertake annual monitoring of rehabilitation sites at the Mandalong South Surface Site (MSSS). This involved utilising the Ecosystem Function Analysis (EFA) and Biodiversity Assessment Methodology (BAM) to assess ecosystem function of control (C) and rehabilitation (R) sites within MSSS. Field surveys were undertaken on 4 and 26 October 2022.

Existing Control and rehabilitation locations (two plots per treatment) were revisited. An additional rehabilitation and control plot (one plot per treatment) was installed to increase the statistical rigour of the experimental design. A total of three paired monitoring sites were sampled each comprising an impact and control transect. These sites were permanently marked in the field using surveyors pegs and flagging tape for future repeat monitoring.

Rehabilitation sites exhibited generally lower Landscape Function Analysis (LFA) and BAM Scores than control sites, indicating that further rehabilitation (both passive and active) is required before pre-mining conditions are achieved. The existing rehabilitation plots poorly represent PCT 1588 (cleared community) and will not rehabilitate without further intervention and consequent follow-up (RPS, 2023f).

To improve the trajectory of rehabilitation toward analogous conditions, the following actions are recommended:

- Weed control to be undertaken in all Rehabilitation sites. Specific focus should be given to abundant HTWs, which includes dense Rhodes Grass (*Chloris gayana*) and African Lovegrass (*Eragrostis curvula*);
- Native undergrowth is to be established and or promoted to further stabilise soil surface. This is most pertinent at rehabilitation site R1 and R3, where a native understory and grasses are entirely lacking;

and

- Further tube stock planting of canopy species is required to improve the trajectory toward a more natural vegetation formation state (i.e., open woodland), with these trees consistent with adjacent plant community types [e.g., *Corymbia maculata* (Spotted Gum) or *Eucalyptus umbra* (Broad-leaf White Mahogany)] (RPS, 2023f).

Further rehabilitation monitoring at Mandalong South Surface Site will be completed in 2023 and reported in the next Annual Review.

8.3.2 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 decommissioning of buildings occurred at the Delta Entry Site in 2022 and as such no rehabilitation of buildings was undertaken.

New portable buildings were installed in 2018 at the Delta Entry Site which included office and lunchroom facilities.

8.3.3 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 2022 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 2022.

8.4 REHABILITATION TRIALS AND RESEARCH

8.4.1 Use of Analogue Sites

Data from analogue rehabilitation sites is an integral part of the monitoring procedure throughout the monitoring process. The purpose of analogue sites is to provide a reference against which to document the progress of rehabilitation towards reaching ecosystem health, structure and composition consistent with undisturbed areas.

In 2022, Centennial Mandalong engaged RPS to select and monitor analogue sites to assess whether they are suitable in the context of the proposed final land use and to suggest the species that will be appropriate for revegetation.

Analogue sites were established within undisturbed areas in the vicinity of the proposed Mandalong South Surface Site (MSSS) corresponding with the intended post mining land use of native bushland, commensurate with pre-mining conditions.

The majority of the Mandalong Mine Access Site and the Cooranbong Entry Site are proposed to be retained as infrastructure and therefore no reference monitoring in the vicinity is deemed necessary.

Specific analogue sites were selected based on the following general criteria:

- Contain vegetation types similar to the rehabilitation sites;
- Secure from future mining related disturbance; and
- Contain vegetation and conditions suitable as a basis for rehabilitation performance criteria.

The monitoring results from analogue sites will provide the basis for comparison to measure the success of the rehabilitation against the relevant closure criteria. Results of analogue site monitoring will be reported in future Annual Reviews.

8.4.2 Mandalong Mine VAM-RAB Offset Area

Refer to **Section 6.5.8** of the Annual Review for details on the Mandalong Mine VAM-RAB Offset Area.

8.4.3 Mandalong South Rehabilitation Monitoring

Refer to **Section 8.2.6** of the Annual Review for details on the Mandalong South Surface Site Rehabilitation Monitoring.

8.4.4 Land Management Strategy for the MSSS and TL24 Offset Areas

Refer to **Section 6.5.6** of the Annual Review for details on the Mandalong Mine Land Management Strategy for the MSSS and TL24 Offset Areas.

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 and October 2022. Representatives of the Mandalong community, 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, Extraction Plan update, upcoming projects and sponsorship.

Additional agenda items discussed in 2022 included the Mandalong South Extension Project, MSSS construction, MSSS noise management, Modifications to the Development Consent, exploration drilling program and Centennial's land management programs.

9.1 EXTRACTION PLAN 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. In general, the Mandalong Mine community consultation has included:

- Community consultation in line with the Stakeholder Engagement Strategy;
- Individual landowner notification and consultation associated with the implementation of Extraction Plans LW24-24A, LW25-29, LW30-31, LW32 and LW34 and their associated PSMP's;
- Consultation and general communication with all relevant government agencies and infrastructure owners during the implementation of the Extraction Plans LW24-24A, LW25-29, LW30-31, LW32 and LW34;
- One-month mining notifications were provided to landowners prior to mining beneath their property, with follow-up meetings and inspections undertaken.
- Individual landowner consultation and implementation of PSMPs during mining of Longwalls 31 to 34;
- Individual landowner consultation for rehabilitation of remnant ponding, flooding and subsidence related repairs to property (LW19-31);
- Commencement of landowner consultation for Extraction Plan LW57-60 in the eastern longwall domain and the associated biodiversity and cultural heritage monitoring requirements.
- Three meetings of the Mandalong Mine Community Consultative Committee (MMCCC) chaired by Margaret MacDonald-Hill delivered updates on the status of Development Consent modifications, Extraction Plan approvals, monitoring and subsidence management on Centennial property, private property and public infrastructure.
- Ongoing consultation with relevant stakeholders on the development and implementation of Infrastructure Management Plans including Public Roads (LMCC), powerlines (Ausgrid), communication lines (Telstra) and high voltage transmission lines (TransGrid).

9.2 COMMUNITY SPONSORSHIP

The Mandalong Mine continues to support the local community through various sponsorship avenues to the following community activities, groups and associations in 2022 –

- Heritage College Morisset;
- LMCC School Environment Awards;
- Salvation Army Bonnells Bay – Community Christmas Carol Event;
- St. John Vianney Morisset end of year awards presentations;
- St. Joseph's Primary School;
- Cooranbong Community Preschool; and
- Mandalong Community Association;

9.3 COMMUNITY COMPLAINTS

Ninety-two community complaints were received in 2022, showing an increase in complaints compared with the previous reporting period. Ninety of the complaints were in relation to noise from the MSSS ventilation fans, with two complaints received in 2022 relating to noise from the Cooranbong Entry Site.

Centennial Mandalong has developed an action plan following the completion of noise investigations and will now progress with noise mitigation options for the MSSS ventilation fans. The design and manufacture for new outlet silencers for Fans 1 and 2 will be completed in February 2023 and installation will take place in March 2023. The installation of Fan 3 outlet silencer will be complete in May – June 2023.

Table 9-1: Record of annual community complaints for 2018 to 2022

Community Complaints						
Year	Air	Water	Noise	Waste	Other	Total
2018	0	0	0	0	1	1
2019	0	0	3	0	0	3
2020	0	0	5	0	2	7
2021	0	0	83	0	0	83
2022	0	0	92	0	0	92

Figure 9-1 shows a general increase in the number of community complaints received since 2018. Ninety-two noise complaints were received in 2022, showing a significant increase in noise complaints compared with the previous reporting periods.

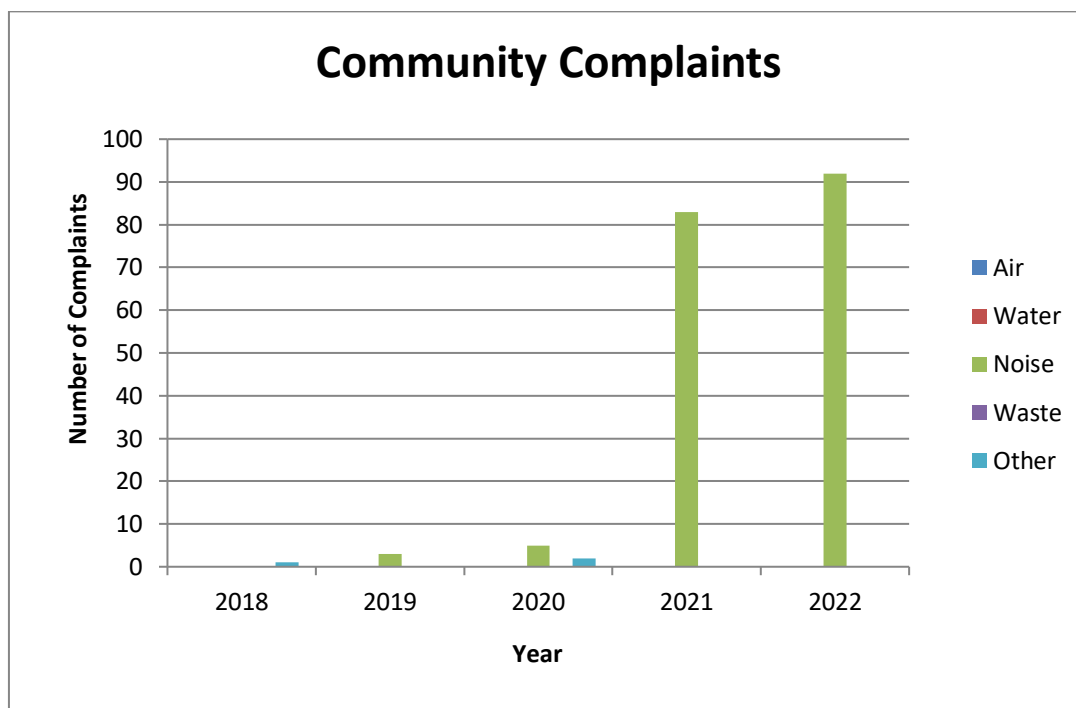


Figure 9-1: Annual Community Complaints

10 INDEPENDENT ENVIRONMENTAL AUDIT

An Independent Environmental Audit (IEMA, 2022) of the Mandalong's operations was completed by Integrated Environmental Management Australia (IEMA) in June 2022. The audit report is publicly available on the Centennial Mandalong website.

The Independent Environmental Audit (IEA) completed by IEMA reviewed the consents and associated Statement of Commitments, Environment Protection Licence, mining tenements, Environmental Management Plans, and the status of previous IEA recommendations. In general, the site was considered largely compliant with only administrative and low-level non-compliance identified. A summary of the audit outcomes is provided in **Table 10-1** (IEMA, 2022)

Table 10-1: Audit Compliance Summary

Compliance Status	SSD-5144	SSD-5144 SOC	DA97/800	DA97/800 SOC	DA35-2-2004	EPL 365	ML 1443	ML 1543	ML 1553	ML 1722	ML 1744	ML 1793	MPL 191	Total
Compliant	72	80	79	30	9	50	17	5	6	9	5	4	19	385
Not triggered	14	14	45	14	9	14	17	10	13	2	5	3	16	176
Admin Non-Compliance	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Low Non-Compliance	3	1	0	0	0	5	0	0	0	0	0	0	0	9
Medium Non-Compliance	0	0	0	0	0	0	0	0	0	0	0	0	0	0
High Non-Compliance	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not Verified	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Observation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Note	1	0	2	0	5	12	2	2	5	1	4	2	2	38
Total	90	95	126	44	23	81	37	17	24	12	14	9	37	609

The Mandalong Mine has prepared an Action Plan in response to the non-compliances and recommendations listed in the 2022 Independent Environmental Audit. The Action Plan was provided to DPE on 27 June 2022 and an updated version is included in **Appendix 3**.

Correspondence from DPE dated 21 September 2022 stated that the Department considered the Independent Environmental Audit report generally satisfies the reporting requirements of the consent. DPE requested a status update on the IEA Action Plan is included in future Annual Reviews.

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 31 March 2025.

11 NON-COMPLIANCES DURING THE REPORTING PERIOD

Table 11-1: Non-Compliance 1

Nature of the incident/non-compliance	EPL 365 L1 Pollution of Waters
Date of incident / non-compliance (if known; if not known state not known)	2 March 2023
The location of the incident/ non-compliance (include a figure if appropriate), if known	MSSS Stockpile Dam
Detail the cause of the incident/non-compliance	<p>At 9am on 2/3/2022, discharge was recorded from the Mandalong South Surface Site (MSSS) Stockpile Dam. The discharge continued until 12:15pm on 2/3/22. The overflow from the MSSS Stockpile Dam was into a tributary of Morans Creek.</p> <p>The Mandalong Mine AWS recorded approximately 126.2mm during the rainfall event between 28/2/22 and 3/3/22. The total rainfall depth for event exceeded the rainfall depth design standard in the Blue Book, which was the basis of the design for the MSSS Stockpile Dam (i.e. 57 mm), noting that the MSSS Stockpile Dam was constructed in accordance with that standard. It is considered that this is the primary reason for the discharge event from the Stockpile Dam on 2 March 2022.</p>
Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance	<p>The actions taken by Centennial Mandalong to manage water contained within the MSSS Stockpile Dam, to manage site surface water and to prevent erosion and sedimentation at the MSSS from 2 March 2022 to 3 March 2022 were as follows -</p> <ul style="list-style-type: none"> • All dams were maintained at low levels (<20%) prior to the rainfall event on 2 March 2022. • Pump operation was undertaken from the MSSS Stockpile Dam to the MSSS 10 ML tank during the rainfall event at the rate of 30 litres / second. • A second diesel pump (30 litres / second) was installed in the MSSS Stockpile Dam at 12 noon on 2 March 2022. Pumping was undertaken to the 10ML tank. • Pump operation was undertaken from the MSSS Sediment Dam to the MSSS 10ML tank during the rainfall event at the rate of 60 litres / second. • Injection of water from the 10ML tank into the underground workings was undertaken during the

	<p>rainfall event via a dedicated borehole at the rate of 15 litres per second.</p> <ul style="list-style-type: none"> Flocculant dosing was undertaken at the MSSS Stockpile Dam during the period of the rainfall event.
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	<p>Future Actions</p> <ul style="list-style-type: none"> Water will continue to be injected into the underground workings via a dedicated borehole at the rate of 15 litres / second from the MSSS 10ML tank. This will provide capacity in the MSSS 10ML tank, to pump from the MSSS Stockpile Dam and reduce the risk of a discharge. Complete the rehabilitation of the MSSS stockpile to reduce the dirty water catchment area at the MSSS. Works will commence in April - May 2022.

Table 11-2 Non-Compliance 2

Nature of the incident/non-compliance	EPL 365 L1 Pollution of Waters
Date of incident / non-compliance (if known; if not known state not known)	5 July 2022 – 7 July 2022
The location of the incident/ non-compliance (include a figure if appropriate), if known	Mandalong South Surface Site (MSSS) Stockpile Dam.
Detail the cause of the incident/non-compliance	<p>At 2.30am on Tuesday 5 July 2022, water was recorded discharging from the Mandalong South Surface Site (MSSS) Stockpile Dam. The discharge has continued until 10:00am on Thursday 7 July 2022.</p> <p>The MSSS AWS recorded approximately 430.6 mm during the rainfall event from 5 to 7 July 2022. The total rainfall depth for the event exceeded the rainfall depth design standard in the Blue Book, which was the basis of the design for the MSSS Stockpile Dam (i.e. 57 mm), noting that the MSSS Stockpile Dam was constructed in accordance with that standard. It is considered that this is the primary reason for the discharge event from the Stockpile Dam between 5 and 7 July 2022.</p>
Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance	<p>The actions taken by Centennial Mandalong to manage water contained within the MSSS Stockpile Dam, to manage site surface water and to prevent erosion and sedimentation at the MSSS from 5 to 7 July 2022 were as follows -</p> <ul style="list-style-type: none"> All dams were maintained at low levels (<20%) prior to the rainfall event on 5 July 2022. Pump operation was undertaken from the MSSS Stockpile Dam to the MSSS 10 ML tank during the

	<p>rainfall event at the rate of 60 litres / second (until the 10ML reached 100% capacity).</p> <ul style="list-style-type: none"> • Pump operation was undertaken from the MSSS Sediment Dam to the MSSS 10ML tank during the rainfall event at the rate of 60 litres / second. • Injection of water from the 10ML tank into the underground workings was undertaken during the rainfall event via a dedicated borehole at the rate of 13 litres per second.
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	<p>Future Actions</p> <ul style="list-style-type: none"> • Water will continue to be injected into the underground workings via a dedicated borehole at the rate of 15 litres / second from the MSSS 10ML tank. This will provide capacity in the MSSS 10ML tank, to pump from the MSSS Stockpile Dam and reduce the risk of a discharge. • Complete the rehabilitation of the MSSS stockpile to reduce the dirty water catchment area at the MSSS. Works will commence in July - August 2022 (pending suitable weather conditions).

Table 11-3 Non-Compliance 3

Nature of the incident/non-compliance	EPL 365 L2.4 Water and / or Land Concentration Limits
Date of incident / non-compliance (if known; if not known state not known)	5-6 July 2022
The location of the incident/ non-compliance (include a figure if appropriate), if known	Mandalong Mine Sediment Dam - LDP003
Detail the cause of the incident/non-compliance	<p>Discharge from LDP003 (EPL Point 10) between 5.20am and 10pm on 5/7/2022 and between 6.20pm and 10pm on 6/7/2022. The TSS results were 106 mg/L on 5/7/22 and 74 mg/L on 6/7/22. The TSS results exceeded the TSS criteria of 50mg/L in EPL365.</p> <p>The total rainfall depth for the 3/7/22 to 7/7/22 event of 315.6mm exceeded the 95th 5-day rainfall depth standard defined within the Mandalong Southern Extension Project EIS and considered within the basis of the design for the MMAS Sediment Control Dam (i.e. 90.1 mm), noting that the MMAS Sediment Control Dam was constructed in accordance with that standard. It is considered that the severity of the rainfall event is the primary reason for the discharge event on 5 and 6 July 2022.</p>

Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance	<p>The actions taken by Centennial Mandalong to manage water contained within the Sediment Control Dam, to manage site surface water and to prevent erosion and sedimentation at the MMAS from 29 June 2022 to 7 July 2022 were as follows:</p> <ul style="list-style-type: none"> • Weekly maintenance was conducted by contractor personnel from Albin Civil on Wednesday 27 June 2022 and Wednesday 6 July 2022. This includes surface cleaning at the MMAS wash-bay, diesel & electrical workshops, oil store and general pit top housekeeping. A bobcat is used to clean-up any coal fine spills on the concrete hardstand area and wash-bay. These works were conducted by two contractors between the hours of 6am and 3pm. • Sweeping of all sealed roads and hardstand areas was undertaken by the sweeper truck operator on Wednesday 27 June 2022 and Wednesday 6 July 2022. The sweeper truck is owned and operated by the contractor Qube. • Booms in the MMAS Sediment Control Dam were installed prior to the rainfall event. • A weekly inspection and service on the MMAS ultraspin oil water separation system at the Gross Pollutant Trap (located adjacent to the MMAS Sediment Control Dam) was conducted by contractor plumbers from Albin Civil during the week ending 1 July 2022. • Pump operation (diesel and electric) to the Mandalong Mine underground workings during the rainfall event.
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	Centennial Mandalong will continue to maintain and manage site surface water infrastructure to prevent erosion and sedimentation at the MMAS.

Table 11-4 Non-Compliance 4

Nature of the incident/non-compliance	EPL 365 L2.4 Water and / or Land Concentration Limits
Date of incident / non-compliance (if known; if not known state not known)	5-6 July 2022
The location of the incident/ non-compliance (include a figure if appropriate), if known	Mandalong South Surface Site Sediment Dam - LDP004
Detail the cause of the incident/non-compliance	Discharge from LDP004 from 4.00am on 5/7/2022 to approximately 10.00am on 7/7/2022. The total suspended solids (TSS) result of the discharge from LDP004 (EPL Point 11) was 208 mg/L on 6/7/22 and 120 mg/L on 7/7/22.

	<p>The MSSS AWS recorded 430.6mm of rainfall between 3/7/22 and 7/7/22. The total rainfall depth for the 3 to 7 July 2022 event exceeded the rainfall depth standard in the Mandalong Southern Extension Project EIS as the basis of the design for the MSSS Sediment Dam (i.e. 58.7 mm rainfall event over 5 days), noting that the MSSS Sediment Dam was constructed in accordance with that standard. It is considered that this is the primary reason for the discharge event.</p>
<p>Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance</p>	<p>The actions taken by Centennial Mandalong to manage water contained within the MSSS Sediment Dam, to manage site surface water and to prevent erosion and sedimentation at the MSSS from 5 to 7 July 2022 were as follows:</p> <ul style="list-style-type: none"> • All dams were maintained at low levels prior to the rainfall event on 5 July 2022. The Sediment Dam level was at 13% prior to the rainfall event. • Pump operation was undertaken from the MSSS Sediment Dam to the MSSS 10ML tank during the rainfall event. • Injection of water from the 10ML tank into the underground workings was undertaken during the rainfall event via a dedicated borehole at the rate of 13 litres per second. <p>Maintenance of drains and sediment controls was completed by contractors from Albin Civil in the week prior to the rainfall event.</p>
<p>Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance</p>	<p>Future Actions</p> <p>Water will continue to be injected into the underground workings via a dedicated borehole at the rate of 15 litres / second from the MSSS 10ML tank. This will provide capacity in the MSSS 10ML tank, to pump from the MSSS Sediment Dam and reduce the risk of a discharge.</p>

Table 11-5 Non-Compliance 5

Nature of the incident/non-compliance	EPL 365 M2.3 Water and / or Land Monitoring Requirements
Date of incident / non-compliance (if known; if not known state not known)	5 July 2022
The location of the incident/ non-compliance (include a figure if appropriate), if known	Mandalong South Surface Site Sediment Dam - LDP004
Detail the cause of the incident/non-compliance	<p>A non-compliance was recorded with EPL 365 Condition M2.3, as a result of not collecting a grab sample for a discharge from LDP004 (EPL Point 11) at the Mandalong South Surface Site (MSSS) on 5 July 2022.</p> <p>Total rainfall received at the Mandalong South Surface Site between 3-7 July 2022 was 430.6 mm. A daily grab sample required during discharge from LDP004 (EPL</p>

	Point 11) on 5/7/22 was not collected as the Mandalong South Surface Site was inaccessible due to flooding.
Detail action that has been, or will be, taken to mitigate any adverse effects of the incident/ non-compliance	<ul style="list-style-type: none"> • Sampling at LDP004 by AECOM employee and Centennial Mandalong Environment & Community Coordinator as required by EPL 365 on 6 and 7 July 2022 once Mandalong Road re-opened. • All dams were maintained at low levels prior to the rainfall event on 5 July 2022. • Pump operation was undertaken from the MSSS Sediment Dam to the MSSS 10ML tank during the rainfall event. • Injection of water from the 10ML tank into the underground workings was undertaken during the rainfall event via a dedicated borehole at the rate of 13 litres per second. • Maintenance of drains and sediment controls was completed by contractors from Albin Civil in the week prior to the rainfall event.
Detail action that has been, or will be, taken to prevent recurrence of the incident/ non-compliance	Incident report provided to EPA, DPE and NSW Resources Regulator on 12 July 2022.

12 ACTIVITIES TO BE COMPLETED IN THE NEXT REPORTING PERIOD

Table 12-1: Forecast Operations for 2023

Centennial Mandalong
<p>Implement Environmental Management Plans required by SSD-5144.</p> <p>Implement LW25-29, LW30-31, LW32 and LW34 Extraction Plan Management Plans</p> <p>Commence LW57-60 and LW39-43 Extraction Plan</p> <p>Continue baseline monitoring for LW39-43 Extraction Plan</p>
Mandalong Mine Access Site
Commence operation of Gas Engines.
Cooranbong Entry Site
Nil major targets for 2023.
Delta Entry Site
Nil major targets for 2023.
Mandalong South Surface Site
Complete the installation of three new outlet silencers for the Mandalong South Surface Site ventilation fans.

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