

<u>nmental Compliance Coordinator</u>
-

CHAIN VALLEY COLLIERY

Annual Review 2022

1 January 2021 - 31 December 2022

Author:	Lachlan McWha Delta Coal Environmental Compliance & Approvals Coordinator
Authorised by:	
Date:	31 March 2023

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Chain Valley Colliery – Annual Review (AEMR) 2022

Table 1 - Annual Review title block

Chain Valley Colliery
Great Southern Energy Pty Ltd trading as Delta Coal
SSD 5465
Delta Coal
Consolidated Coal Lease 706, Consolidated Coal Lease 707, Mining Lease 1051, Mining Lease 1052, Mining Lease 1308, Mining Lease 1781, Mining Lease 1782, Mining Lease 1783, Mining Lease 1784, Mining Lease 1785, Mining Purposes Lease 1349, Mining Purposes Lease 1389, Mining Purposes Lease 1400, Mining Purposes Lease 337.
Great Southern Energy Pty Ltd
WAL41508 / Work Approval 20MW065025
1 January 2022
31 December 2022

I, Lachlan McWha, certify that this audit report is a true and accurate record of the compliance status of Chain Valley Colliery for the period 1 January 2021 to 31 December 2022 and that I am authorised to make this statement on behalf of Great Southern Energy Pty Ltd (trading as Delta Coal Pty Ltd).

Note.

- a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250.000.
- b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).

Reporting Officer	Name:	Lachlan McWha
	Title:	Environmental Compliance Coordinator
	Date:	31 st March 2023
	Signature:	Loncura

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Executive Summary

Below details a summary of the key performance indicators for Chain Valley Colliery.

Indicator	Value
Total full-time employees (at 31 December 2022)	208
ROM coal produced on site (tonnes)	954,103
Product coal transported from site via Mannering Colliery (tonnes)	954,103
Total ROM coal to export market (million tonnes)	0
Total ROM coal to domestic market (tonnes)	954,103
Total Coal Haulage on public roads (tonnes)	0
Total waste disposed (tonnes)	237.5
Total waste recycled (tonnes)	98.5
Waste recycling % achieved (%)	26.5%
Potable water consumed (ML)	40.17
Total water discharged from the operation (ML)	2,271
Total number of community complaints received	0
Total number of reportable environmental incidents (including approvals non-compliances) for the period	14
Total funding accrued for the Voluntary Planning Agreement with Council in reporting period	\$42,725
Number of Community Consultative Committee (CCC) meetings undertaken	4
Total Scope 1 greenhouse gas emissions (CO ₂ equivalent tonnes) 1 st July 2020 – 30 th June 2021	542,408

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1 Statement of Compliance

Summary of Non-compliances (2022 Reporting Period):

The **fourteen** reportable environmental incidents during the reporting period were air quality or water related exceedances. These are summarised in **Table 2** and **Table 3**.

Table 2 - Statement of Compliance

Were all conditions of the relevant approval(s) complied with?	
SSD 5465	No
EPL 1770	No
Consolidated Coal Lease 706, Consolidated Coal Lease 707, Mining Lease 1051, Mining Lease 1052, Mining Lease 1308, Mining Lease 1781, Mining Lease 1782, Mining Lease 1783, Mining Lease 1784, Mining Lease 1785, Mining Purposes Lease 1349, Mining Purposes Lease 1389, Mining Purposes Lease 1400, Mining Purposes Lease 337.	Yes
Water Access Licence 41508 / Work Approval 20MW065025	Yes

Table 3 - Non-compliances

Relevant Approval	Condition No.	Condition Description (summary)	Compliance Status	Comment	Where addressed in Annual Review
EPL 1770	L2.4	Faecal Coliform Exceedance at EPA 1 discharge point.	Non-compliant	18 January 2022	Section 7.4 and Section 11
Development Consent SSD- 5465	Schedule 3, Condition 11	PM2.5 exceedance of daily limits at Wyee monitoring Location.	Non-compliant	3, 6, 16, 18, 19, 20 and 24 January 2022	Section 6.1.3 and Section 11
EPL 1770	L2.4	Faecal Coliform Exceedance at EPA 1 discharge point.	Non-compliant	30 March 2022	Section 7.4 and Section 11
Development Consent SSD- 5465	Schedule 3, Condition 11	PM2.5 exceedance of daily limits at Wyee monitoring Location.	Non-compliant	20 April 2022	Section 6.1.3 and Section 11

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Relevant Approval	Condition No.	Condition Description (summary)	Compliance Status	Comment	Where addressed in Annual Review
Development Consent SSD- 5465	Schedule 3, Condition 11	PM2.5 unit vandalised at Wyee monitoring Location (ceased data collection).	Non-compliant	8 June 2022	Section 11
EPL 1770	L3.2	Exceedance of volumetric limits at EPA 1 discharge point.	Non-compliant	5 July 2022	Section 7.4 and Section 11
EPL 1770	L2.4	Exceedance of Faecal Coliforms limit at EPA 27 discharge point.	Non-compliant	5 July 2022	Section 7.4 and Section 11
EPL 1770	L2.4	Exceedance of total suspended solids limit at EPA 27 discharge point.	Non-compliant	5 July 2022	Section 7.4 and Section 11
EPL 1770	L3.2	Exceedance of volumetric limits at EPA 1 discharge point.	Non-compliant	6 July 2022	Section 7.4 and Section 11
Development Consent SSD- 5465	Statement of Commitments	Non-compliance to bathymetric scanning frequency (6-monthly scan missed).	Non-compliant	8 July 2022	Section 11
EPL 1770 Development Consent SSD- 5465	L5.1 Schedule 3, Condition 7	Exceedance of noise limits at receiver R22.	Non-compliant	15 September 2022	Section 6.7 and Section 11
EPL 1770	L2.4	Exceedance of Faecal Coliforms limit at EPA 27 discharge point.	Non-compliant	8 October 2022	Section 7.4 and Section 11
EPL 1770	L2.4	Exceedance of total suspended solids limit at EPA 27 discharge point.	Non-compliant	8 October 2022	Section 7.4 and Section 11

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Relevant Approval	Condition No.	Condition Description (summary)	Compliance Status	Comment	Where addressed in Annual Review
Development Consent SSD- 5465	Schedule 3, Condition 11	Depositional Dust Exceedance at DDG006.	Non-compliant	4 November 2022	Section 6.1.1 and Section 11

Compliance status key for Table 3

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 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 potential for moderate environmental consequences, but is unlikely to occur; or potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-Compliant	Non-compliance which does not result in any risk of environmental harm

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2 Introduction

2.1 Background

Chain Valley Colliery (CVC) is an underground coal mine located on the southern end of Lake Macquarie approximately 60 km south of Newcastle, 80 km north of Sydney and adjacent to Vales Point Power Station (VPPS). The pit-top is located 1 km south-east of the township of Mannering Park. The sites locality and approved boundary are shown on **Figure 1**.

CVC operates under Development Consent SSD-5465 which was most recently modified (Modification 4) in August 2021.

Underground mining at CVC commenced in 1962 and since that time has extracted coal from three seams; namely, the Wallarah Seam, the Great Northern Seam and the Fassifern Seam, using a combination of bord and pillar and miniwall mining methods. Current mining activities are within the Fassifern Seam. CVC completed its final planned miniwall in 2021. All mining undertaken in the reporting period was first-workings bord and pillar methods.

Delta Coal is currently undertaking the mine closure/rehabilitation process for the Moonee Colliery and completed the rehabilitation of the Catherine Hill Bay Coal Preparation Plant.

CVC peaked with a workforce of approximately 380 personnel in the mid 1980's. At the end of the reporting period, CVC had a workforce of 208 personnel.

2.2 Mine Contacts

The Colliery contacts as at the end of the reporting period were:

Mine Manager: Joshua Cornford
Telephone: 02 4358 0800

Email: <u>Jcornford@deltacoal.com.au</u>

Environmental Compliance & Approvals Coordinator: Lachlan McWha
Telephone: 02 4358 0883

Email: <u>Lmcwha@deltacoal.com.au</u>

Postal Address: Delta Coal

P.O Box 7115

Mannering Park NSW 2259

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umwelt 363000 365000 367000 SILVERWATER SUNSHINE MIRRABOOKA State RIGHTWATERS Lake Macquarie Lake Macquarie State Conservation Area Vales Point Power Station Chain Valley Colliery Development Consent Boundary Seagrass Protection Barrier ---- High Water Mark Subsidence Barrier FIGURE 1 Zone A - Long term stable mining systems generating up to 20 mm surface subsidence Zone B - Mining systems generating up to a maximum of 780 mm vertical susbsidence Chain Valley Colliery Modification 4 State Conservation Area

Figure 1 - Chain Valley Colliery Site Boundary and Regional Locality

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3 Approvals

This Annual Review has been completed in compliance with Condition 8 of Schedule 6 within SSD-5465. A copy of the modified Development Consent is attached as **Appendix 1**.

3.1 Development Consent SSD-5465

CVC commenced mining operations in 1962 and the mine had been operating under existing use rights until 23 January 2012 at which time major project approval (MP 10_0161) was issued under Section 75J of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The project approval permitted secondary extraction within domains referred to as Domain 1 and Domain 2, along with first workings within an area identified as Parcel A. The approval also permitted the continuation of mining within the Fassifern Seam until 31 December 2016.

The approval was subsequently modified on 30 August 2012, following approval of a Section 75W modification, to permit a revised mine layout associated with the introduction of wider minimals within the Domain 1 and 2 areas.

In 2013 the mine lodged an application for the Chain Valley Colliery Mining Extension 1 Project (SSD-5465) under Part 4 of the EP&A Act. The Mining Extension 1 Project sought approval for:

- an extension of the approved extraction area to allow underground mining to continue within the Fassifern Seam;
- the increase of the approved maximum rate of production from 1.2 million tonnes per annum (Mtpa) to 1.5 Mtpa of run-of-mine (ROM) coal;
- an increase in the approved hours for haulage of coal from the Colliery on private roads to Delta Electricity's VPPS;
- minor upgrades and modifications to existing approved infrastructure;
- an extension of the approved mining by a period of approximately 14 years, i.e., to around 2027; and
- the consolidation of the above with all the operations and environmental activities currently approved under MP10_0161, as modified, within a single development consent.

Development Consent for the Mining Extension 1 Project was subsequently issued under Section 89E of the EP&A Act on 23 December 2013.

On 24 April 2014 a modification (Mod 1) was sought for SSD-5465, which related to the development of an underground linkage between Chain Valley Colliery and Mannering Colliery. Concurrently, a modification (Mod 2) to Mannering Colliery's Project Approval (MP 06_0311) was sought to permit coal to be received from Chain Valley Colliery and transported via existing facilities to VPPS. The modification application was approved on the 27 November 2014.

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On the 15 July 2015 an additional modification (Mod 2) was sought for SSD-5465. The Department of Planning and Environment (DP&E) approved the modification on 16 December 2015. The modification approved the following changes to the CVC operations:

- an increase in the maximum rate of ROM coal extraction at the mine from 1.5 Mtpa to 2.1 Mtpa;
- mine design changes, primarily the re-orientation of miniwall panels in the mine's northern area;
- an increase in full-time personnel from approximately 160 to approximately 220; and
- construction of asset protection zones (APZs) around critical infrastructure to protect from bushfires.

In May 2019 a Statement of Environmental Effects was submitted to support an additional modification (Mod 3) being sought for SSD-5465. The Department of Planning, Industry and Environment (DPIE) approved the modification on the 26th June 2020, the modification approved the following changes to the CVC operations:

- the use of alternate bord and pillar mine designs and
- an extension of allowed operations until 31 December 2027.

On the 25th August 2021 a further modification to SSD-5465 (Mod 4) was approved by the DPIE. The modification approved the following changes to the CVC operations:

- extend the boundary of the Northern Mining Area approved for extraction under the Chain Valley Colliery consent into a mining lease area partially transferred from Centennial Myuna Colliery (Part ML1632 transferred to ML1785); and
- increase the maximum employee numbers permitted at Chain Valley Colliery to approximately 330 full-time equivalent employees.

Delta Coal undertook works in 2022 to prepare an Environmental Impact Statement to facilitate the consolidation of the Chain Valley Colliery and Mannering Colliery consents, as well as the extension of the life of both mines to 31 December 2029 in line with the VPPS current operational timeframe.

3.2 Extraction Plans

Delta Coal submitted an extraction plan to facilitate the mining of Miniwall S5 and pillar extraction in the northern mining area, which was approved by the Planning Secretary on 6th April 2021.

No further extraction plans were submitted in the 2022 review period. During the 2022 reporting period, no secondary extraction was undertaken by Delta Coal. All coal mined during the reporting period was obtained via bord and pillar first workings designed to be long-term stable, however is approved to undertake pillar extraction within Subsidence Zone B (beneath Lake Macquarie excluding sea-grass and subsidence protection barriers) in the Northern mining area (up to 780mm of subsidence approved).

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3.3 Rehabilitation Management Plan

Throughout the 2022 period the site operated in accordance with the Mining Operation Plan (MOP) for Chain Valley Colliery 2020-2023 (amendment 2) which was approved by the Resources Regulator in 2021.

During the reporting period the requirement for MOPs were made obsolete under changes implemented to Schedule 8A of the Mining Regulations 2021, being replaced by Rehabilitation Management Plans. Delta Coal prepared and implemented a rehabilitation management plan in accordance with the requirements of Schedule 8A of the mining regulations and Resources Regulator form and way documents.

3.4 Leases

The surface areas occupied by CVC lie within the Central Coast local government area (LGA). The facilities include the pit top area at Mannering Park and ventilation shaft site at Summerland Point.

All extraction during the reporting period was undertaken within the Lake Macquarie LGA.

The Colliery holdings are shown on Figure 2 and the applicable mining tenements are listed in Table 4.

Table 4 - Mining Tenements

Current Mining tenement	Holder	Grant date / Renewal date	Lease expiry date	Applicability
CCL 706	Great Southern Energy	10 February 2023	29 December 2029	Incorporates historical workings within the Fassifern, Wallarah and Great Northern Seams which are, and would continue to be utilised for passive operational activities.
CCL 707	Great Southern Energy	3 July 1989	30 Dec 2023 (renewal requested in reporting period)	Incorporates historical workings within the Fassifern, Wallarah and Great Northern seams which are, and would continue to be, utilised for passive operational activities and the Summerland Point ventilation shaft site.
A 383	Great Southern Energy	24 June 2021	21 September 2025	Authorisation for area covered by ML1781.
EL 8428	Great Southern Energy	8 November 2021	7 Dec 2025	Potential future mine extension area.
EL 8853	Great Southern Energy	31 October 2022	23 October 2026	Exploration lease for ML 1785 area. Current mine area approved under Development Consent SSD-5465.
EL 8854	Great Southern Energy	12 October 2022	23 April 2026	Exploration Lease for ML 1785 area. Potential future mine extension area.

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Current Mining tenement	Holder	Grant date / Renewal date	Lease expiry date	Applicability
ML 1051	Great Southern Energy	30 January 2023	7 July 2042	Part of the area approved under Development Consent SSD-5465.
ML 1052	Great Southern Energy	30 January 2023	7 July 2042	Part of the area approved under SSD-5465.
ML 1308	Great Southern Energy	30 January 2023	4 January 2031	Mining lease for the mine drift entries.
ML1781	Great Southern Energy	22 April 2022	3 July 2031	Partial Transfer from subleased area of CCL719 from Centennial Coal to GSE. Incorporates historic workings within the Wallarah and Great Northern Seams utilised for passive operational activities.
ML 1785	Great Southern Energy	14 October 2022	13 October 2043	Partial transfer of previous subleased area of ML1632 from Centennial Coal to GSE.
ML 1783	Great Southern Energy	22 April 2022	28 June 2028	Partial transfer of previous subleased area of CCL722 from Centennial Coal to GSE.
ML 1782	Great Southern Energy	24 January 2022	29 July 2026	Partial Transfer of previous sublease area of CCL721 from Centennial coal to GSE.
ML 1784	Great Southern Energy	14 May 2021	7 Mar 2033	Partial Transfer of previous sublease area of ML1370 from Centennial coal to GSE.
MPL 337	Great Southern Energy	30 January 2016	30 January 2037	Mining purposes lease for a portion of the electricity cable on the bed of Chain Valley Bay connecting the pit top switchyard to the ventilation shaft site at Summerland Point.
MPL 1349	Great Southern Energy	5 Oct 1967	5 Oct 2028	Mining purposes lease for the Chain Valley pit top area.
MPL 1389	Great Southern Energy	14 May 1970	14 May 2031	Mining purposes lease for a portion of the electricity cable on the bed of Chain Valley Bay connecting the pit top switchyard to the ventilation shaft site at Summerland Point.
MPL 1400	Great Southern Energy	6 Nov 1970	6 Nov 2031	Mining purposes lease for a portion of the electricity cable on the bed of Chain Valley Bay connecting the pit top switchyard to the ventilation fan at Summerland Point.

Blue = Change within the reporting period

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It is noted that while the CVC holding boundary now incorporates the entirety of the former Mannering Colliery holding, Annual Reviews for the two Collieries remain separate pending a consolidation of the consents and relate specifically to the activities occurring within the relevant approvals boundaries under the EP&A Act 1979.

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Mine Holdings - Mining Leases / Consolidated Coal Leases CCL706 - all seams excludes Wallarah Current Chain Valley CCL707 - all seams //// excludes GTN Colliery Holding ML1052 ML1308 ML1781 (formerly part CCL719) ML1782 (formerly part CCL721) ML1783 (formerly part CCL722) ML1784 (formerly ML1370) ML1785 (formerly part ML1632) Exploration Licenses, Authorisations EL8853 (formerly part EL4444) EL8854 (formerly part EL6640) [_____] EL8428 [____] A383 Surface Leases MPL1349 - (Pit Top Surface Facilities) MPL1400 - (Submarine - CCL707) MPL337 - (Submarine Cable - ML1052) MPL1389 - (Submarine Cable - Foreshore) CCL706 - (CHB Surface Area) ML1781 - Surface only ML1782 - Surface only Consent ML1781 Extraction Approval - Fassifern Seam Development Consent - Mod 4 DELTA COAL SCALE: DATE: 14 November 2022 CHAIN VALLEY COLLIERY DRAWN: DRG NO: C180003A LEASE HOLDINGS - UNDERGROUND LEASES CHECKED: REV NO: 11 SIGNED:

Figure 2 - Delta Coal Tenement Holdings

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3.5 Licences

Environment Protection Licence (EPL) No. 1770 issued by the Environment Protection Authority (EPA) under the Protection of the Environment Operations Act 1997 covers the Collieries activities / premises.

EPL 1770 also includes the licenced daily discharge volume for mine water from the pit top settling ponds into Lake Macquarie at a maximum rate of 12,161 kL per day. EPL 1770 was last varied on 1 March 2023.

A copy of EPL 1770 is posted on the Delta Coal website, www.deltacoal.com.au or via the EPA website, http://www.environment.nsw.gov.au/licensing/ and is also provided in **Appendix 2**.

Monitoring results obtained in accordance with the license conditions are made available on the Delta Coal website (updated monthly), under the environmental reporting page: https://www.deltacoal.com.au/environment/chain-valley-colliery/chain-valley-colliery-environmental-reporting

Delta Coal also holds WAL41508 issued under the *Water Act 1912* and permits the extraction of 4443 ML per annum.

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4 Operations

4.1 Exploration

There was no surface exploration drilling undertaken during the reporting period.

4.2 Land Preparation

There was no land preparation undertaken during the reporting period, as a result the surface disturbance footprint remains unchanged.

4.3 Construction/Demolition

There were no construction or demolition works undertaken during the reporting period.

4.4 Mining

In the 2022 reporting period, CVC undertook first workings through bord and pillar mining methods in a herringbone style, while pillar extraction is permitted in the northern mining area within subsidence zone B (**Figure 1**) pillar extraction was not undertaken in the 2022 reporting period.

Total production for 2022 was:

• 954,103 tonnes of ROM coal from herringbone first workings.

CVC's existing underground workings and mining undertaken in the reporting period is shown on Figure 3.

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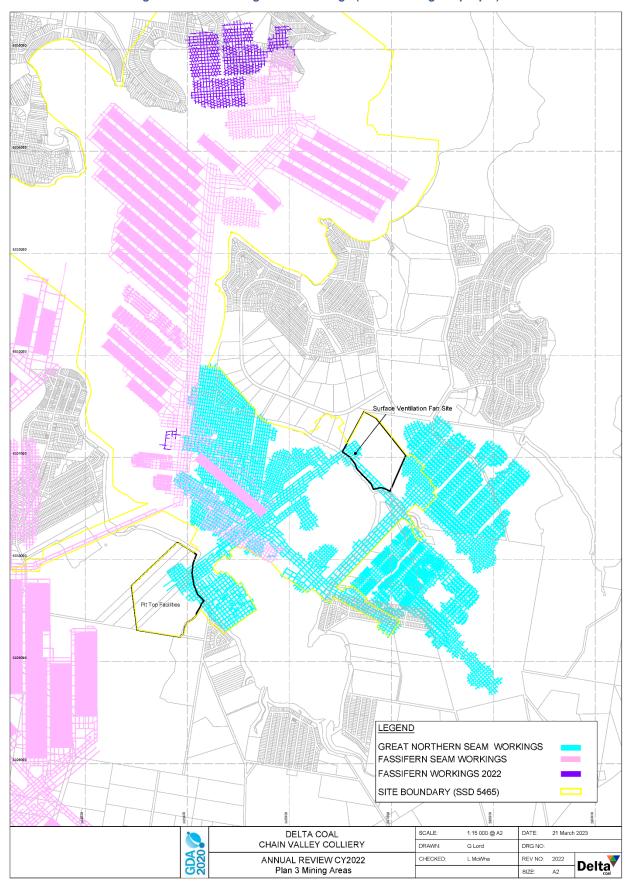


Figure 3 - CVC Underground Workings (2022 workings in purple)

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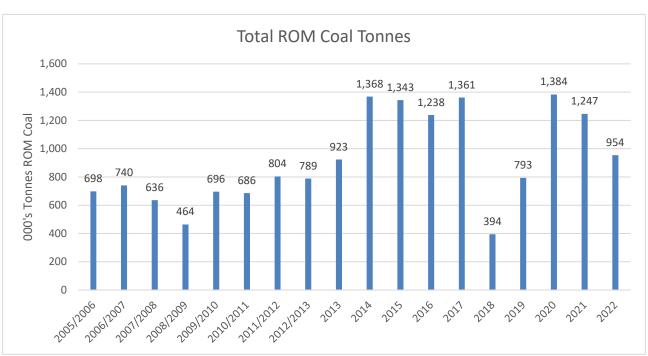


A production summary for the reporting period is provided in **Table 5**. **Figure 4** shows the past 17 years of annual ROM production, including that for the current reporting period. Note that prior to 2013 the reporting period was on a financial year basis, however, to align reporting with Development Consent requirements, this has now been moved to a calendar year basis. All coal produced was dispatched to VPPS via conveyor from Mannering Colliery. During the reporting period a total of 954,103 tonnes was dispatched to VPPS (domestic market). No coal was sold for export in the reporting period.

Table 5 - Production Summary

Material	Approved Limit (Mt)	Previous Reporting Period (Actual)	This Reporting Period (Actual)	Next Reporting Period (Forecast)
Waste Rock / Overburden	n/a	n/a	n/a	n/a
ROM Coal	2.1 Mt	1.25 Mt	0.95 Mt	1.36 Mt
Coarse Reject	n/a	n/a	n/a	n/a
Fine Reject	n/a	n/a	n/a	n/a
Saleable Product (Same as ROM)	2.1 Mt	1.25 Mt	0.95 Mt	1.36 Mt

Figure 4 - Annual ROM Production Levels



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4.4.1 Mine Geology

The Fassifern seams have been mined at CVC to produce a raw, crushed thermal coal with low sulphur, which is suitable for both export and domestic markets.

The Fassifern Seam is mined at a depth of approximately 160 to 200 m, approximately 30 m deeper than the Great Northern Seam, which underlies the Wallarah Seam by approximately 30 m also. **Figure 5** shows the typical stratigraphy at CVC including the Wallarah, Great Northern and Fassifern seams.

The Fassifern Seam is overlain by a tuffaceous claystone material which varies in thickness between 20 and 30 metres. The Fassifern Seam measures up to 5 metres in thickness with roadway development carrying a coal roof and floor.

Mining in the Wallarah Seam is complete in the Colliery holding area and mining was discontinued in the late 1990's. There is still some remaining resource within the Great Northern and Fassifern seams. Current operations and development consent only permits mining within the Fassifern Seam.

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LITHOLOGY AND COAL SEAMS Munmorah Group (Conglomerate) Dooralong Shale Narrabeen Group Vales Point Seam (Coal) Karignan Conglomerate Tuff Wallarah Seam (Coal) Mannering Park Tuff Teralba Conglomerate Moon Island Beach Sub-Group Great Northern Seam (Coal) Karingal Conglomerate Awaba Tuff Fassifern Seam (Coal) **Newcastle Coal Measures** Source: Modified by AECOM (2011) from Seedsman Geotechnics Pty Ltd (2010). Typical stratigraphy at the Site

Figure 5 - Typical Stratigraphy at Chain Valley Colliery



Chain Valley Colliery Mining Extension 1 Project - Environmental Impact Statement

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4.5 Coal Processing

CVC produces a raw, crushed thermal coal which is suitable for both export and domestic markets. In 2020 Mannering Colliery's above ground rotary breaker was decommissioned. Since the rotary breaker was decommissioned initial crushing and sizing occurs underground before being conveyed to Mannering Colliery pit-top for further sizing and screening in the coal handling and preparation plant (CHPP). Coal is transferred from the CHPP to either the YE1 conveyor for transport directly to VPPS or for storage on the Mannering Coal Stockpile where coal transport to VPPS is offline or limited.

4.6 Waste Management

Delta Coal continued to implement a total waste management system for the site during the reporting period. The waste streams currently provided for include:

- general waste (disposal), 237.5 tonne (t) (63.9 %);
- scrap metal (recycle), 54 t (12.5 %);
- diesel particulate filters (disposal), 27.1 t (7.3 %);
- Effluent (recycle), 10.5 t (2.8 %);
- oily water (recycle), 9.9 t (2.7 %);
- comingled recycling (recycle), 8.1 t (2.2 %);
- waste oil (recycle),7.9 t (2.1 %);
- pallecons (recycle), 3.2 t (0.8 %);
- empty oil drums (recycle), 2.0 t (0.5 %);
- timber / pallets (recycle), 1.3 t (0.4%);
- sludge (recycle), 0.8 t (0.2%);
- oil filters (recycle), 0.48 t (0.1 %);
- confidential documents (recycle), 0.2 t (0.05 %);
- silent seal kit waste (disposal), 0.3 t (0.08 %);
- oily rags (disposal),0.1 t (0.03 %); and
- waste batteries (recycle), 0.2 t (0.05 %).

The total waste management system also involves weekly site inspections by the waste management contractor to facilitate effective waste management and continual improvement along with monthly reporting, with data from key waste streams presented in **Figure 6**.

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During the reporting period there was a continued focus on recycling with a large amount of scrap metal removed from site. The total waste management system will continue during the next reporting period. A total of 26.5% of waste collected from the site was recycled.

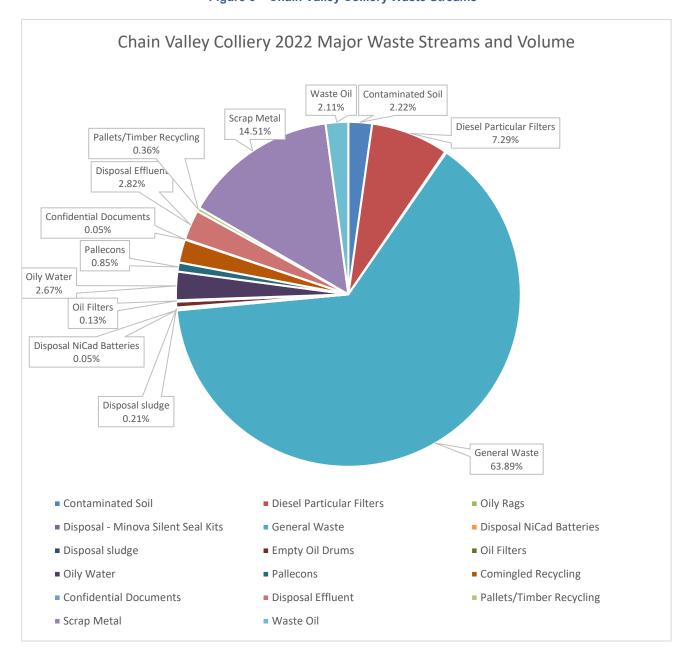


Figure 6 - Chain Valley Colliery Waste Streams

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4.7 Stockpiles

The CVC stockpile does not receive product coal following the linkage of CVC and MC underground. Clean-up works on the stockpile in 2020 generated product coal with general non-coal material present. Product coal was transferred to VPPS and waste separated during processing was disposed of to landfill. Delta Coal has allocated capital budget for the upcoming reporting period (2023) to undertake sediment and erosion control works on the CVC stockpile area in consideration of no current or forecasted future use at current.

4.8 Hazardous Materials Management

Bulk storage of hazardous materials and dangerous goods occurs in the stores area adjacent to the workshop. The primary hazardous chemicals storage locations are:

- a 15,900 L above ground diesel tank (not in operation during the reporting period);
- a covered, bunded area for storage of pallets of oils, and bulk fluid containers;
- 31.4 kL self-bunded diesel tank (compliant with both AS1692 and AS1940); and
- three 210kg LPG bottles.

There have been no significant changes made to the management of hazardous materials during the 2022 reporting period.

4.9 Other Infrastructure Management

Connection of the CVC Administration building septic system (an aerated water treatment system) to the CVC bathhouse septic system. While the connection was completed in the reporting period the pump enabling the connection was not commissioned as the project is pending the completion of PRP 8 – CVC bathhouse connection to Council sewer, which was delayed in the reporting period as discussed in Section 4.10.

No significant changes have been made to other infrastructure during the reporting period. Some minor changes were made to the site buildings and general maintenance was undertaken.

4.10 Proposed Changes

Forecast changes for CVC that are likely to occur in the next reporting period include:

• complete construction of a sewage pump station (following Development Application approval by Central Coast Council in December 2020) at CVC adjacent to the bathhouse and a sewer pipeline to Tall Timbers Road for connection to Central Coast Council sewage system, in order to satisfy Pollution Reduction Program 8 (EPL 1770). This project was delayed during the reporting period due to construction approval pending a transfer of land previously operated by Crown Lands to Central Coast Council, the transfer processed in January 2023 and the project will be completed in the 2023 reporting period;

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- submission of Response to Submissions in relation to the Consent Consolidation Project; and
- If the CVC and MC Consent Consolidation Project is approved, request to consolidate EPL 1770 and EPL 191 to one license.

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5 Actions Required from Previous Annual Review

5.1 Actions required from 2021 Annual Review

As detailed in **Table 6**, correspondence was received from DPIE on 12 May 2022, noting that the CVC Annual Return 2021 generally satisfied reporting requirements.

Table 6 - Actions requiring updating in 2021 Annual Review

Item	Section	Action	Status
		Nil – the CVC AR 2021 was reviewed by the	
		Department and was considered to generally satisfy	
-	-	the reporting requirements of the consent and the	N/A
		Departments Annual Review Guideline (October	
		2015).	

5.2 Delta Coal Environmental Management System

Environmental management at CVC is structured through the environmental management system based on the company's Environmental Policy. The site risk assessment of environmental aspects at CVC forms the basis of environmental impact mitigation and control and will be reviewed throughout the life of the Colliery.

The Environmental Management Strategy provides the overview of the environmental management system which has been visually presented in **Figure 7**. Modification 3 of SSD-5465 (June 2020) allowed for the combination of some Mannering Colliery and Chain Valley Colliery management plans, at the end of the reporting period the following combined plans were approved:

- Delta Coal Environmental Management Strategy (incorporating Environmental Monitoring Program);
- <u>Delta Coal Noise Management Plan</u> (combining the Mannering Colliery Noise Management Plan and Noise Monitoring Program and CVC Noise Management Plan);
- Delta Coal Air Quality and Greenhouse Gas Management Plan (combining CVC Air Quality Management Plan and Mannering Colliery Air Quality and Greenhouse Gas Management Plan); and
- Delta Coal Heritage Management Plan (combining CVC Heritage Management Plan, Mannering Colliery Aboriginal Cultural Heritage Management Plan and Mannering Colliery Non-indigenous Management Plan).

The Delta Coal Land Management Plan was pending completion of consultation and approval at the end of the 2022 reporting period and is forecasted to be enacted in the 2023 reporting period.

Table 7 provides the status of CVC's Environmental Management Plans.

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Env Management Plans Delta Coal Delta Coal **Environmental Policy Environmental Management Strategy Env Monitoring Program** (EMS) **Component Plans** CVC and MC Combined CVC and MC **CVC Extraction Plans** Mining Operations Plan **Management Plans Management Plans** Subsidence Management Plans (MOP) Rehabilitation Monitoring DC Heritage MP Subsidence Monitoring Program CVC Water MP Program DC Noise MP MC Water MP **Public Safety MP** DC Air Quality & GHG MP **Built Features MP** CVC Rehabilitation MP DC Land MP CVC Biodiversity MP Seagrass MP DC Environmental Monitoring **Benthic communities MP** MC PIRMP Program CVC PIRMP **Exploration Activities and Minor Surface Infrastructure** MP **Environmental Procedures Environment and Community Aspects** and Impacts Register

Figure 7 - Environmental Management Strategy Summary

Table 7 - Primary Elements of the Environmental Management System

Document Title	Last Approved / Reviewed	Status as of 31 December 2022	
Delta Coal Environment Policy	September 2021	Current	
Delta Coal Environmental Management Strategy	March 2021	Revised version submitted for consultation and approval with DPE (post IEA review)	
Delta Coal Environmental Monitoring Program	March 2021	Incorporated into combined Delta Coal Environmental Management Strategy	
Environmental Risk Assessment	December 2019	Final	
CVC Water Management Plan	December 2022	Revised version post IEA review approved and current	
Delta Coal Air Quality and Greenhouse Gas Management Plan	March 2022	Revised version submitted for consultation and approval with DPE (post IEA review)	
Delta Coal Noise Management Plan	April 2022	Revised version submitted for consultation and approval with DPE (post IEA review)	
Delta Coal Heritage Management Plan	April 2021	Revised version submitted for consultation and approval with DPE (post IEA review)	

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Document Title	Last Approved / Reviewed	Status as of 31 December 2022	
Delta Coal Land Management Plan	Pending completion of consultation and approval.	Submitted for consultation and approval in 2022, anticipated approval in 2023.	
Biodiversity Management Plan	December 2020	Revised version submitted for consultation forecasted approval in 2023	
Road Transport Protocol (Traffic Management Plan) and Coal Haulage Drivers Code of Conduct	December 2019 / December 2022	Reviewed in 2022, unchanged as CVC does not undertake road coal haulage.	
Seagrass Management Plan	April 2021	Revised in December 2022 and submitted for consultation.	
Benthic Communities Management Plan	April 2021	Revised in December 2022 and submitted for consultation.	
Groundwater Management Plan	December 2022	Water Management Plan incl. Groundwater Management Plan approved December 2022.	
Built Features Management Plan	April 2021	Approved with Miniwall S5 and NMA Extraction Plan.	
Public Safety Management Plan	April 2021	Approved with Miniwall S5 and NMA Extraction Plan.	
Rehabilitation Management Plan	October 2022	Updated in 2022 per Schedule 8A amendment of Mining Regulation.	
Subsidence Monitoring Program – Northern Mining Area First Workings and Lake Macquarie Extraction	August 2021	Approved with Delta Coal Mining Operations Plan Amendment 2.	
Subsidence Monitoring Program – Miniwall S5 and Northern Mining Area Pillar Extraction	November 2020	Approved with Miniwall S5 and NMA Extraction Plan.	
Pollution Incident Response Management Plan (PIRMP)	December 2022	Final	
Environmental Inspection	April 2021	Final (revision anticipated in 2023)	
Complaints Register	December 2022	Updated monthly on www.deltacoal.com.au	

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6 Environmental Performance

6.1 Air Pollution

6.1.1 Depositional Dust

During the reporting period monitoring was undertaken in accordance with the approved Air Quality Management Plan. Depositional dust monitoring results are shown in **Table 8** and the 12 month rolling averages are presented in **Figure 8**. In addition to the results during the reporting period, long term data showing the annual average depositional dust results trend from the commencement of monitoring are shown on **Figure 9**. Delta Coal ceased monitoring at DDG005 during the reporting period due to frequent issues with dust gauge contamination following approval of the Delta Coal Air Quality Management Plan which proposed the removal of DDG005 and substitution with DDG006.

Table 8 - 2022 CVC Depositional Dust Monitoring

Dep Dust	Limit	DDG001 - Mine Cottages	DDG002 - South Easement	DDG003 - Macquarie Shores	DDG004 - North Easement	DDG005 - Adjacent Vent Site	DDG006 - Adjacent Vent Site
Month		Insoluble Solids	Insoluble Solids	Insoluble Solids	Insoluble Solids	Insoluble Solids	Insoluble Solids
Jan-22	4	0.10	0.40	1.20	1.50	0.50	0.20
Feb-22	4	0.70	1.60	1.90	1.20	1.40	0.40
Mar-22	4	0.10	0.70	0.40	0.50	1.20	0.30
Apr-22	4	0.20	0.70	0.80	0.90		0.30
May-22	4	0.10	0.10	0.10	0.40		0.10
Jun-22	4	0.30	0.60	0.30	0.80		0.10
Jul-22	4	0.1	0.5	0.1	0.6		0.20
Aug-22	4	0.1	0.1	0.1	0.5		0.10
Sep-22	4	0.6	1.1	1	0.9		0.40
Oct-22	4	0.3	0.7	2.4	0.8		0.10
Nov-22	4	0.3	1.3	1.1	0.8		12.50
Dec-22	4	0.4	0.5	0.9	0.8		0.20
2022 AVG	4	0.3	0.7	0.9	0.8	1.0	1.2

Notes: 1) For site locations refer **Figure 10**. 2) purple – increase >2g/m²/month

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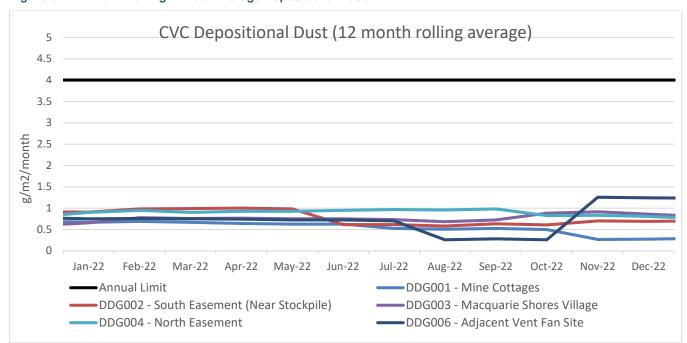


Figure 8 - CVC 2022 Rolling Annual Average Depositional Dust

There was one instance where a result exceeded the 2 g/m²/month increase limit, DDG006 (October 2022 to November 2022 result), the increase was 12.4 g/m²/month. The rises in deposited material were anomalous to other gauge readings located around the site and were not repeated in on-going monitoring. It was noted that the site targeted by DDG006 is the CVC Ventilation fan site, which operated consistently without change 24/7 year-round. Investigation into the exceedance determined there was no change in site operations contributing to the elevated monthly sample and that CVC would continue monitoring and undertake further action should the results remain elevated. The sample was also noted to be 92% ash after combustion with coal mined at chain valley colliery typically has an ash content around 25-30%, indicating that the dust reported was not produced by the operation.

Annual averages were similar to the maximum predicted cumulative air quality impacts identified in the EIS (May 2013) as presented in Table 3 of the Air Quality Management Plan. Long term (2012-2022) depositional dust annual average values are shown on **Figure 9**.

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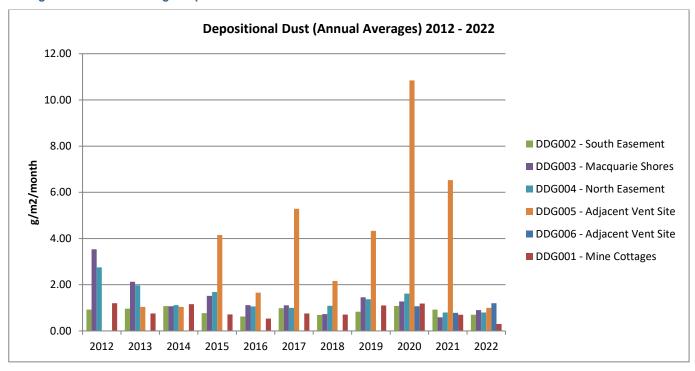


Figure 9 - Annual Average Depositional Dust Trend

6.1.2 PM₁₀ Monitoring

The real-time air quality monitor was installed in late 2013 within the Mannering Park Wastewater Treatment Plant site. The site is identified as RTD001 with the location shown on **Figure 10**. The real-time monitor measures particulate matter less than 10 microns (μ m) in size (PM10).

Data capture from the real time monitor for the 2022 period was 98.9% with 361 days monitored of 365 available days. There were no exceedances of the EPA short-term 24hr average criteria (50 μ g/m³) during the reporting period.

The annual average criterion (25 µg/m³) was not exceeded during the 2022 period. Daily results, the rolling average and relevant limits are shown on **Figure 11**.

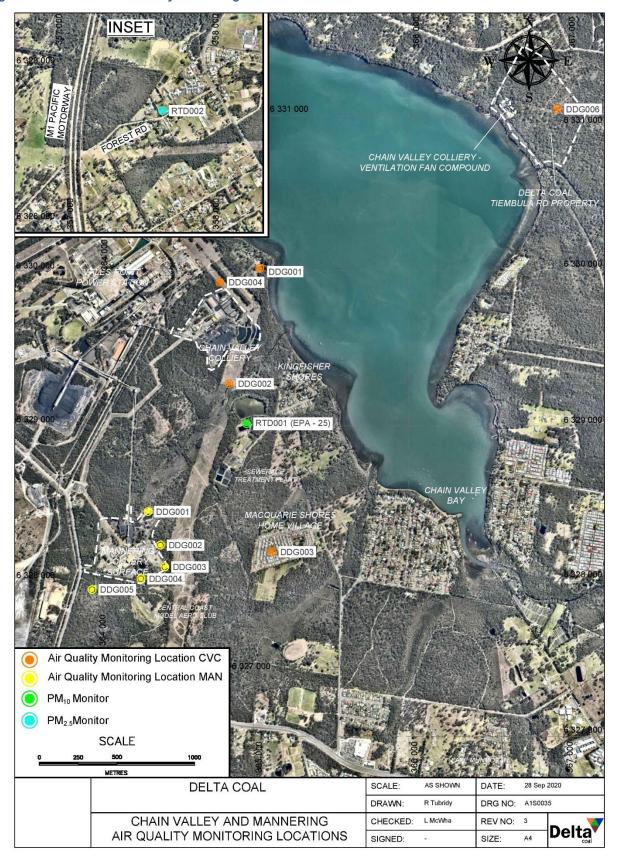
Daily (24-hour) results ranged from a minimum of 4.9 μ g/m³ to a maximum of 39.5 μ g/m³ during 2022. The 2022 annual average of 24hr PM₁₀ results was 12.1 μ g/m³. The most comparative locations from the EIS where PM₁₀ air quality modelling was completed relate to receptors R12 and R15, with cumulative PM₁₀ annual average predictions of 22 μ g/m³ and 20 μ g/m³ respectively. The actual location of real time PM₁₀ monitoring is in between these two receivers, as such, a result of 12.1 μ g/m³ is below modelled values.

Monitoring of the PM₁₀ via the TEOM unit commenced in late December 2013. When comparing the 2022 annual results to the previous year, the data capture rate was slightly improved to 2021. Data from the commencement of monitoring through to the end of the reporting period is shown on **Figure 12**.

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Figure 10 - Delta Coal Air Quality Monitoring Locations



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Figure 11 - CVC 2022 PM₁₀ Particulate Monitoring

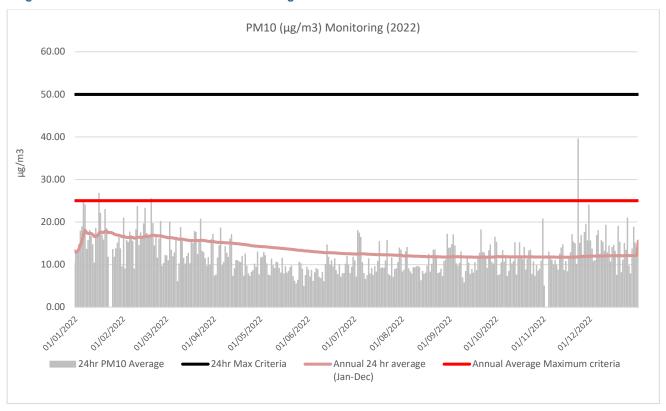
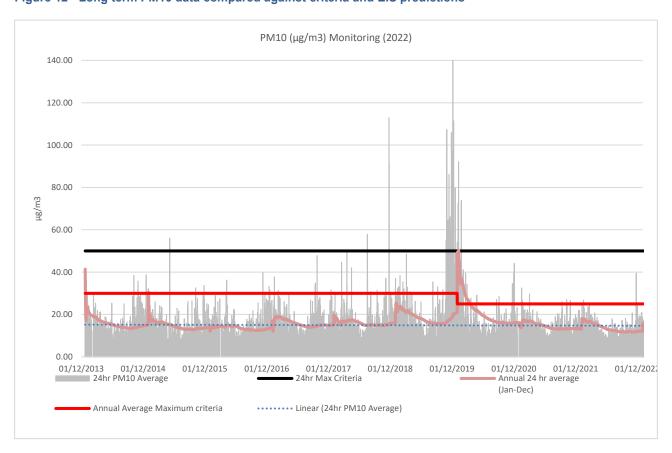


Figure 12 - Long term PM10 data compared against criteria and EIS predictions



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In relation to **Figure 12**, note that the apparent yearly spikes in the rolling annual averages are associated with the commencement of a new calendar year when the annual average "resets", and is not reflective of significant air quality changes. Additionally, seasonal variations in concentrations, particularly increases in PM₁₀ load during summer, impacts the long-term data as evident in **Figure 12**. As noted in the linear trend line for the dataset there has been no observable increase or decrease in PM₁₀ concentration trends since commencement of monitoring in December 2013.

The operation of a water cart continued throughout the current reporting period. The water cart operates around the unsealed surface areas, including hardstands, roads, coal stockpile and handling area. It is noted that in the reporting period, CVC completed sealing of the site carparks with a bitumen seal. There were no complaints received or environmental incidents during the reporting period relating to dust with exception to one anomalous depositional dust exceedance in DDG006 discussed in Section 6.1.1.

6.1.3 PM_{2.5}

In accordance with Table 3, Condition 11 of Schedule 3 SSD-5465 (as modified), Delta Coal commenced monitoring of PM_{2.5} concentrations following the approval of Modification 3 to SSD-5465 in June 2020. PM_{2.5} monitoring for the 2022 period utilised Delta Electricity's PM_{2.5} Beta-attenuation monitor (BAM) which was replaced with a TEOM unit at the same location at Tingley Road, Wyee as shown on the inset on **Figure 10**. Delta Coal's current arrangement to monitor PM_{2.5} was approved within Delta Coal Air Quality and Greenhouse Gas Management Plan last approved on 21 March 2022. PM_{2.5} concentrations for the 2022 reporting period have been displayed on **Figure 13**.

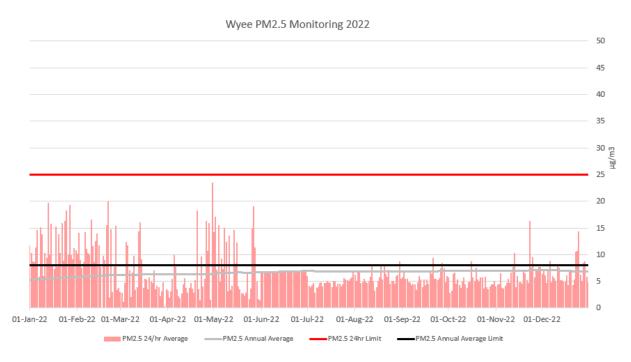
No exceedances of PM_{2.5} criteria were observed in the 2022 reporting period. The average PM_{2.5} concentration for the period of 1 January 2022 to 31 December 2022 was 6.8 μ g/m³ with 24/hour averages between 0.0 and 23.4 μ g/m³.

It was noted that during the reporting period, there were instances where Delta Coal reported $PM_{2.5}$ exceedances prior to receiving validated data from the plant maintenance and calibration contractor Verico Pty Ltd. Following review of data, the reported non-compliances were not considered to be exceedances of $PM_{2.5}$ criteria.

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Figure 13 – CVC PM2.5 Monitoring 2022



The air quality monitoring program, including depositional dust, PM₁₀ and PM_{2.5} monitoring will continue into the 2023 reporting period.

6.2 Contaminated Land

There were no significant spills during the reporting period or reports of polluted land.

There is no known contaminated land at CVC, however it is expected that a detailed contamination study, such as an environmental site assessment would be completed at a time closer to mine closure as part of the operational rehabilitation requirements.

6.3 Threatened Flora

6.3.1 Aquatic Flora

Seagrass communities are a major feature of Lake Macquarie, which have the potential to be affected by subsidence as a result of mining activities under the Lake. To ensure protection of the seagrass communities from mining related impacts a Seagrass Protection Barrier was placed around the mapped seagrass communities, with the barrier extending out to the 26.5° angle of draw to the Colliery workings. Only first workings are permitted in the Seagrass Protection Barrier, which will result in negligible subsidence (<20 mm).

Seagrass monitoring occurred during the reporting period in accordance with the 2022 seagrass monitoring report reproduced in **Appendix 3**. Seagrass transect locations are shown in the report.

The discussion from the report (Laxton, June 2021) related to the results obtained during the reporting period highlighted the following:

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- In June 2022 seagrass cover ranged from 79 to 100 percent. The seagrasses were in good condition, with most seagrasses not fouled or only lightly fouled with epiphytic algae. Algae coverage of the seagrasses had improved to the prior year;
- Since 2008 seagrass coverage has been increasing throughout the study area, and percentage cover has been consistent since 2012. This is reflected in the percentage of bare ground observed in the study transects, with bare ground decreasing from 38.13% in 2011 to 6.36% in 2022 in the Summerland Point, Frying Pan Bay and Sugar Bay region. In the Chain Valley Bay region bare ground has decreased from 13.32% in 2011 to 0.58% in 2022. In Crangan Bay, bare ground has decreased from 26.98% in 2011 to 2.5% in 2022;
- Seagrass cover was relatively consistent with 2021 monitoring, with minor natural variations as expected when monitoring and ecosystem; and
- The study concluded that the June 2022 seagrass monitoring programme shows compliance to the SSD-5465 (MOD 4) Schedule 4, Condition 2 being that seagrass display nil to minor environmental consequences due to underground mining.

Figures 9.1 to 9.6 in the June 2022 Seagrass Annual report (**Appendix 3**) details percentage changes in of seagrass coverage in the study area.

6.3.2 Terrestrial Flora

Potential impacts to threatened flora would arise from either impact or clearing of vegetation communities surrounding the pit top and ventilation shaft site which have been classified as the following communities:

Surrounding the pit top area:

- Coastal Open Woodland;
- Swamp Oak Forest; and
- Swamp Sclerophyll Forest.

Surrounding the ventilation shaft site:

- Coastal Open Woodland;
- · Grassy Open Woodland and
- Swamp Sclerophyll forest.

Figure 14 and **Figure 15** identify the approximate boundaries of the communities surrounding the surface infrastructure.

A Biodiversity Management Plan was previously completed and approved in 2014. A review and update of management plans, including the CVC Biodiversity Management Plan, was completed in 2019. The latest approved version of this document is available from the Delta Coal website, the Biodiversity Management Plan

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was updated and submitted for consultation in 2022 and is expected to be approved and enacted in the 2023 reporting period.

Annual biodiversity monitoring was undertaken by EMM Consulting in accordance with the Biodiversity Management Plan was continued during the reporting period. Fieldwork was carried out on 6 January 2023 for the 2022 reporting period, the impact of this delay to the validity and representativeness of the annual biodiversity monitoring is considered to be insignificant. The 2022 annual biodiversity monitoring report is provided as **Appendix 4**.

The annual biodiversity monitoring specifically monitors:

- the Swamp Oak Floodplain Forest condition below the sediment dams;
- Vegetation community condition at the ventilation shaft site;
- weeds (both at the pit top area and ventilation shaft site); and
- feral animal activity.

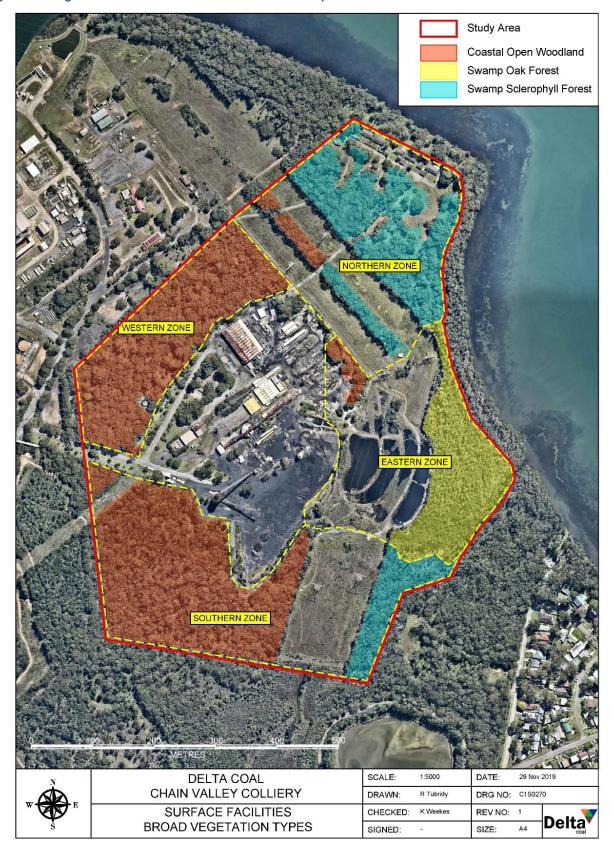
The monitoring results were assessed against the criteria and triggers within the Biodiversity Management Plan with no trigger levels being reached. Specifically, monitoring of the two established plots within the Swamp Oak Floodplain Forest, recorded a total weighted score of 67.8% which is higher than the established trigger value of 60% (refer to the Biodiversity Management Plan for details on site attributes and methodology for determining the weighted score) and a broadly similar to the score in the 2021 annual monitoring of 68.1%.

No evidence of feral animals had been detected in the 2017-2019 period, however in 2020 two feral animal species were recorded using the presence of scat indicators and in 2021 one scat indicator of the European fox was identified in the Swamp Oak Forest, in the 2022 monitoring period one scat was observed from the European Fox consistent with 2021 monitoring results. Weed monitoring and management is discussed in **Section 6.5**.

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Figure 14 - Vegetation Communities around the CVC Pit Top Area



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Figure 15 - Vegetation Communities around the Ventilation Shaft Site



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6.4 Threatened Fauna

6.4.1 Terrestrial Fauna

No clearing works were undertaken during the reporting period and as a result potential to impact threatened fauna or other native fauna was minimised. The annual biodiversity report for the 2022 reporting period is provided as **Appendix 4**.

6.4.2 Aquatic Fauna

In 2021 Delta Coal undertook seasonal benthic communities monitoring within the sediment of Lake Macquarie, the surveys were completed in March 2022 (autumn) and September 2022 (spring) in accordance with the approved Benthic Communities Management Plan. The spring and autumn monitoring undertaken in 2022 sampled 22 benthic stations, benthic sampling locations are shown on **Figure 16**. The March 2022 and September 2022 benthic communities monitoring reports are provided in **Appendix 5**.

In 2022 Delta Coal undertook biennial statistical evaluation of benthic communities monitoring data. The benthic communities biennial statistical analysis has been provided as **Appendix 6.** The benthic statistical analysis reviewed monitoring data from 2012-2022 and observed the following:

- Statistical analysis of CVC's benthic monitoring data, primarily undertaken for the period September 2016 to September 2022, did not identify statistical differences between the benthic assemblages evident at sites designated as Impact, Reference and Control;
- From an ecological perspective, the benthic assemblages across the monitoring area fall into several
 groups (statistically) that do not appear to be a response to CVC operations but are most likely
 grouping because of environmental factors;
- Concluded that the results of statistical analysis of CVC's benthic monitoring data indicate that no
 exceedance of the Benthic Communities Management Plan subsidence impact performance measure
 of "minor environmental consequences, including minor changes to species composition and/or
 distribution" has occurred. Consequently CVC is not required to implement any additional
 investigations of benthic communities within the project study area at this time and should continue
 the monitoring of benthic assemblages; and
- Given the absence of statistically relevant differences between benthic assemblages at CVC's impact
 monitoring sites when compared to the reference and control sites, it was recommended that the
 frequency of CVC's benthic monitoring could be reduced to once per year.

In monitoring undertaken between 2012 and 2022 the mud basins off Summerland Point, in Chain Valley Bay and Bardens Bay, were found to be inhabited by 26 different taxonomic groups. Polychaete worms and bivalve molluscs were the most frequently encountered fauna.

Benthic Community monitoring undertaken in the 2022 reporting period identified the following:

• the same suite of organisms dominated each of the 22 sample stations as in previous years. These were polychaete worms and bivalves;

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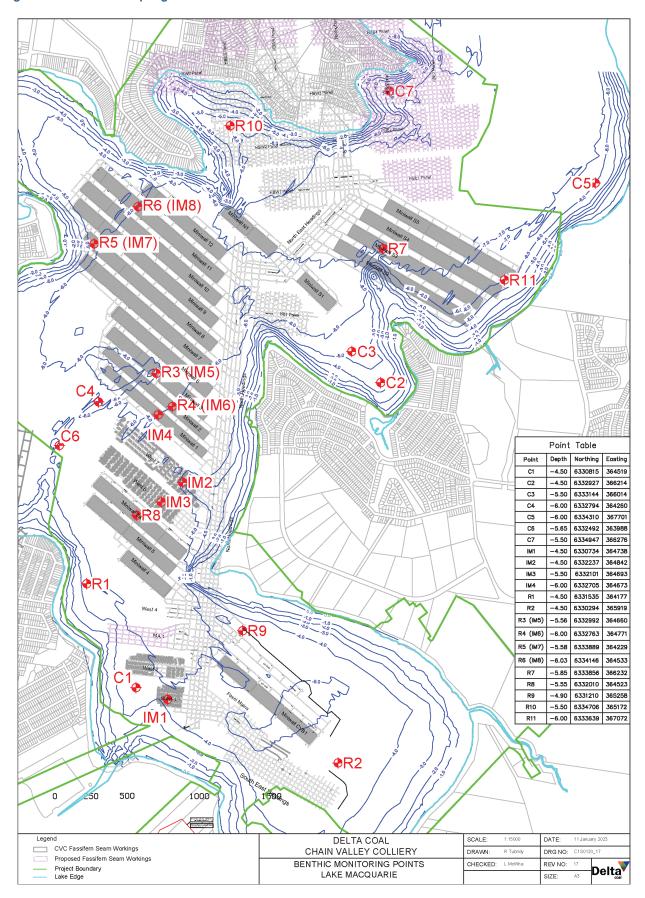
- In March 2022 a total of 1196 organisms greater than 1mm in size were found, comprising 10 species. This compares with the results from March 2017, March 2018, March 2019, March 2020 and March 2021 where 1031, 1160, 832, 1032 and 797 organisms respectively were recorded representing approximately twelve species.
- In September 2022 a total of 1981 organisms greater than 1mm in size were found, comprising 12 species. This compares with the results from September 2018, September 2019, September 2020 and September 2021 where 1576, 815, 1367, 1032 and 2096 organisms respectively were recorded representing approximately twelve species.
- stations were distinguished by the relative abundance of the dominant species;
- water depth was not in any way important in determining the species composition at a station; and
- Physical variables such as salinity, conductivity and turbidity of the bottom water had little influence on the species composition of the benthos. Dissolved oxygen concentration, however, can have a major effect on abundance. Major extinction events have occurred in the mud basin of Lake Macquarie. The evidence for this lies in the presence of large numbers of intact but dead bivalve shells entombed in the mud. The cause of extinction events appears to be prolonged dissolved oxygen depletion of bottom water. Prolonged dissolved oxygen depletion of the bottom water was measured during the water quality study conducted by Laxton and Laxton (1983 to 1997) and low dissolved oxygen levels were measured during the March 2020 benthic survey. In March and September 2021, the total number of organisms found in sediment from the 22 stations were 797 and 2096 organisms collected respectively. There was a suspected extinction event observed in 2019 with recovery observed throughout 2020. The reduced number of organisms in the March 2021 was considered to be attributed to seasonal impact as opposed to an extinction event, with significant recovery observed in September 2021. In March 2022, dissolved oxygen levels of Lake Macquarie ranged from 4.2% saturation to 114.1% saturation. In September 2022, dissolved oxygen levels of Lake Macquarie ranged from 7.34 mg/L to 8.54 mg/L or 93.8% to 109.2%.saturation. Surface waters had higher concentrations of dissolved oxygen than the bottom waters.

The results appear to support the notion that increasing the water depth by the predicted 0.78 m subsidence (SSD-5465 subsidence limit in Lake Macquarie) has, to date, had no discernible effect on the composition and abundance of organisms making up the benthos of the mud basin.

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Figure 16 - Benthic Sampling Locations



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6.5 Weed Management

Identification, treatment and ongoing monitoring are the key steps in managing weeds that surround the surface infrastructure areas (pit top area and ventilation shaft site).

During the reporting period Delta Coal engaged a land-care contractor to undertake a weed control campaign across its operational areas. The main weeds targeted included Lantana, Bitou Bush, Crofton Weed and Pampas Grass. See **Appendix 7** for the Weed Action Plan. Delta Coal will be continuing the weed control program in the 2023 reporting period. The 2022 annual biodiversity monitoring report (**Appendix 4**) noted the following regarding weed control at CVC:

"Whilst evidence of weed control was observed in some areas, ongoing control is recommended to suppress those weeds still present and to prevent re-establishment in treated areas."

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6.6 Blasting

No surface blasting activities were undertaken during the reporting period at CVC. From time to time, small amounts of explosives are used underground to remove geological intrusions into the coal seam to create overcasts or inter-seam shafts. This blasting is not relevant to environmental impact.

6.7 Operational Noise

Relevant noise criteria from SSD-5465 (Mod 4) and EPL 1770 are provided in **Table 9**. Attended noise monitoring locations are shown on **Figure 18**.

Table 9 - CVC Noise Criteria dB(A)

		Day	Evening	Ni	ght
Location	NMP ID	LA _{eq(15 min)}	LA _{eq(15 min)}	LA _{eq(15 min)}	LA _{1(1 min)}
R8 (EPL Point 9)	ATN001	38	38	38	45
R11 (EPL Point 12)	ATN002	49	49	49	54
R12 (EPL Point 13)	R12	49	49	49	53
R13 (EPL Point 14)	R13	43	43	43	49
R15 (EPL Point 16)	ATN003	36	36	36	45
R19 (EPL Point 20)	ATN006	37	37	37	45
R22 (EPL Point 23)	ATN007	46	46	46	46
All other privately- owned land	-	35	35	35	45

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The long-term noise goals are reproduced in **Table 10**. Mechanisms that will be used to achieve these goals are detailed in Section 2.6 of the Delta Coal Noise Management Plan. It is noted that during the reporting period Delta Coal commenced a Noise Mitigation Options Assessment for reasonably and feasibly achieving long-term noise goals, focusing in particular on Receiver 22, at the time of reporting the Noise Mitigation Options Assessment is ongoing and forecasted for completion in the 2023 reporting period.

Table 10: CVC Long-term Noise Goals dB(A)

Location	Day L _{Aeq(15 min)}	Evening L _{Aeq(15 min)}	Night L _{Aeq(15 min)}
R11-13	41	41	41
R22	40	40	40

During the reporting period, quarterly environmental noise monitoring was undertaken on 14, 15 and 18 March (Quarter 1), 20 and 22 June (Quarter 2), 7, 12 and 15 September (Quarter 3) and 14, 15 and 16 December (Quarter 4) 2022.

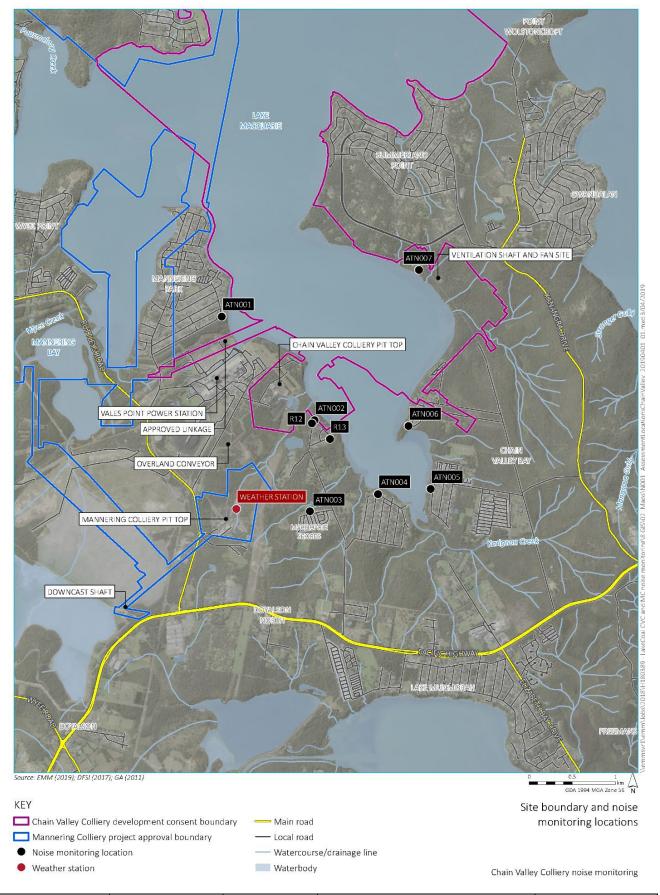
Attended noise monitoring during the 2022 reporting period was undertaken in accordance with the methodologies described in the approved Delta Coal Noise Management Plan. Attended noise monitoring results for the reporting period are provided in **Appendix 7**. CVC was compliant with the relevant limits during 2022 noise monitoring, with exception to one exceedance at location R22 during monitoring being undertaken for the Noise Mitigation Options Assessment as opposed to compliance noise monitoring primarily due to the application of a +5dB low-frequency noise modifying factor. The exceedance was reported to the NSW DPE and NSW EPA. The ventilation fan silencers were cleaned after the incident with results indicating that noise emissions from the vent fan returned to a compliant level.

Following approval of the Delta Coal Noise Management Plan in March 2022 which proposed the removal of a real-time noise monitor located at former mine cottages demolished in 2020, the real time noise monitor was decommissioned in April 2022. The removal was justified as it no longer monitored a near-by receiver as well as the data being dominated by VPPS noise emissions.

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Figure 17 - CVC Noise Monitoring Locations



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6.8 Visual, Stray Light

The pit top area and ventilation shaft site are not dominant features of the landscape. The pit top area is somewhat overshadowed by the adjacent power station. The ventilation fans were also designed to maintain a relatively low profile, below the surrounding vegetation to ensure amenity and lighting impacts were minimised.

There have been no significant changes to surface lighting during the reporting period and no visual amenity or lighting complaints were received in 2022.

A lighting and visual review was completed in 2019 as per the project approval conditions. A letter was received from DPIE on 17th February 2020 noting that "no lighting complaints have been received by the site in 2018 or 2019. As such, future lighting survey reports are not considered necessary, unless otherwise directed by the Secretary".

In accordance with the relevant Australian standard, no lights are directed offsite or installed to shine above the horizontal. Additionally, the nearest residents to CVC sites are approximately 300 m away.

6.9 Aboriginal Heritage

Chain Valley Colliery has a total of 3 heritage sites registered with AHIMS within the surface footprint. Two midden sites were identified in 2020 during demolition of the former mine cottages, and a known flake site adjacent the CVC pollution control dams. During 2022 no aboriginal heritage sites were identified nor were known sites disturbed, all sites within the surface foot print are fenced off-with high visibility fencing to prevent access or accidental disturbance.

The Heritage Management Plan was updated and submitted to for consultation and approval during the 2022 reporting period following an Independent Environmental Audit in 2022. The revised Delta Coal Heritage Management Plan is pending approval at the time of reporting.

6.10 Natural Heritage

There are no sites or items of historic heritage within the pit top area and ventilation shaft site as determined by both the Environmental Assessment completed in 2011 and the Environmental Impact Statement that was prepared to support the Mining Extension 1 Project.

Accordingly, no ongoing monitoring or management actions were required and none have been undertaken within the reporting period.

6.11 Spontaneous Combustion

The R₇₀ self-heating rate value recorded for a sample from the middle of the Fassifern Seam is 3.03 °C/h. This rates the coal as having medium intrinsic spontaneous combustion reactivity for New South Wales conditions.

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This value is consistent with the rank and type of coal and agrees with previous test results obtained for the Fassifern Seam at CVC. The self-heating rates of the samples from the CVC are significantly lower than coals from the Hunter Valley, and are also lower than Spring Creek Mine in New Zealand and San Juan Mine in New Mexico.

Moist adiabatic benchmark tests of the samples from CVC indicate that self-heating is controlled by the moisture in the coal and the initial start temperature. Heating development to thermal runaway would take in the order of 48 to 72 days for the middle of the Fassifern Seam, but the top and bottom of the seam show self-heating over a protracted period, before any possible thermal runaway could take place. Similarly, the higher ash content Chain Valley Rider Seam also shows a protracted delay in self-heating due to its lower intrinsic reactivity.

While the laboratory R₇₀ analysis of the Fassifern Seam coal at CVC indicates a medium propensity for spontaneous combustion, propensity to spontaneously combust is only one factor in a complex chain of conditions that can create spontaneous combustion in underground coalmines. There have been no known underground spontaneous combustion incidences in the Fassifern Seam at CVC. Accordingly, the risk of spontaneous combustion is considered to be low. Coal stockpiling is kept to a minimum and is managed in such a way as to limit risk of combustion.

Controls in place to mitigate the risk from spontaneous combustion include:

- sealing of extracted panels;
- consideration of spontaneous combustion issues within the mine design and utilisation of an Authority to Mine Permit:
- the development of Trigger Action Response Plans (TARP) for Spontaneous Combustion;
- segregation of extraction panels by an inter panel pillar; and
- monitoring of mine gases using a multipoint tube bundle gas analysis system and a real time gas monitoring system.

There were no incidents of spontaneous combustion at CVC during the reporting period.

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6.12 Bushfire

The pit top area contains vegetation which is considered to be bushfire prone land (Category 1) as shown on **Figure 19**. The ventilation shaft area has also been identified as containing Category 1 vegetation as shown on **Figure 20**.

As the project site is not a residential development, there are no strict requirements for fire management, with the exception of preventing fires within the project area and their spread to surrounding land.

To manage bushfire risk Delta Coal have the following management measures in place:

- a high capability for firefighting purposes through the 100 mm diameter mine water reticulation line and the mine Emergency Management System;
- breaks and trails in the vicinity of the pit top area and ventilation shaft site;
- fire hydrants and depots placed in strategic positions around the pit top area; and
- regular training of mine firefighting crews and liaison with local rural firefighting brigades.

Figure 21 shows the approved Asset Protection Zone (APZ) area. The establishment of the APZ's was undertaken during the 2017 reporting period to improve its bushfire protection zones. As detailed in the Biodiversity Management Plan, fire trails are inspected annually prior to the start of the Bushfire Danger Period. This inspection is scheduled via the Work Order system. An inspection was undertaken in August 2022 with follow-up slashing and clearing as required.

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Figure 18 - Bushfire Prone Land Map for CVC Pit Top Area (Source: Central Coast Council, 2022)



Figure 19 - Bushfire Prone Land Map for Ventilation Shaft Area (Source: Central Coast Council, 2022)



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Figure 20 - Chain Valley Colliery Approved APZ's and Fire Trails





Land management zones

Chain Valley Colliery Bushfire Management Plan

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6.13 Mine Subsidence

The Annual Subsidence Report as required by SSD-5465 (Statement of Commitments) is provided in **Appendix 9** of this report, this section provides a summary of subsidence monitoring at Chain Valley Colliery.

6.13.1 Overview of Mining Progress

Please refer to **Section 4.4** for details of the mining activities undertaken during the 2022 reporting period.

6.13.2 Approvals

During the reporting period Delta Coal undertook its mining activities in accordance with its extraction plan approvals for Miniwall S5 and Northern Mining Area.

6.13.3 Subsidence Surveys

Subsidence surveys are required to be undertaken annually as a minimum, with reference monitoring points located on shorelines nearby any mining activities. Shoreline surveys are also undertaken at intervals corresponding with key Miniwall retreat milestones.

Bathymetric surveys are also undertaken each year to gauge subsidence levels over the area of secondary extraction undertaken beneath Lake Macquarie, where land-based surveys are not possible.

Delta Coals subsidence monitoring commitments are presented in Table 11.

Table 11 - Delta Coal Subsidence Monitoring Commitments

Type of monitoring	Pre-extraction requirements	During extraction requirements	Post extraction requirements		
Secondary Extraction					
Bathymetric surveys	Single baseline survey prior to extraction	End of panel (of relevance to S2, S3, S4 and S5) Annual surveys over areas of pillar extraction (not commenced)	Annual for three years unless TARP triggered (as committed in Subsidence Monitoring Program) Six monthly bathymetric scans committed in SSD-5465 Statement of Commitments		
Foreshore monitoring	Baseline survey prior to commencement of extraction	Monthly intervals	Annual for three years unless TARP triggered		
Pelican Rock Navigation Marker	Baseline RL and tilt measurements	End of panel (of relevance to S2 and S3)	Visual inspection and confirmation from RMS of nil impacts		
First Workings					
Terrestrial based subsidence monitoring (foreshore)	Baseline prior to extraction	Annual surveys during extraction unless TARP triggered	Annual surveys ongoing unless TARP triggered		

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Type of monitoring	Pre-extraction requirements	During extraction requirements	Post extraction requirements
Terrestrial based subsidence monitoring (along main roads in suburbs of Brightwaters, Mirrabooka and Sunshine)	Baseline prior to extraction	Annual surveys during extraction unless TARP triggered	Annual surveys ongoing unless TARP triggered

6.13.4 Performance Measures

Performance measures summarised from SSD-5465 are detailed in **Table 13**.

Table 12 - SSD-5465 Summary of Subsidence Performance Measures

Condition No.	Condition
Schedule 4, Condition 1	The Applicant must ensure that vertical subsidence within the High Water Mark Subsidence Barrier and within seagrass beds is limited to a maximum of 20 millimetres (mm). If at any stage predicted subsidence levels are exceeded within these areas, an ecological monitoring program shall be initiated to assess the impacts to ecological communities and threatened species and if appropriate, offsets are to be provided for any impacts detected.
Schedule 4, Condition 2	The Applicant must ensure that the development does not cause any exceedance of the performance measures in Table 6 to the satisfaction of the Planning Secretary.
Schedule 4, Table 6: Subsidence Impact Performance Measures - Natural and Heritage Features	First Workings under an approved Extraction Plan beneath any feature where performance measures in this table require negligible environmental consequences. They are to remain long term stable and non-subsiding
Schedule 4, Condition 4	The Applicant must ensure that the development does not cause any exceedances of the performance measures in Table 7, to the satisfaction of the Planning Secretary.
Table 7, Schedule 4: Subsidence Impact Performance Measures - Built Features	Trinity Point Marina Development and other built features. They are to remain: • Always safe; • Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated; • Damage must be fully compensated.

6.13.5 Foreshore Monitoring

Delta Coal completes subsidence monitoring around Trinity Point, Brightwaters, Mirrabooka, Sunshine Frying Pan Bay, Summerland Point, Chain Valley Bay (**Figure 23**). Monitoring points occur along the foreshore at approximately 20 m – 30 m intervals where practicable / achievable with a slightly wider distribution of monitoring points in the Northern Mining Area (50 – 80 m in some areas). The results are issued to the Resources Regulator within 10 days of survey. In addition, observations are made where required to report on visual impacts or changes to public safety risk. A Subsidence Inspection Proforma is completed with each survey. The proforma includes visual inspection of steep slopes, boulder or tree instability, ponding and other potential effects of mine subsidence. Annual foreshore surveying was undertaken in January and February 2022 with additional quarterly monitoring undertaken at the request of the Resources Regulator for Lines 50 and 51 overlying the Northern Mining Area (predominant area of workings within the 2022 reporting period).

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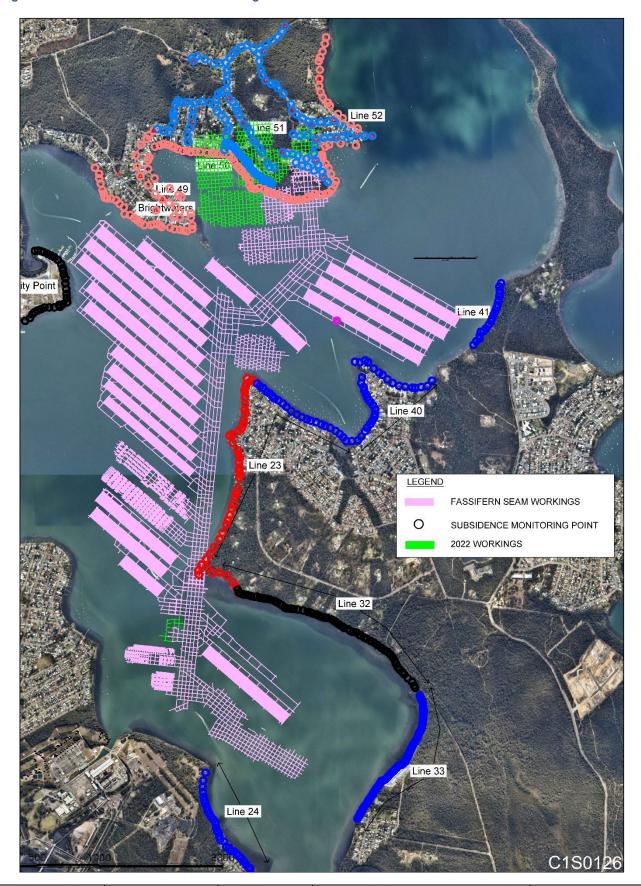


No subsidence attributable to mining operations undertaken in the 2022 reporting period were detected. subsidence monitoring results are graphically presented in the 2022 Annual Subsidence Report (**Appendix 9**).

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Figure 21 - Foreshore Subsidence Monitoring Points



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Line 49, 50, 51 and 52

Foreshore monitoring lines 49, 50, and 51 where installed with baseline levels recorded in 2021. Line 52 was installed in 2022 to extend foreshore monitoring as mining progressed north. Lines 49, 50, 51 and 52 were installed for the purpose of monitoring potential subsidence associated with future northern mining area workings. An annual survey for areas of extraction was undertaken 2022 and will be ongoing in 2023.

Brightwaters Monitoring Line

Monitoring points were installed along the Brightwaters peninsula in June 2016 to monitor the effects of Miniwall 11 and 12 extraction. Nil subsidence movement has been detected along the monitoring line.

Trinity Point

Monitoring points were installed in the area in 2014 for shoreline monitoring during extraction of Miniwalls 7-12 panels. A number of marks have been disturbed / destroyed due to development / construction works along the foreshore in the area, however nil movement attributable to subsidence has been detected.

Summerland Point, Lines 23, 32, 40 and 41

The foreshore along Summerland Point has been monitored since 1994, after secondary extraction was undertaken in the Wallarah seam beneath the south-western point (corresponding to mark S63 – 74). Approximately 130-150mm of subsidence was measured (Point S71 – Line 23) since 1994.

Monitoring points along Line 40 were established in 2018 to monitor the shoreline adjacent to Miniwall S1. This line was extended in 2019 as part of the subsidence monitoring program for Miniwall S2 and S3. Minor ground movement along the line is limited to ±5mm and appears seasonal, subsidence appears to be limited to negligible subsidence (<20mm). Monitoring of Line 40 was undertaken monthly during MWS2 – MWS4 extraction.

Line 41 was established in July 2020 to monitor the shoreline adjacent Miniwall S4. Monitoring was undertaken monthly during extraction and as part of annual monitoring, surveying has indicated to date nil to negligible subsidence (<20mm).

Chain Valley Bay, Lines 24 and 33A

Surveys of the existing monitoring points along the foreshore of Chain Valley Bay (many of which had experienced 40-60mm of subsidence) were ongoing during the reporting period, and where required additional monitoring locations were installed. Similarly to the Summerland Point monitoring, many of the historically monitored subsidence marks have experienced greater than negligible subsidence (20mm), however no additional subsidence movement was detected during the miniwall extraction in CVB.

Monitoring results for Line 24 shows potential minor changes in level in the reporting period from points L24A-03 to L24A-17, however any identified vertical movement was negligible (< 20mm). No additional subsidence was observed at Line 33A within the reporting period.

As the area where Line 33A monitoring marks are located is along a public reserve where regular slashing / brush-cutting activities are carried out, a number of monitoring points have been disturbed / moved over

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time. Where this type of movement occurs, the new RL point is adopted and monitoring continues (i.e. Point 62A).

Pelican Rock Navigational Marker

As described in CVC's Subsidence Monitoring Program, Pelican Rock Navigation Marker is expected to be impacted by approximately 130 mm of subsidence from mining within Miniwall panels S2 and S3.

NSW Roads and Maritime Services (RMS) has indicated a functional impact on the marker is likely to occur at 500 mm of subsidence and 5° or 87 mm/m of tilt.

A survey for RL and tilt was conducted on 10 July 2019 by Daly Smith Surveyors prior to mining and measured Pelican Rock Navigation Marker was 1.14 mm Australian Height Datum (AHD) and the navigational pole was vertical. A survey for RL and tilt was conducted on 10 July 2019 by Daly Smith Surveyors.

The following surveys were undertaken by Daly Smith after Miniwall S2 extraction in March 2020 recording the level at 1.13 m AHD and following Miniwall S3 extraction in August 2020 recording the height at 1.11 m AHD. The August 2020 measurement of the Pelican Rock Navigational Marker commented that the pole was found to be vertical and its metal base to be level. No further monitoring of the marker is considered to be required following the completion of Miniwall S3 extraction indicated approximately 300 mm of subsidence, within a range not considered to have an effect of the functionality of the marker.

6.13.6 Lake Floor Bathymetric Survey / Scanning

Chain Valley Colliery's Secondary Extraction subsidence monitoring requirements are presented in **Table 11**. It is noted that subsidence predictions were not updated for subsequent extraction approved and proposed after initial subsidence predictions, hence there have been exceedances of subsidence predictions triggering geotechnical review, however all subsidence recorded has remained within the sites subsidence limit.

Table 13 - Chain Valley Colliery Secondary Extraction Subsidence Monitoring Commitments

Secondary Extraction Panel	Approved S _{max} (mm)	Predicted S _{max} (mm)	Measured S _{max} (mm)	Extraction Completion date	Post Extraction Monitoring Commitment
Miniwall S1	780	410	<200	February 2019	Annual for 3 years unless TARP triggered
Miniwall S2	780	300	300-350	March 2020	Annual for 3 years unless TARP triggered
Miniwall S3	780	300	500-550	July 2020	Annual for 3 years unless TARP triggered
Miniwall S4	780	300	600-650	February 2021	Annual for 3 years unless TARP triggered
Miniwall S5	780	500	450-500	August 2021	Annual for 3 years unless TARP triggered
NMA Pillar Extraction	780	500	n/a	Not commenced in 2022.	Annual for 3 years unless TARP triggered

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Bathymetric scans undertaken in the 2022 reporting period have been provided as Figure 2 in the 2022 Annual Subsidence Monitoring Report (**Appendix 9**):

• MWS1, MWS2, MWS3, MWS4, MWS5, NMA First Workings (annual survey and completion of extraction survey for MWS5) undertaken in September 2022. Subsidence remained below the 0.78m limit imposed in Development Consent SSD-5465, with a maximum subsidence of 500-650mm observed over Miniwall S4. The maximum subsidence of Miniwall S4 triggered level 1 of the Chain Valley Colliery subsidence TARP and as such prompted a geotechnical review of the results and underlying workings to ensure on-going stability and compliance to the 0.78m subsidence limit.

Final surveying was undertaken of the CVB1 area in 2021 with CVB1 monitoring not undertaken in 2022.

In the 2022 reporting period Delta Coal missed a 6-monthly bathymetric scan, with only one scan undertaken for the reporting period in September 2022.

Subsidence between Miniwalls MWS2-MWS4 and the Lake Macquarie foreshore was monitored via bathymetric scanning, as required to substitute foreshore monitoring, with negligible subsidence observed to the foreshore and seagrass protection zone.

6.14 Hydrocarbon Contamination

Hydrocarbons are managed in accordance with the site Storage of Fuel and Chemical Standard.

Suitable bunding has been installed around all liquid storage areas with an oil separator installed on the wash down sump which treats water prior to transfer of the treated water to the site sediment dams. Spill kits are also located at hydrocarbon storage areas. All waste oil is taken off site by an external licensed waste collection company. A weekly inspection regime is in place to check waste oil levels and arrange disposal on an as required basis.

During the reporting period any contaminated material encountered on site was disposed of at a licensed waste facility by the site's approved waste management contractor.

6.15 Methane Drainage and Greenhouse Gases

Methane levels in the Fassifern seam of approximately $2 - 4 \text{ m}^3/\text{t}$ is not at a level that allows pre or post gas drainage, and as such all methane from the mining operations are ventilated from the via the main fans at Summerland Point.

The methane levels in the return are low enough to ensure operations are not adversely affected by the gas levels.

Methane levels are manageable with the existing ventilation system there are no plans to install pre or post gas drainage infrastructure at this time.

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Methane emissions from CVC are reported annually to the Clean Energy Regulator in accordance with the *National Greenhouse and Energy Reporting Act 2007* (NGER Act).

For the Financial Year 2021-2022 period (NGER reporting period) CVC emitted approximately 542,408 tonnes of CO₂-e as Scope 1 and Scope 2 emissions.

6.16 Public Safety

Public safety is primarily a concern around the surface facilities at CVC being both the pit top area and the ventilation shaft site.

The public safety around the ventilation shaft site is afforded by:

- restricting access to the site by utilising a locked access gate across the access road;
- provision of a security fence around the entire perimeter of the compound, with locked access gates;
 and
- security monitoring.

In relation to the pit top area, there is one sealed access road into the site which has a set of lockable gates present, which can be closed should the need arise to stop access to the site. These gates may be closed and locked at times of no expected traffic, such as during the night time period but would otherwise remain open for deliveries, employee and authorised visitor access. A security firm is also engaged to undertake scheduled site security checks and remote alarm monitoring and reporting. The security checks are random, but typically undertaken at times of higher unauthorised access risk such as nights, public holidays and weekends.

Public access is monitored and managed during operation of the mine through the standard incident reporting process which includes reporting of unauthorised access.

A visitor login system onsite ensures that authorised visiting members of the public are assigned a site contact and that upon login the site contact is notified immediately by email of the visitors' presence onsite.

A Built Features Management Plan was developed for the Extraction Plan associated with Miniwall S4 as well as the Extraction Plan for Miniwall S5 and Northern Pillar Extraction. This included subsidence monitoring for foreshore infrastructure.

Public safety is also a consideration in the road coal haulage operations; this is discussed in Section 6.17.

During the reporting period there were no incidents of injury to the public as a result of Delta Coal's operations.

6.17 Other Issues and Risks

During the reporting period CVC did not undertake any coal haulage and as such was not required to undertake an independent traffic audit as completed in previous years.

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Delta Coal was not required to complete an independent traffic audit for the 2022 period as no coal haulage was undertaken during the reporting period, Delta Coal submitted a notification to the NSW DPE regarding this and received acknowledgement from the NSW DPE with no comment (23 January 2023).

6.18 Summary of Environmental Performance

In summary, environmental performance during the reporting period for CVC is detailed in **Table 13**.

Table 13 - Environmental Performance

Aspect	Approved criteria/ EIS prediction	Performance during the reporting period	Trend/ key management implications	Implemented/ proposed management actions	
Noise	Chapter 9 Noise (EIS, EMGA Mitchell McLennan 2013)	Generally in accordance with approved criteria.	Main trend (attended noise monitoring during 2022): Quarterly noise monitoring results from the AR reporting period indicate that CVC is operating within relevant limits and is not the dominant source of environmental noise within the vicinity. VPPS is audible to receivers to the north and the Pacific Highway is also audible from the south. The CVC ventilation fan site is an exception to the above were it is typically audible at ATN007 monitoring location. The EIS predicted that that CVC will operate within acceptable noise limits.	There were no exceedances during 2022 quarterly attended noise monitoring (see Appendix 8 for results). However there was one exceedance at R22 during monitoring undertaken for the noise mitigation options assessment. Mitigation actions of cleaning the ventilation fan silencers was undertaken, with further monitoring to be undertaken to determine long-term noise mitigation requirements for R22. Noise management will continue to be monitored in an effective manner.	
Blasting	n/a	n/a	n/a	n/a	
Air Quality	Chapter 10 Quality and Greenhouse Gases (EIS, EMGA Mitchell McLennan 2013)	In accordance with approved criteria and EIS predictions	Main trend (depositional dust results 2022): Based on modelling in the EIS, total dust emissions from CVC are expected to be minor, at less than 2 grams/m²/month. No exceedances of depositional dust limits were attributed to mining operations during the reporting period. The depositional dust PM10 and PM2.5 results for 2022 reflect CVC's compliance to air quality criteria, remaining minor at most	The air quality monitoring program, in accordance with the approved management plan, was ongoing at the end of the reporting period. Results are detailed in Section 6.1 . Management of air quality will continue to be monitored in an effective manner.	

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Aspect	Approved criteria/ EIS prediction	Performance during the reporting period	Trend/ key management implications	Implemented/ proposed management actions
			locations for the reporting period.	
Biodiversity	Chapter 14 Terrestrial Ecology (EIS, EMGA Mitchell McLennan 2013)	In accordance with approved criteria and EIS predictions/surveys.	Main trend: Vegetation and habitat values broadly similar to previous years.	The biodiversity monitoring program, in accordance with the approved management plan, was ongoing at the end of the reporting period. See Appendix 4 for results. Biodiversity will continue to be monitored, with noxious weed control to be continued on-site.
Heritage	Chapter 15 Heritage (EIS, EMGA Mitchell McLennan 2013)	No predicted impact on aboriginal or non- aboriginal heritage items was identified in the EIS.	Main Trend: No aboriginal heritage incidents within the reporting period, with 3 identified Aboriginal Heritage sites within CVC pit-top boundaries. All locations are fenced off with restricted public access to prevent disturbance.	Ongoing diligence and monitoring of ground disturbance activities. Heritage Management Plan revision in 2022 reporting period. Ongoing consultation with RAPs, as required.

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7 Water Management

7.1 Water Management

7.1.1 Licenced Mine Dewatering

Delta Coal holds a groundwater bore license WAL41508 under the *Water Act, 1912*, which permits the industrial dewatering of groundwater up to volume of 4443 megalitres (ML) per year. The following details groundwater extraction volumes during the reporting period.

During the 2022 reporting period, an average of 6,429 kL of mine water was extracted per day from within the mine workings, before being pumped to the CVC surface facilities, where it is discharged into sediment dams, prior to being discharged into Lake Macquarie under NSW Environment Protection Authority (EPA) EPL No.1770 granted under the POEO Act 1997. This daily average has increased somewhat over the reporting period when compared with 2021 daily average of 5,735 kL (refer to **Section 7.1.4** Water Balance for long term water data).

The maximum groundwater extraction on any day during 2022 peaked at 10,500 kL, which reflects the automated control of pumping limits (10.5 ML) implemented on site as committed to by Delta Coal within the Environmental Impact Statement (EIS) for the current mining operations.

Delta Coal operated well within the groundwater extraction limits prescribed by license WAL41508 as shown in **Figure 24**. Groundwater extraction data is summarised in **Table 14**.

Table 14 - CVC Groundwater Extraction, 2022

Water Access Licence	Water sharing plan, source and management zone (as applicable)	Entitlement	Passive Take / inflows	Active pumping	TOTAL
WAL41508	Sydney Basin North Coast Groundwater Source	4443 ML	N/A	2346 ML	2346 ML

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CVC Groundwater Extraction Volume and Water Access License Limits 2500 ⋠ Jul-21 Aug-21 Sep-21 Oct-21 Nov-21 Dec-21 Jan-22 Feb-22 Mar-22 Apr-22 May-22 Jun-22 Jul-21 Aug-21 | Sep-21 | Oct-21 | Nov-21 | Dec-21 | Jan-22 | Feb-22 | Mar-22 | Apr-22 | May-22 | Jun-22 CVC Groundwater Extraction Running Total (ML) IWAS Limit Running Total (no roll-over inclusion) ■ CVC Groundwater Extraction Running Total (ML) ■ IWAS Limit Running Total (no roll-over inclusion)

Figure 22 – CVC Groundwater Extraction Volume and Water Access License Limits (WAL reporting period FY21-22)

7.1.2 Licenced Discharge under EPL 1770

Delta Coal holds EPL 1770, which licences the discharge of up to 12,161 kL per day from the site. During the 2022 reporting period the daily average discharges were 6,221 kL with a maximum of 15,512 kL and a minimum of 79 kL.

Figure 25 shows the daily discharge volumes over the reporting period. Note that discharge limits applied under EPL 1770 relate to both licenced discharge points 1 and 27 which reflect the low and high (emergency) flow discharge points at the final sediment dam. As shown in **Figure 25**, there were two exceedances of the daily volumetric limit (12,161 kL) during the reporting period on 5 July 2022 and 6 July 2022. Further detail of the volumetric exceedance is provided in **Section 7.4**.

There were three discharges via Point 27 (CVC High Flow Spillway) in the reporting period on 2 March 2022, 30 March 2022 and 5 July 2022. As required under EPL 1770, sampling of discharge from EPA Point 27 is undertaken daily during periods of discharge, on 30 March 2022 and 5 July 2022 of the high flow recorded at EPA Point 27, water quality limits were also exceeded. Further detail of EPA Point 27 water quality non-compliances is provided in **Section 7.4**.

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1 January 2022 - 31 December 2022 CVC Surface Water Discharge Volumes (kL) and Daily Rainfall Total (mm) mm \overline{A} Daily Discharge Volume (kL) EPL 1770 Daily Discharge Limit ···· Rainfall

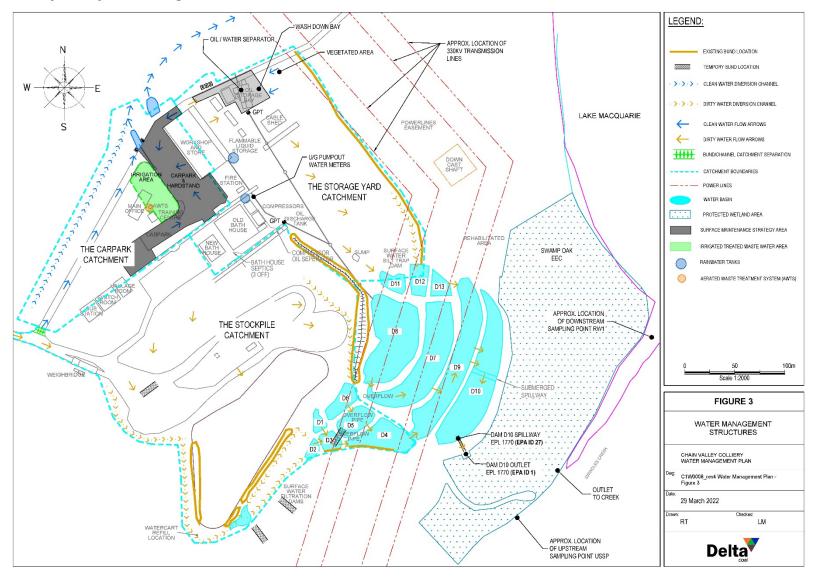
Figure 23 - Chain Valley Colliery, EPA Point 1 Discharge Volume (2022 Period)

Water quality monitoring is required, and undertaken, at the licensed discharge point (EPA Point 1) with sampling undertaken on a monthly basis, Delta Coal also collects water quality samples from additional locations to obtain data from receiving environments, water quality monitoring locations are detailed in Figure 26. Results for pH, EC, TSS and faecal coliforms are compared against the compliance limits specified in EPL 1770 are presented in Figure 27, Figure 28, Figure 29 and Figure 30, respectively.

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Figure 24 - Chain Valley Colliery Water Management Structures



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Figure 25 - pH Monitoring Results at EPA Point 1

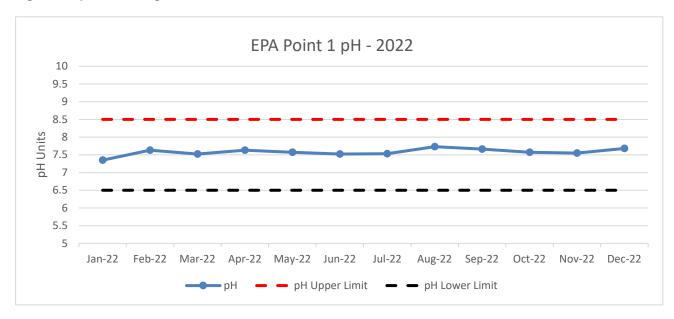
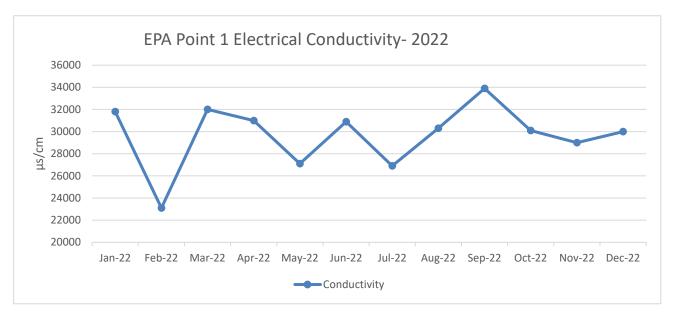


Figure 26 - Electrical Conductivity Monitoring Results at EPA Point 1



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EPA Point Total Suspended Solids - 2022 60 50 40 30 20 10 Jan-22 Feb-22 Mar-22 Apr-22 May-22 Jun-22 Jul-22 Aug-22 Sep-22 Oct-22 TSS Limit Series1

Figure 27 - Total Suspended Solids Monitoring Results at EPA Point 1

Notes: 1. TSS results that were below the limit of reporting (<5 mg/L) have been reported as 0 mg/L.

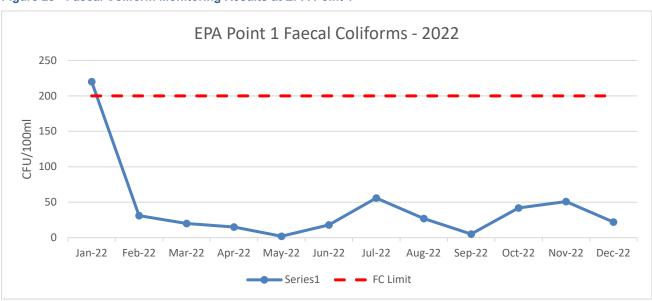


Figure 28 - Faecal Coliform Monitoring Results at EPA Point 1

7.1.3 Long Term Water Management

To assess any long-term trends in both water quality and quantity, ten years of monthly sampling data (2012 to 2022 inclusive) is presented for pH (**Figure 31**), electrical conductivity (**Figure 32**), total suspended solids (**Figure 33**) and faecal coliforms from EPA Point 11 (**Figure 34**).

The annual average of mine dewatering volumes for the past twelve years is also presented in **Figure 35**. Note that prior to 2013, average mine dewatering volumes were calculated using the EPL 1770 reporting period (April – March), but since this time have reflected the calendar year period consistent with Annual Review requirements.

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From the below figures, there are no significant trends in the water quality parameters, with infrequent spikes in faecal coliforms and total suspended solids concentrations and dips in electrical conductivity. minor trends observed are a reduction in faecal coliform concentrations, pH, electrical conductivity and mine dewatering volumes over the period of 2012-2022.

There is no obvious increase in mine dewatering volumes over the last six or seven years, however, it is expected that this will occur over time consistent with the groundwater modelling within the Chain Valley Colliery EIS that predicts an increase in groundwater make will occur to an annual average of 10.5 ML/day (at the end of mine life). The current mine dewatering levels (approximately 6.4 ML/day during 2022) are still significantly below this level.

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Figure 29 - Long term pH monitoring results at EPA Point 1

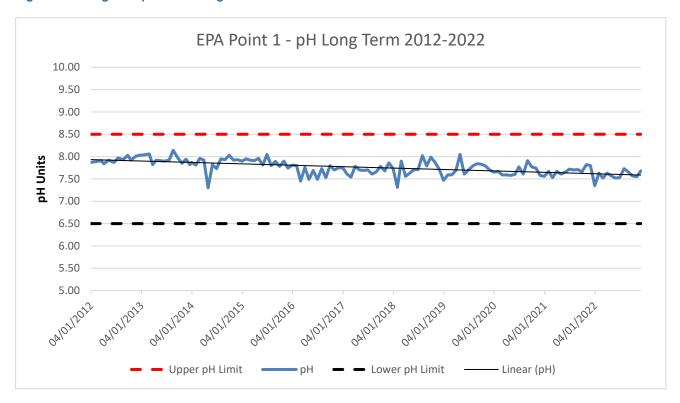
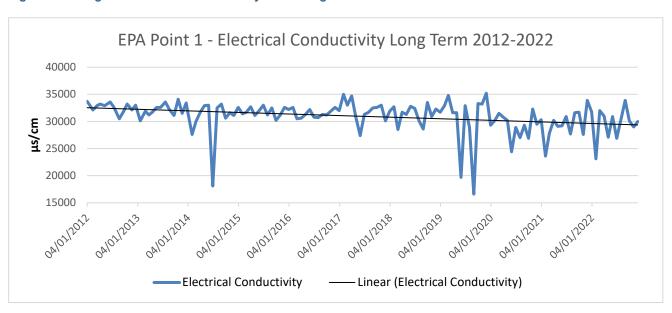


Figure 30 - Long term electrical conductivity monitoring results at EPA Point 1



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Figure 31 - Long term total suspended solids monitoring results at EPA Point 1

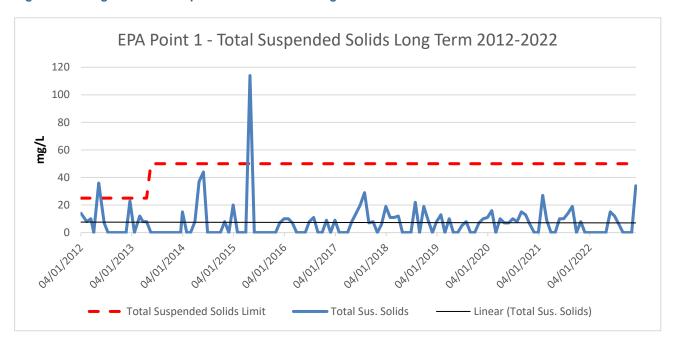
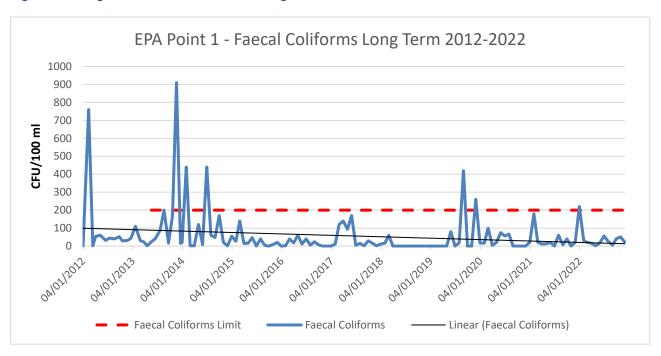


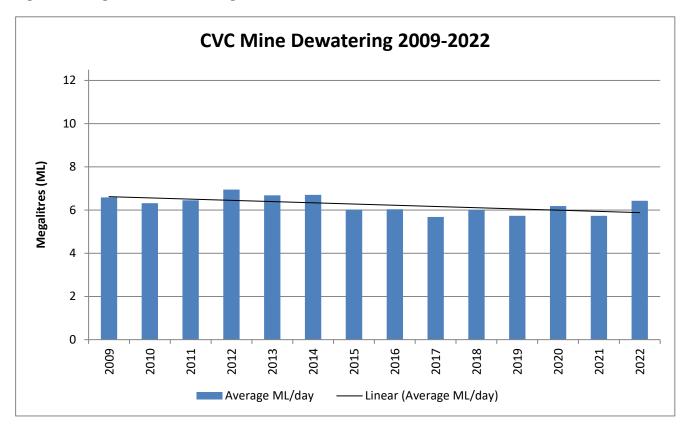
Figure 32 - Long term faecal coliform monitoring results EPA Point 1



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Figure 33 - Long term mine dewatering volumes



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7.1.4 Water Balance

A summary of the key water balance model predictions from the EIS compared with actual results over the reporting period are provided in **Table 15**.

Table 15 - Key Water Balance Predictions and Actual Results - 2022

Water Balance Results (from EIS)	2022 Reporting Period Result	Comment
Daily average discharge through the EPA Point 1 of	Daily annual average discharge of 6.2 ML/day	The water balance used the groundwater model end of mine life groundwater make to ensure model was conservative over the life of the mine.
10.716 ML		2022 result is significantly below the water balance prediction but not unexpected due to the assumptions used in the water balance.
Maximum discharge through EPA Point 1 of 30.52 ML/day	Maximum discharge of 15.37 ML/day	While the maximum discharge is greater than the EPL volumetric limit, the result is significantly lower than the water balance prediction as water balance was conducted using a daily time step model over a 100-year period, as a maximum result would not be expected except in the event of a 1:100 ARI rainfall event.
Likelihood of EPA Point 1 volumetric limit exceedance on any given day of 4% (or approximately 15 times per year)	Two exceedances of the EPL volumetric limit at EPA Point 1 and EPA Point 27 (combined volume).	Result reflects significance of rainfall events in July 2022 and improvements made to both the surface and underground water management system subsequent to the EIS modelling.
Average annual rainfall 1206 mm	1731 mm (Mannering Colliery Meteorological Station)	Greater than previous year and approximately 30% greater than anticipated annual average.
Potable water use of 161.9 ML/yr	40.17	Significant potable water usage decrease to 2021 use (152.7 ML) due to both the cessation of miniwall mining methods as well as the during the reporting period the primary underground water-supply was switched from CVC to MC as the primary supply source.

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7.2 Erosion and Sediment

7.2 Libsion and Sediment

Mining operations and related activities that have the potential to cause erosion and/or generate sediment and impact on the surrounding catchment areas were unchanged during the reporting period, with exception to the sealing of the previously unsealed CVC carparks, and consist of:

- the exposed areas of the laydown and internal access tracks;
- coal stockpiling area (not utilised for coal storage in 2022 reporting period) and coal handling equipment areas;
- · vehicle and equipment movements; and
- erosion of drainage structures.

Water draining from the access road on the western side of the site runs via a number of small drainage channels through dry basins, swales or silt fencing.

The water draining from the hardstand catchment area reports to the pollution control ponds D11, D12 and D13. D13 overflows in to D9 which then flows into D10 prior to being discharged from site via the gravity fed discharge point (EPA Point 1), or, if over-loaded via the concrete spill-way (EPA Point 27). The pollution control ponds (sediment dams) and the location of the monitoring points are show on **Figure 26**.

Runoff from the coal handling and stockpile area is contained by two main drainage channels that surround the stockpile and report to a number of sediment dams below the stockpile. Runoff from this area can contain a significant amount of coal fines due to the nature of the activities. In the 2020 residual coal stockpiles at CVC were removed and processed off-site by a contractor for domestic sale, reducing the potential and volume of coal fines reporting to the sediment dams. The majority of the runoff from this catchment area reports to D1, D2 and D6. These dams also function as primary settling ponds before discharging into dams further downstream. Both D1 and D2 report to D3 and then into D4 while D6 reports to D5 and then into D4. Once in D4 all the water flows into D9, water from D9 flows into D10 prior to discharge. Delta Coal has allocated capital funding for additional sediment and erosion control works in the 2023 reporting period.

7.3 Stream monitoring

Delta Coal undertakes monitoring of stream health, channel flow and riparian vegetation monitoring of Swindles creek (receiving creek of EPA Point 1 and Point 27 discharge). The monitoring inspections involve undertaking a visual assessment and photographs of the creek on a 6-monthly basis to identify any potential instabilities that may form as a result of operations. The results of the visual inspection of watercourse stability are recorded on a pro-forma field inspection sheet.

Monitoring has been undertaken at four locations along the unnamed creek since 2014. There has been no noticeable degradation of stream and riparian health during the reporting period, with inspections undertaken on a quarterly basis in the 2022 reporting period.

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7.4 Surface Water Pollution

There were two exceedances of the volumetric limit for EPA Point 1 and EPA Point 27 combined discharge in the reporting period, comprising:

- 5 July 2022 Combined discharge total via EPA Point 1 and EPA Point 27 of 15,512 kL, with 166 kL of this discharge via EPA Point 27. The volumetric exceedance occurred during a period of significant rainfall between 2 July and 5 July 2022 (206mm total over period with 88.6mm on 5 July 2022 recorded at the MC Meteorological Station). Due to high water levels underground that could affect mine ventilation arrangements, it was decided not to cease all pimping from the underground workings during periods prior to this specific rain event. When underground water levels allowed, dewatering was ceased from one or both underground dewatering pumps in an attempt to minimise the total discharge for the period. On 5 July 2022, groundwater discharge to surface dams was ceased from both underground pumps at 8:50am for the remainder of the period, which resulted in only 712 kL discharged from underground during the 24-hour period.
- 6 July 2022 Total of 14,645 kL discharge via EPA Point 1 with no discharge via EPA Point 27. The volumetric exceedance occurred during a period of significant rainfall between 2 July and 6 July (279mm total over period with 73mm on 6 July 2022 recorded at the MC Meteorological Station). A total of 7,835 kL of groundwater was discharged to surface ponds on 6 July 2022 as underground water storage had reached maximum safe holding capacity due to the previous limitations placed on groundwater discharge and prior infrastructure issues with a main dewatering pump.

Actions undertaken to minimise future volumetric discharge exceedances included:

- Ensuring mine dewatering systems are maintained such that they are available and operational with failures in the dewatering system considered business critical and being prioritised.
- Delta Coal reviewed the CVC site water balance and the TARP to include time dependent escalation
 of failed water management infrastructure (including underground pumps and high-water levels in
 underground holdings) to assist in surge capacity management within the mine dewatering system.
- Delta coal reviewed clean water diversion systems to ensure no additional load is placed on the surge capacity management within the mine dewatering.

During the reporting period there were separate exceedances of discharge water quality exceeding site water quality limits:

• 18 January 2022 – Exceedance of Faecal Coliform limits during monthly sampling of EPA Point 1. The result of 220 CFU/100ml exceeded the site limit of 200 CFU/100ml. Faecal Coliform limits exceeded the National Health Research and Medical Council, Guidelines for Managing Risk in Recreational Water, 2008 (NHRMC 2008) primary contact guidelines (i.e. swimming) of 150 CFU/100ml however did not exceed secondary contact guidelines of 1000 CFU/100ml (i.e. boating and fishing). It was noted that upstream sampling of EPA Point 1 Discharge in Swindles Creek recorded a Faecal Coliform concentration of 520 CFU/100ml representing the receiving environment.

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- 30 March 2022 Exceedance of Faecal Coliform limit at EPA Point 27 with a result of 1,200 CFU/100ml. It was noted that flow was recorded at EPA Point 27 (requiring daily sampling during discharge) due to intensive and unpredicted rainfalls with approximately 25 mm of rainfall over an approximate 2-hour period causing significant surface water flows received by the CVC sediment control dams. Faecal Coliform limits exceeded both National Health Research and Medical Council, Guidelines for Managing Risk in Recreational Water, 2008 (NHRMC 2008) primary contact guidelines (i.e. swimming) of 150 CFU/100ml hand secondary contact guidelines of 1000 CFU/100ml (i.e. boating and fishing). Upstream sampling of the sites discharge point to Swindles Creek recorded results of 3,700 CFU/100ml representing the receiving environment.
- 5 July 2022 Exceedance of Faecal Coliform and Total Suspended Solids limits at EPA Point 27. The sample was collected from Point 27 following a spillway flow event with results exceeding limits for:
 - Faecal Coliform = 360 CFU/100ml exceeding the 200 CFU/100ml limit within EPL 1770.
 - Total Suspended Solids = 52 mg/L exceeding the 50 mg/L limit within EPL 1770.

During the sampling it was noted that electrical conductivity was below the annual average value by $23{,}000~\mu\text{s/cm}$ (result of $6{,}870~\mu\text{s/cm}$) indicating a large volume of fresh (rain) water inflow to the CVC water management system following a significant rainfall event.

- 8 October 2022 Exceedance of Faecal Coliform and total suspended solids limit at EPA Point 27. The sample was collected from the spillway during a high rainfall event, where a total of 178 kL of flow was recorded to be discharged via the spillway. The Mannering Colliery meteorological station recorded 46.8mm of rainfall between 5pm and 10pm on 8 October 2022. The results of the sample exceeded water quality limits for:
 - Faecal Coliforms = 420 CFU/100ml exceeding the 200 CFU/100ml limits
 - Total Suspended Solids = 56 mg/L exceeding the 50 mg/L limit.

Actions taken to mitigate the risk of the exceedance and/or prevent reoccurrence were:

- Increases to the chlorination of outgoing effluent from the septic system at CVC were made in order to reduce bacteriological pollution being received to the CVC sediment control dams.
- Reviews were made of the site water management systems including clear water diversion and the management of headspace and surge capacity in the CVC sediment control dams to improve settlement time for suspended solids.
- Delays beyond the control of Delta Coal were incurred on Delta Coals sewage connection project to connect effluent generated at the site to the Council sewer system, however this project will be completed in the 2023 reporting period. With the required completion date for EPL 1770 PRP8 and PRP9 extended to 24 May 2023.
- Septic systems were maintained with a weekly inspection undertake by the waste management contractor and pump-out as required.

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7.5 Groundwater Pollution

There was no evidence of groundwater pollution detected during the 2022 reporting period, and there has been no groundwater pollution previously identified at CVC.

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8 Rehabilitation

8.1 Buildings

There were no changes to the site infrastructure in the 2022 reporting period.

8.2 Rehabilitation of Disturbed Land

There were no significant rehabilitation works on disturbed lands during the reporting period.

Infrastructure pertaining to coal conveyors and ROM coal handling facilities were demolished on site in the previous reporting period (2020). Former mine cottages and the land they occupied adjacent Lake Macquarie were demolished in 2020 with the rehabilitation of the land ongoing within the 2021 reporting period. The area is being rehabilitated to an open grasslands land use scenario through the collection and chemical analysis of representative soil samples and active spreading of native grass seed and fertiliser. At the completion of the 2022 annual reporting period, the site has returned to open grassland, with active noxious and priority weed management ongoing in the 2022 reporting period. It is not anticipated that the rehabilitated area will be relinquished from the mining lease.

A summary of the rehabilitation statistics for Chain Valley Colliery is provided in **Table 16** and **Table 17**. The sites layout as current is presented as **Figure 36**.

Table 16 - Summary of rehabilitation at CVC

		Last period (2021)	This period (2022)	Next period (2023)
A	Total mine footprint (managed by Delta Coal)	Approximately 14.70 ha	Approximately 14.70 ha	Approximately 14.70 ha
В	Total active disturbance	14.70 ha	14.70 ha	14.70 ha
С	Land being prepared for rehabilitation	Nil	nil	Nil
D	Land under active rehabilitation	Nil	Nil	Nil
E	Completed rehabilitation	Nil	Nil	Approximately 0.69 h. Ongoing land management of open grasslands area (former mine cottages)

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Table 17 - Maintenance activities on rehabilitated land at CVC

	Area Tre	ated (Ha)	
NATURE OF TREATMENT	This period (2022)	Next period (2023)	Comment/Control Strategies/Treatment Detail
Additional erosion control works (drains re-contouring, rock protection)	0	0	No additional works required.
Re-covering (further topsoil, subsoil sealing etc.)	0	0	n/a
Soil treatment (fertiliser, lime, gypsum etc.)	0	0	n/a
Treatment/management (grazing, cropping, slashing etc.)		0	n/a
Re-seeding/replanting (species density, season etc.)		0	n/a
Adversely affected by weeds (type and treatment)	Approx 7	7	Ongoing implementation of a weed management program of noxious weeds including but not limited to lantana, bitou bush, asparagus fern and pampas grass, foliar spray, physical removal and poisoning of stems as appropriate.
Feral animal control (additional fencing, trapping, baiting etc.)	0	0	No feral animal control undertaken during the reporting period.

During the reporting period, Delta Coal aligned its rehabilitation management plan to meet Schedule 8A requirements, as well as submitting a rehabilitation forward program and rehabilitation objectives to the resources regulator. The forward program and revised management plan has been made public on the Delta Coal website and can be accessed at the following link https://www.deltacoal.com.au/environment/chain-valley-management-plans.

The Forward Program details the following for the two active rehabilitation areas at CVC:

Former Mining Cottages Area Rehabilitation:

- Ecosystem and Land Use Establishment phase, Q2 2021 Q4 2023
- Ecosystem and Land Use Sustainability phase, Q1 2024 Q1 2026

Catherine Hill Bay – Possum Gulley Area Rehabilitation:

- Landform Establishment phase, current Q2 2023
- Growth media development, Q2 2023 Q3 2023
- Ecosystem and land use sustainability phase Q3 2023 Q1 2024
- Relinquishment date to be confirmed with NPWS and RR

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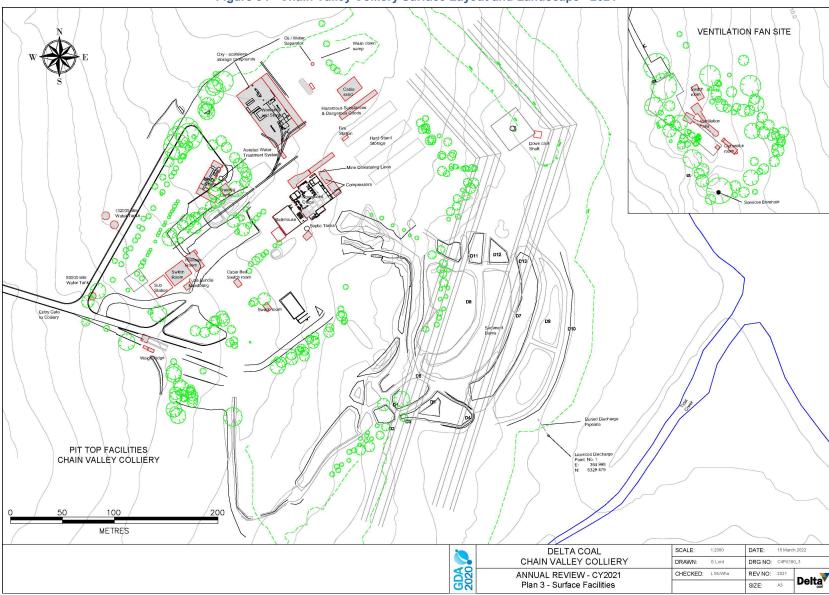


Figure 34 - Chain Valley Colliery Surface Layout and Landscape - 2021

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8.3 Rehabilitation Trials and Research

No rehabilitation trials or research was undertaken during the reporting period.

8.4 Further Development of the Final Rehabilitation Plan

The current approved Rehabilitation Management Plan was updated in July 2022 following reforms to Schedule 8A of the Mining Regulation, it was provided to regulators and stakeholders as required by Condition 27, Schedule 3 of SSD-5465. The plan is publicly available on the Delta Coal website.

The proposed final rehabilitation landforms, consistent with both the Rehabilitation Management Plan and Mining Operations Plan is presented as **Figure 37**.

8.5 Post Rehabilitation Land Use(s)

As identified in the current Rehabilitation Management Plan the post mining land uses for CVC is to revegetate the surface facilities areas to a near-native ecosystem compatible with the surrounding vegetation communities. As the goal is to return the areas of disturbance to a native plant community (or communities) aligned with the surrounding bushland, no introduced species (e.g., *Melaleuca armillaris*, *Pinus radiata* and non-endemic eucalypts) would be used in the revegetation program. The focus of the works would be the use of locally occurring species plant preferentially grown from locally sourced seeds. CVC is on land owned by Delta Electricity who will, therefore, be a key stakeholder in determining the vegetation selection and landform of the area.

Some areas will be revegetated to grassland where this is consistent with the final land use and surrounds. This applies to the areas within existing high voltage power line easements, where the existing grassland vegetation communities are actively managed to ensure they have no impact to the transmission of electricity for the state. Accordingly, a grassland community is both consistent with other areas within the easement and considerate of future management requirements (as the high voltage power lines will remain following mine closure).

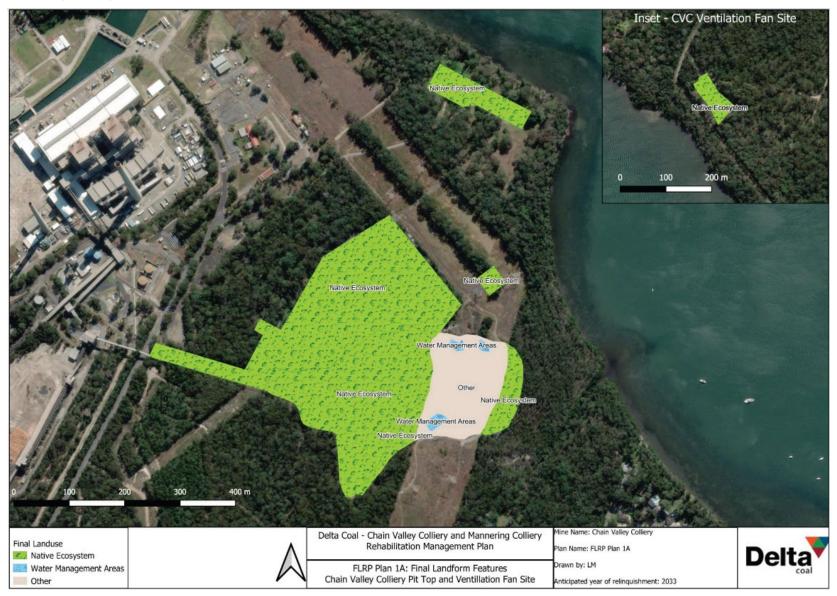
The final land use for each of the secondary domains is:

- Domain A Establishment of a native bushland ecosystem compatible with the surrounding vegetation communities, which includes targeting a final vegetation community comparable to:
 - Coastal Open Woodland (for majority of Chain Valley pit top);
 - Swamp Sclerophyll Forest (for Chain Valley upcast shaft).
- Domain B Establishment of grass cover consistent with surrounding grass species for the:
 - Areas of the Chain Valley site that are within existing high voltage power line easements;
- Domain C Retention of water management structures.

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Figure 35 - Chain Valley Colliery Proposed Rehabilitation and Final Landform



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8.6 Decommissioning

During mine closure the following actions will be taken with respect to the buildings and structures associated with the mining, preparation and transport of the coal:

- any plant, structures, buildings or conveyors would be preferentially sold and/or relocated for reuse at another mining operation
- the remaining surface conveyor plant, buildings and built structures will be demolished or removed.
 All demolition is to occur in accordance with AS 2601-2001: The Demolition of Structures (or its latest version at the time)
- concrete pads and footings will be either completely removed or removed to a minimum 1 m below surface levels and disposed of at an appropriate place or recycled, and following removal will be covered with at least 300 mm of growth medium
- roadways not required for access to the mine site or other areas for purposes such as bushfire management will be rehabilitated
- asphalt hardstand will be removed
- all services not required following mine closure will be disconnected and any stored energy dissipated;
- mining related power lines within the domains will be removed
- mining related surface services will be removed
- buried services encountered during civil works will either be completely removed or removed to 300 mm below the final landform level and remain buried. As mentioned above, all services, including buried services will be safely disconnected and have any stored energy dissipated.

These proposed actions could be subject to change during the mine closure process depending on requests by the landowner for infrastructure to be left in accordance with alternative future land use options. Additionally, it is noted that while services will be disconnected to the majority of the site during decommissioning activities, services may remain connected to a portion of the site for beneficial use during the later rehabilitation phases (such as watering tube stock) and subsequently would be disconnected following ecosystem establishment.

The decommissioning phase will also address the following:

- risks associated with any remaining combustible materials. An assessment of combustion risk will be undertaken and specific controls implemented based on report findings
- completion of Environmental Site Assessments, with specific focus on areas around storage tanks, oil
 storage areas, fuel dispensing locations, service areas, buildings housing powered plant and known
 locations of hazardous materials
- undertaking any necessary contamination remediation, if required, to ensure the land is suitable for
 use as buffer land for the Vales Point Power Station. As the lands will not be used as "recreation/public
 space", nor is it planned to be used for "commercial/industrial" purposes which are land use scenarios

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within the *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as modified in 2013)*, it is proposed that a combination of health-based investigation criteria applicable to either of these classifications will be adopted as the rehabilitation criteria should contamination requiring remediation be identified

- · heritage sites, which are not anticipated to be impacted during decommissioning
- asbestos, a hazardous building material register was completed in February 2020 for the CVC pit top area.

8.7 Objectives

The rehabilitation objectives below have been compiled from Condition 25 within Schedule 3 of SSD-5465 and are listed in **Table 18**.

Table 18: Rehabilitation objectives

Feature	Objective	
Mine site (as a whole of disturbed land and water)	Safe, stable and non-polluting.Final land use compatible with surrounding land use.	
Surface Infrastructure	 To be decommissioned and removed, unless agreed otherwise with relevant regulatory authority and landowner. 	
Portals and ventilation shafts	 To be decommissioned and made safe and stable. Retain habitat for threatened species (e.g. bats), where practicable (Chain Valley pit top facilities only). 	
Other land affected by the development	 Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems: local native plant species (unless agreed otherwise with relevant regulatory authority and landowner); and a landform consistent with the surrounding environment. 	
Built features damaged by mining operations	 Repair to pre-mining condition or equivalent unless: the owners agrees otherwise; or the damage is fully restored, repaired or compensated under the Mine Subsidence Compensation Act 2017. 	
Community	 Ensure public safety. Minimise the adverse socio-economic effects associated with mine closure. 	

8.8 Other Infrastructure

There was no other rehabilitation works completed during the reporting period.

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9 Community

9.1 Community Complaints

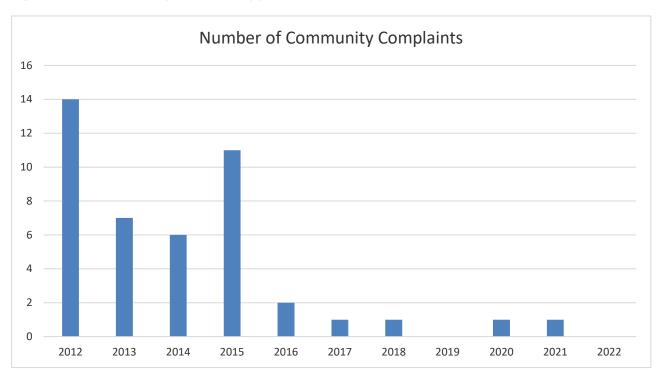
There were no community complaints received during the reporting period.

A copy of the Complaints Register is provided on the Delta Coal website. This register includes:

- the date and time of the complaint;
- the method by which the complaint was made;
- any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
- the nature of the complaint;
- the action taken in relation to the complaint, including any follow-up contact with the complainant; and
- if no action was taken, the reasons why no action was taken.

The Annual total complaints and complaints by subject type trends are Figure 38 and Figure 39.

Figure 36 - Total community complaints by year



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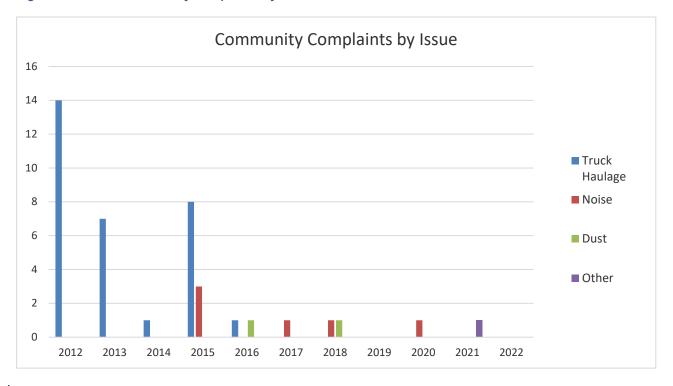


Figure 37 - Annual Community Complaints by Issue

9.2 Community Liaison

The Chain Valley Colliery and Mannering Colliery combined Community Consultative Committee (CCC) continued to operate in accordance with the *Community Consultative Guidelines for State Significant Development* (January 2019) during the reporting period.

There were four CCC meetings held during the reporting period on the 16 February 2022, 18 May 2022, 17 August 2022 and 16 November 2022. Minutes for each of the committee meetings are available on the Delta Coal website https://www.deltacoal.com.au/community/community-consultative-committee.

In addition, the Delta Coal website was updated on a monthly basis with monitoring data, management plans, reports, audits and complaint details among other items.

The community hotline number (1800 687 260) also remained in place during the reporting period and is displayed prominently and permanently on the website.

9.3 Voluntary Planning Agreement

A Voluntary Planning Agreement (VPA) with Central Coast Council was successfully established during 2017. Following extensive consultation with Central Coast Council, the Community Advisory Panel was established and met to plan and coordinate the framework for the VPA funding. The Chain Valley Colliery VPA fund was launched during September 2017 via the Council grants and sponsorship scheme.

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The Delta Coal Community funding program was established as a joint initiative between Delta Coal and Central Coast Council to provide funding for organisations to deliver projects that improve community infrastructure and services in the following communities:

- · Summerland Point
- Gwandalan
- · Chain Valley Bay; and
- Mannering Park.

The VPA is subject to indexation and in the 2022 reporting period was \$0.04478 per tonne of ROM coal sold, which started at \$0.035 in 2017. In the 2022 reporting period, Delta Coal generated and paid \$42,725 to the Central Coast Council, Voluntary Planning Agreement. Correspondence with the Central Coast Council in July 2022 indicated the recommended projects for the grant were:

- Mannering Park Tidy Towns Group Inc "time to renew"
- Manno Mens Shed Inc- replacement of miscellaneous workshop equipment
- Gwandalan and Summerland Point Peninsula Improvement Group Incorporated Provision of large pavilions for disabled people
- Chain Valley Bay Progress Association Incorporated Tables, Seats & Covered BBQ area at Chain Valley Bay Hall playground area
- Southlake Incorporated (auspicing Kingfisher Shores Community Garden) Community Garden Set Up

9.4 Community Support / Engagement

Delta Coal is committed to supporting and engaging with the local communities which surround its operations. While Delta Coal provides a monetary offsets associated with its VPA under its operating approvals, Delta Coal also supports the local community through a variety of additional avenues. This support is provided through in kind support, cash donations, staff time, and charitable donations.

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10 Independent Audit

An independent environmental audit (IEA) was undertaken by GHD in 2022. The Response to Audit Recommendations was submitted to DPIE on 11 July 2022 (revised 19 September 2022) and accepted on 21 September 2022. The IEA is provided in **Appendix 10** and a current IEA Action Plan is provided as **Appendix 11**.

Throughout the 2022 period, Delta Coal have completed recommendations from the 2019 IEA that were achievable (i.e. not ongoing recommendations) and .

10.1 Key Audit Outcomes

Recommendations with respect to the annual review are summarised in Table 19.

Table 19 - Actions required from IEA

Item	Issue / Observation	Action	Status
Action 5	Transport	A summary of the Independent Traffic Audit findings are not included in the annual review documentation. This constitutes and administrative non-compliance	See Section 6.18

10.2 Action Plan

The IEA Action Plan has been included in Appendix 11.

10.3 Future Audit

The next Independent Environmental Compliance Audit is scheduled to commence in 2025.

An updated table of compliance with the 2022 Independent Environmental Audit will be completed as part of that audit.

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11 Incidents and non-compliances during the reporting period

All non-compliances, exceedance, and reportable incidents relating to the site's licences and approvals are summarised below in **Table 19**.

Table 20 - Summary of reportable incidents/non-compliances for 2020

Date	Description of Incident	Approval / Condition / Clause	Actions taken to address incident
18 January 2022	On 21 Jan Delta Coal received analytical results for monthly sampling of the LDP1 discharge point, indicating an exceedance of Faecal Coliform (FC) limits (result of 220 CFU/100ml exceeding the limit of 200 CFU/100ml). It was noted that sampling at the LDP1 outlet to creak location recorded a result of 96 CFU/100ml and upstream of the discharge point indicated a FC concentration of 520 CFU/100ml.	EPL 1770 – L2.4	The incident was reported to the NSW EPA, Department of Planning, Industry and Environment and the Resources Regulator. Delta Coal reviewed and update its chlorine dosing unit dosage timing and volume for CVC effluent. Delta Coal remains committed to the Chain Valley Colliery Sewer Pipeline connection.
3, 6, 16, 18, 19, 20 and 24 January 2022	On the 14th February 2022, Delta Coal staff downloaded PM2.5 data from a continuous particle Beta-attenuation monitoring (BAM) unit, and identified 7 days of non- compliance to 24-hour PM2.5 limits in the January 2022 period. The location of the PM2.5 unit is off Tingley Road, Wyee. The location of Delta Coals operations to the PM2.5 monitor and prevailing meteorological conditions throughout the period, Delta Coal has determined that its operations did not contribute with any significance to the non- compliances recorded at Tingley Road, Wyee. This is based on site operations and meteorological conditions.	SSD-5465 - Schedule 3, Condition 11	Further calibration and replacement of filters was undertaken by the maintenance contractor and the unit's performance will be monitored. Alarms have been developed on the PM2.5 unit based on instantaneous (forecasted to 24/hr) readings for exceedances of daily average limits, which allows for faster turn-around times with potential unit repairs and maintenance requirements, as well as, faster investigation of non-compliances and potential incidents. Delta Coal developed a trigger action response plan (TARP) to further detail the management procedures for the newly established PM2.5 alarms.
30 March 2022	Exceedance of EPL 1770 Faecal Coliform Limit (200 CFU/100ml) at LDP 27 (CVC spillway) during a high intensity rainfall event on between 4:30pm and 7pm on 30th March	EPL 1770 – L2.4	The incident was reported to the NSW EPA, Department of Planning, Industry and Environment and the Resources Regulator. Delta Coal reviewed it's chlorine

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Date	Description of Incident	Approval / Condition / Clause	Actions taken to address incident
	2022. During spillway discharge samples are to be collected of discharged waters daily, laboratory analysis identified a faecal coliform concentration of 1200 CFU/100ml, a total of 33 kL of surface water was discharged via LDP 27 on 30 March 2022.		dosing system, noting it had recently increased dosage volumes, with field testing identifying chlorine presenting in concentrations that would disinfect water during routine monthly sampling. It was considered likely that the Faecal Coliform concentrations in surface waters collected within the CVC dam system catchment area likely contributed significantly to the exceedance. Delta Coal remains committed to the
20 April 2022	The non-compliance was recorded at a continuous BAM unit located at Wyee, with a daily average concentration of 28.6 ug/m3 exceeding the 25 ug/m3 daily average limit.	SSD-5465 - Schedule 3, Condition 11	Chain Valley Colliery Sewer Pipeline connection. The non-compliance to SSD-5465 was reported to the NSW EPA, DPE and Resources Regulator. It was noted that during the periods where exceedances of daily limits were observed, coal production and coal handling was not occurring at Delta Coal facilities (maintenance shift), and in-turn it was not considered that the exceeding PM2.5 concentrations were attributed to Delta Coal operations.
			It is noted that following validation of the data by the contractor maintaining the BAM PM2.5 unit that the 24/hr result was 23µg/m³. As such, the event was not included as a non-compliance, however was reported to regulators.
8 June 2022	the BAM unit located in Wyee utilised to monitor PM2.5 concentrations was vandalised and following did not fully function and impacting the unit's operation.	SSD-5465 - Schedule 3, Condition 11	the unit was replaced with a TEOM unit on the 30th June 2022. Data recorded in the period of 8 to 30 June 2022 was substituted with the annual average value. The incident was reported to the NSW EPA, DPE and Resources Regulator.
5 July 2022	On 5 July 2022 an exceedance of the combined discharge volume limit was recorded by the site flow meters, recording a total discharge of 15,370 kL. 166 kL was discharge via the Point 27 spillway between the hours of 1:55am and 3:35am. The exceedance was contributed to	EPL 1770 – L3.2	The volumetric exceedance was reported to the NSW EPA, NSW DPE and NSW Resources Regulator. Actions resulting from the incident investigation include: - Delta Coal reviewed the CVC site water balance and TARP to include time dependent escalation of failed water management infrastructure Delta Coal reviewed the clean water diversion system to ensure no additional load is placed on the surge

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Date	Description of Incident	Approval / Condition / Clause	Actions taken to address incident
	by an intensive rainfall event from 2-6 July 2022.		capacity management. - Delta Coal implemented a short and medium term strategy and will implement a long term strategy to manage sampling of any Point 27 discharge (Spillway).
5 July 2022	EPL 1770 requires that in the event a discharge is recorded at the Point 27 spillway, water quality samples must be collected daily of discharge waters. Spillway flow was recorded on 5 July 2022. Analytical results for the sample collected adjacent Point 27 exceeded both faecal coliform and total suspended solids (TSS) limits within EPL 1770 being 200 CFU/100ml and 50 mg/L respectively. The sample results were 360 CFU/100ml for faecal coliforms and 52 mg/L for TSS	EPL 1770 – L2.4	The water quality non-compliance exceedance was reported to the NSW EPA, NSW DPE and NSW Resources Regulator. Actions resulting from the incident investigation include: - Complete CVC sewer connection project - Continue chlorine treatment of outgoing effluent - Reviewed the CVC water balance and TARP to include time dependant escalation of failed water management infrastructure - Reviewed the clean water diversion systems at CVC.
6 July 2022	On 6 July 2022 an exceedance of the combined discharge volume limit was recorded by the site flow meters, recording a total discharge of 14,645 kL. There was no recorded discharge via the spillway (Point 27).	EPL 1770 - L3.2	The volumetric exceedance was reported to the NSW EPA, NSW DPE and NSW Resources Regulator. Actions resulting from the incident investigation include: - Delta Coal reviewed the CVC site water balance and TARP to include time dependent escalation of failed water management infrastructure Delta Coal reviewed the clean water diversion system to ensure no additional load is placed on the surge capacity management.
8 July 2022	Delta Coal last conducted secondary extraction in August 2021 from Miniwall S5. Delta Coal last conducted a bathymetric survey over areas of secondary workings following completion of Miniwall S5 in September 2021. On the 8th of July 2022, Delta Coal became aware that a 6 monthly bathymetric survey was required during March 2022, resulting in a non-compliance to the Statement of Commitments of SSD-5465 (as modified).	SSD-5465 - Statement of Commitments	The missed commitment was reported to the NSW DPE, NSW EPA and NSW Resources Regulator. Actions arising from the incident investigation include: - Commissioning of a bathymetric survey in September 2022 - Delta Coal will continue to undertake bathymetric surveys in accordance with the sites Development Consent and Statement of Commitments.

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Date	Description of Incident	Approval / Condition / Clause	Actions taken to address incident
15 September 2022	Whilst undertaking on-site monitoring at R22 for the purpose of a noise mitigation options assessment, Delta Coal identified an exceedance of noise limits at receiver R22. The exceedance was not identified at the monitoring point for R22 (ATN007) due to inconsistencies between modelled low-frequency noise (LFN) and appropriate LFN penalties to be applied at ATN007.	SSD-5465 - Schedule 3- Condition 7	Delta Coal became aware of the exceedance on the 21st of October 2022, notifying the resident at R22 as well as the NSW DPE, NSW EPA and NSW Resource Regulator. An incident investigation and report was submitted to relevant stakeholders. Follow-up monitoring at R22 was undertaken on the 3rd November in suitable meteorological conditions and did not identify an exceedance at R22. Delta Coal is investigating reasonable and feasible methodologies to mitigate ventilation fan noise contributing to the original exceedance at R22.
8 October 2022	EPL 1770 requires that in the event a discharge is recorded at the Point 27 spillway, water quality samples must be collected daily of discharge waters. Spillway flow was recorded on 8 October 2022. Analytical results for the sample collected from Point 27 during discharge exceeded both faecal coliform and total suspended solids (TSS) limits within EPL 1770 being 200 CFU/100ml and 50 mg/L respectively. The sample results were 420 CFU/100ml for faecal coliforms and 56 mg/L for TSS	Condition L2.4	The water quality non-compliance was reported to the NSW EPA, NSW DPE and NSW Resources Regulator. Actions resulting from the incident investigation include: - Continue progression toward completing CVC sewer connection project - Continued chlorine treatment of outgoing effluent until CVC sewer connection project has been completed Reviewed and update the CVC water balance and TARP.
Friday, 4 November 2022	on 15 November 2022 Delta Coal received depositional dust analysis results. It was reported that DDG006 recorded a level of 12.5 g/m2/month.	SSD-5465 - Schedule 3, Condition 11	The exceedance was reported to the NSW EPA and NSW DPE. The exceedance was investigated, it was noted that the operation of the CVC ventilation fans had not changed in the monitoring period. The annual average value for DDG006 remained below the limit of 4 g/m2/month. Actions resulting for the exceedance were for Delta Coal to continue to monitor Depositional Dust at the CVC ventilation fan for any trends which may present and implement dust mitigation measures as a result.

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12 Activities to be Completed in the Next Reporting Period

12.1 Activities Proposed for 2022 Reporting period

A summary of the activities that were proposed to be undertaken during the 2022 reporting period and current status is provided in **Table 20**.

Table 21: Status Update to 2021 Proposed Activities

Activity Proposed in 2021 Annual Report	Status Update	31 December 2022 update, percentage complete
Reconsider use of chemical dust suppressant on un-sealed access roads.	In the 2022 reporting period Delta Coal sealed the CVC carpark, which was considered the highest trafficked area at the site. A watercart was employed throughout the 2022 period on unsealed portions of the site, and as such the use of a chemical dust suppressant wasn't deemed to be warranted.	100% - The use of chemical dust suppressant at CVC on un-sealed and access roads was reconsidered in the reporting period. However, following sealing of the highest trafficked areas and low depositional dust levels at dust gauges nearby the site, the use of chemical suppressant wasn't considered necessary.
Ongoing weed management in 2021 period	Ongoing weed management was undertaken on a routine basis with land maintenance contractors in 2022.	Ongoing
Ongoing weed management as per Weed Action Plan	Completed in 2022	Ongoing weed management in 2023 period.
Ongoing rehabilitation monitoring following development of a rehabilitation monitoring program and baseline monitoring.	Rehabilitation monitoring on-going in 2022 of Former mine cottages area and Catherine Hill Bay.	50% - Rehabilitation monitoring ongoing in 2022 and 2023 to establishing final-land use, refer to section 8.2.

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Activity Proposed in 2021 Annual Report	Status Update	31 December 2022 update, percentage complete
Review land contouring and erosion and sediment controls at the former coal stockpiling area in relation to final landform contours presented in the MOP.	Design completed in 2021.	10% - Works delayed to 2023 with capital budget for sediment and erosion controls on CVC stockpile area allocated in 2023.
Submission of an Environmental and Social Impact Statement to facilitate consent consolidation.	EIS and SIA submitted in 2022.	100% - Submission of an Environmental and Social Impact Statement to facilitate consent consolidation.
		Project referred to Independent Planning Commission.
Decommissioning of chlorine dosing pump following completion of the CVC sewer connection.	Delays incurred to CVC sewage connection project with current project schedule to commission the project by 24 May 2023.	50% - Delayed due to transfer of land between Crown Lands and Central Coast Council. Project permitted to commence in January 2023.
Sewage pump station and connection to Central Coast Council sewer, construction is anticipated to commence in Q2 2022.	Delays incurred to CVC sewage connection project with current project schedule to commission the project by 24 May 2023.	50% - Delayed due to transfer of land between Crown Lands and Central Coast Council. Project permitted to commence in January 2023.
Connection of the administration building septic tank to the onsite sewage pump station and Council sewer (EPL 1770 - PRP 9) and be completed prior to 25 August 2021.	On-site works completed to connect administration building septic to CVC septic which will be connected to Council Sewer. Delays incurred to connection to Council Sewer.	80% - Project unable to be completed due to requiring completion of PRP8 (connection of CVC bathhouse to Council Sewer).

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Activity Proposed in 2021 Annual Report	Status Update	31 December 2022 update, percentage complete
Upon completion of PRP 8 and PRP 9, submission to EPA to vary EPL 1770 to remove biological monitoring requirements at the CVC Licensed Discharge Points.		0% - Unable to submit variation due to delays in PRP8.

12.2 Activities Proposed to be Completed in 2023 Reporting Period

Table 222 - Activities Proposed for the 2023 Period

Proposed Activities for 2023

Annual weed management in 2023 period

Consider revision of weed action plan with site-wide mapping of to guide weed management activities on-site.

Rehabilitation monitoring as per the requirements of the rehabilitation monitoring program to be completed in Q4 2022.

Undertake sediment and erosion control works on the former CVC stockpile area.

Submission of a response to submissions and meeting requirements of the Independent Planning Commission.

Completion of effluent connection to the Central Coast sewer system prior to 24 May 2023. Allowing for the removal of the chlorine dosing pump.

Development of CVC bathhouse sewer connection anticipated to commence Q2 2023 and be completed prior to 24 May 2023.

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Proposed Activities for 2023

Connection of the administration building septic tank to the on-site sewage pump station and Council sewer (EPL 1770 - PRP 9) and be completed prior to 24 May 2023.

Upon completion of PRP 8 and PRP 9, submission to EPA to vary EPL 1770 to remove biological monitoring requirements at the CVC Licensed Discharge Points.

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13 References

Documents used in the preparation of this report are detailed in **Table 22**.

Table 23: References

Reference	Title
Legislation and Regulations	Development consent SSD-5465 (as modified) Environment Protection Licence (EPL) 1770 Mining Act 1992 Protection of the Environment Operations Act, 1997
External documents	AECOM, 2011 – Environmental Assessment Chain Valley Colliery Domains 1 & 2 Continuation Project. Prepared for LakeCoal Pty Ltd.
	EMGA Mitchell McLennan, 2013 – Environmental Impact Statement, Chain Valley Colliery Mining Extension 1 Project. Prepared for LakeCoal Pty Ltd.
	EMM Consulting (February 2023) Biodiversity Monitoring 2022 Chain Valley Colliery.
	Laxton, E. S., 2022 – Seagrass Survey of Chain Valley Bay, Summerland Point and Crangan Bay, Lake Macquarie, NSW (Results for 2008 to 2022)
	Laxton, E. S. 2022 – Lake Macquarie Benthos Survey Results No. 21 (March 2022)
	Laxton, E. S. 2022 – Lake Macquarie Benthos Survey Results No. 22 (September 2022)
	NSW DPIE (January 2019) Community Consultative Guidelines for State Significant Development
	Total Earth Care Pty Ltd (January 2020) Weed Action Plan Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft.
	Total Earth Care Pty Ltd (August 2020) Weed Action Plan – Addendum 1, Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft.

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14 Acronyms / Definitions

AEMR Annual Environmental Management Report, now known as the Annual Review

Annual Review The annual environmental report compiled for CVC, the Annual Review also fulfills the

requirement for an Annual Environmental Report or an Annual Environmental Management

Report required by mining leases.

CCC Community Consultative Committee

CVC Chain Valley Colliery

DP&E Department of Planning & Environment (former)

DPIE Department of Planning, Industry and Environment

EA Environmental Assessment

EMS Environmental Management System

EPA NSW Environment Protection Authority

EP&A Act Environmental Planning and Assessment Act 1979

EPL Environmental Protection LicensekL Kilolitre

EPA Point 1 Licenced Discharge Point 1 (per EPL 1770)

MC Mannering Colliery

NGER National Greenhouse and Energy Reporting

NSW New South Wales

OEH NSW Office of Environment and Heritage

PM₁₀ Particulate matter less than 10 microns in size

POEO Act Protection of the Environment Operations Act 1997

ROM Run of mine

Secretary Secretary of the Department, or nominee

TEOM Tapered element oscillating microbalance

t - CO₂-e Tonnes of carbon dioxide equivalent

The website
The website of Delta Coal - Chain Valley Colliery, which is www.deltacoal.com.au

MP10_0161 Project approval MP 10_0161, as modified, issued under Section 75J of the Environmental

Planning and Assessment Act 1979 for the Chain Valley Colliery Domains 1 & 2

Continuation Project.

SSD 5465 Development Consent SSD 5465, as modified, issued under Section 89E of the

Environmental Planning and Assessment Act 1979 for the Chain Valley Colliery Mining

Extension 1 Project.

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VPPS Vales Point Power Station

WCJV Wallarah Coal Joint Venture

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15 Appendices

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Appendix 1: Development Consent SSD-5465

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Development Consent

Section 89E of the Environmental Planning & Assessment Act 1979

As delegate of the Minister for Planning and Infrastructure, I approve the development application referred to in Schedule 1, subject to the conditions in Schedules 2 to 6.

These conditions are required to:

- prevent, minimise, and/or offset adverse environmental impacts;
- set standards and performance measures for acceptable environmental performance;
- require regular monitoring and reporting; and
- provide for the ongoing environmental management of the development.

Chris Wilson

Executive Director

Development Assessment Systems and Approvals

Sydney 2013

SCHEDULE 1

Application Number: SSD-5465

Applicant: Great Southern Energy Pty Limited

Consent Authority: Minister for Planning and Infrastructure

Land: See Appendix 1

Development: Chain Valley Extension Project

Red type represents November 2014 Modification (SSD_5465 MOD 1) Blue type represents December 2015 Modification (SSD_5465 MOD 2) Green type represents June 2020 Modification (SSD-5465 MOD 3) Purple type represents July 2021 Modification (SSD-5465 MOD 4)

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DEFINITIONS

Aboriginal Object / Place	
	Has the same meaning as the definition of the term in section 5 of the NP&W Act
Adaptive management	Adaptive management includes monitoring subsidence impacts and subsidence effects
	and, based on the results, modifying the mining plan as mining proceeds to ensure that
	the effects, impacts and/or associated environmental consequences remain within
	predicted and designated ranges and in compliance with the conditions of this consent
Affected Councils	LMCC and/or CC Council
Annual Review	The review required by Condition 4 of Schedule 6
Applicant	Great Southern Energy Pty Limited, or any person carrying out development under this
 	consent
Approved mine plan	The mine plan shown in Appendix 3, as varied by any Extraction Plan approved under this
A D.7-	consent
APZs BCA	The asset protection zones shown in Appendix 7A
BCD	Building Code of Australia
BMP	Biodiversity and Conservation Division within the Department Biodiversity Management Plan
Built features	Any building or work erected or constructed on land or water, and includes dwellings and
built leatures	infrastructure such as any formed road, street, path, walk, marina or driveway; any
	pipeline, water, sewer, telephone, gas or other service main
Calendar Year	A period of 12 months from 1 January to 31 December
CCC	Community Consultative Committee
CC Council	Central Coast Council
Coal haulage route	The route proposed in the EIS for haulage of coal by trucks between the site and the Port
Coar Hadiage Todic	of Newcastle (as shown in Appendix 5)
Conditions of this consent	Conditions contained in Schedules 2 to 6 inclusive
Construction	The demolition of buildings or works, carrying out of works and erection of buildings
	covered by this consent
Day	The period from 7am to 6pm on Monday to Saturday, and 8am to 6pm on Sundays and
,	Public Holidays
Delta Electricity	Delta Electricity, or subsequent owners of the Vales Point Power Station
Department	Department of Planning, Industry and Environment
Development	The development described in the EIS, as amended by the SEE (Mod 1), SEE (Mod 2)
	and SEE (Mod 3)
DPIE Crown Lands	Crown Lands Group within the Department
DPIE Water	Water Group within the Department
EIS	Environmental Impact Statement titled 'Chain Valley Colliery Mining Extension 1 Project'
	dated 28 May 2013, as modified by the response to submissions, titled 'Chain Valley
	Colliery Mining Extension 1 Project Response to Submissions', dated August 2013, and
	the letter by EMM to the Applicant, dated 29 October 2013
Endangered population	As defined under the Fisheries Management Act 1994
Environment	Includes all aspects of the surroundings of humans, whether affecting any human as an
Facility and the last	individual or in his or her social groupings
Environmental	The environmental consequences of subsidence impacts, including: damage to built
Environmental consequences	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope
	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats;
consequences	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding.
consequences	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority
EPA EP&A Act	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979
EPA EP&A Act EP&A Regulation	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000
EPA EP&A Act EP&A Regulation EPBC Act	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999
EPA EP&A Act EP&A Regulation EPBC Act EPL	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act
EPA EP&A Act EP&A Regulation EPBC Act EPL Evening	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act The period from 6pm to 10pm
EPA EP&A Act EP&A Regulation EPBC Act EPL Evening Feasible	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act The period from 6pm to 10pm Means what is possible and practicable in the circumstances
EPA EP&A Act EP&A Regulation EPBC Act EPL Evening	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act The period from 6pm to 10pm Means what is possible and practicable in the circumstances The extraction of coal from underground workings by bord and pillar mining methods
EPA EP&A Act EP&A Regulation EPBC Act EPL Evening Feasible	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act The period from 6pm to 10pm Means what is possible and practicable in the circumstances The extraction of coal from underground workings by bord and pillar mining methods (including herringbone pattern workings) and from main headings, gateroads and cut-
EPA EP&A Act EP&A Regulation EPBC Act EPL Evening Feasible	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act The period from 6pm to 10pm Means what is possible and practicable in the circumstances The extraction of coal from underground workings by bord and pillar mining methods (including herringbone pattern workings) and from main headings, gateroads and cutthroughs and the like, provided that such workings are long-term stable and do not
EPA EP&A Act EP&A Regulation EPBC Act EPL Evening Feasible First Workings	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act The period from 6pm to 10pm Means what is possible and practicable in the circumstances The extraction of coal from underground workings by bord and pillar mining methods (including herringbone pattern workings) and from main headings, gateroads and cutthroughs and the like, provided that such workings are long-term stable and do not generate more than 20 mm of vertical subsidence at the surface
EPA EP&A Act EP&A Regulation EPBC Act EPL Evening Feasible First Workings	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act The period from 6pm to 10pm Means what is possible and practicable in the circumstances The extraction of coal from underground workings by bord and pillar mining methods (including herringbone pattern workings) and from main headings, gateroads and cutthroughs and the like, provided that such workings are long-term stable and do not generate more than 20 mm of vertical subsidence at the surface Fisheries Branch of the Primary Industries Group within the Department
EPA EP&A Act EP&A Regulation EPBC Act EPL Evening Feasible First Workings	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act The period from 6pm to 10pm Means what is possible and practicable in the circumstances The extraction of coal from underground workings by bord and pillar mining methods (including herringbone pattern workings) and from main headings, gateroads and cutthroughs and the like, provided that such workings are long-term stable and do not generate more than 20 mm of vertical subsidence at the surface Fisheries Branch of the Primary Industries Group within the Department Hectare
EPA EP&A Act EP&A Regulation EPBC Act EPL Evening Feasible First Workings	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act The period from 6pm to 10pm Means what is possible and practicable in the circumstances The extraction of coal from underground workings by bord and pillar mining methods (including herringbone pattern workings) and from main headings, gateroads and cutthroughs and the like, provided that such workings are long-term stable and do not generate more than 20 mm of vertical subsidence at the surface Fisheries Branch of the Primary Industries Group within the Department Hectare An Aboriginal object, an Aboriginal place, or a place, building, work, relic, moveable
EPA EP&A Act EP&A Regulation EPBC Act EPL Evening Feasible First Workings	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act The period from 6pm to 10pm Means what is possible and practicable in the circumstances The extraction of coal from underground workings by bord and pillar mining methods (including herringbone pattern workings) and from main headings, gateroads and cutthroughs and the like, provided that such workings are long-term stable and do not generate more than 20 mm of vertical subsidence at the surface Fisheries Branch of the Primary Industries Group within the Department Hectare An Aboriginal object, an Aboriginal place, or a place, building, work, relic, moveable object, tree or precinct of heritage significance, that is listed under any of the following:
EPA EP&A Act EP&A Regulation EPBC Act EPL Evening Feasible First Workings	The environmental consequences of subsidence impacts, including: damage to built features; loss of surface water flows to the subsurface; loss of standing pools; slope changes to streams; adverse water quality impacts; development of iron bacterial mats; landslides; damage to Aboriginal heritage sites; impacts on aquatic ecology; and ponding. NSW Environment Protection Authority Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000 Commonwealth Environment Protection and Biodiversity Conservation Act 1999 Environment Protection Licence issued under the POEO Act The period from 6pm to 10pm Means what is possible and practicable in the circumstances The extraction of coal from underground workings by bord and pillar mining methods (including herringbone pattern workings) and from main headings, gateroads and cutthroughs and the like, provided that such workings are long-term stable and do not generate more than 20 mm of vertical subsidence at the surface Fisheries Branch of the Primary Industries Group within the Department Hectare An Aboriginal object, an Aboriginal place, or a place, building, work, relic, moveable object, tree or precinct of heritage significance, that is listed under any of the following:

	a Local Favirance atal Plan under the FD9 A Act
	 a Local Environmental Plan under the EP&A Act; the World Heritage List;
Litala Mata	anything identified as a heritage item under the conditions of this consent. The area of least defined to
High Water Mark	The area of land defined:
Subsidence Barrier	a) on the surface by the highwater level of Lake Macquarie and a point 2.44 metres in
	elevation above that highwater level; and b) in the seam, where it is intersected by lines:
	drawn landwards from all points 2.44 metres elevation above the highwater level
	of Lake Macquarie; and
	drawn lakewards from the highwater level of Lake Macquarie,
	at an angle of 35 degrees from the vertical.
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm
moldent	that may or may not be or cause a non-compliance
Land	Has the same meaning as the definition of the term in section 1.4 of the EP&A Act, except
Laria	where the term is used in the noise and air quality conditions in Schedules 3 and 5 of this
	consent where it is defined to mean the whole of a lot, or contiguous lots owned by the
	same landowner, in a current plan registered at NSW Land Registry Services at the date
	of this consent
LMCC	Lake Macquarie City Council
Material harm	Is harm to the environment that:
	involves actual or potential harm to the health or safety of human beings or to the
	environment that is not trivial; or
	results in actual or potential loss or property damage of an amount, or amounts in
	aggregate, exceeding \$10,000, (such loss includes the reasonable costs and
	expenses that would be incurred in taking all reasonable and practicable measures to
	prevent, mitigate or make good harm to the environment)
MEG	Regional NSW – Mining, Exploration and Geoscience
Minimise	Implement all reasonable and feasible mitigation measures to reduce the impacts of the
	development
Mining operations	The carrying out of underground mining, including the extraction, processing, stockpiling
	and transportation of coal on the site and the emplacement of coarse/fine reject material
	resulting from underground mining
Minister	Minister for Planning and Public Spaces, or delegate
Minor	Not very large, important or serious
Mitigation	Activities associated with reducing the impacts of the development
Modification 1	The modification to the development as described in SEE (Mod 1)
Modification 2	The modification to the development as described in SEE (Mod 2)
Modification 3	The modification to the development as described in SEE (Mod 3)
Modification 4	The modification to the development as described in SEE (Mod 4)
NCC	Newcastle City Council
Negligible	Small and unimportant, such as to be not worth considering
Night	The period from 10pm to 7am on Monday to Saturday, and 10pm to 8am on Sundays and
Nieu-e-e-E-e-e	Public Holidays
Non-compliance	An occurrence, set of circumstances or development that is in breach of this consent
NP&W Act	National Parks and Wildlife Act 1974
Pleasing Corretory	7 am to 9 am and 4:30 pm to 6 pm weekdays
Planning Secretary	Planning Secretary under the EP&A Act, or nominee
POEO Act	Protection of the Environment Operations Act 1997
Privately-owned land	Land that is not owned by a public agency, Delta Electricity (or its subsidiary) or a mining
Public infrastructure	company (or its subsidiary) Linear and related infrastructure that provides services to the general public such as
T abile lilitastructure	roads, railways, water supply, drainage, sewerage, gas supply, electricity, telephone,
	telecommunications, etc.
Reasonable	Reasonable relates to the application of judgement in arriving at a decision, taking into
	account: mitigation benefits, cost of mitigation versus benefits provided, community views
	and the nature and extent of potential improvements
Reasonable costs	The costs agreed between the Department and the Applicant for obtaining independent
Reasonable costs	The costs agreed between the Department and the Applicant for obtaining independent experts to review the adequacy of any aspects of the Extraction Plan, or where such costs
Reasonable costs	experts to review the adequacy of any aspects of the Extraction Plan, or where such costs
	experts to review the adequacy of any aspects of the Extraction Plan, or where such costs cannot be agreed, the costs determined by a dispute resolution process
Registered Aboriginal	experts to review the adequacy of any aspects of the Extraction Plan, or where such costs
Registered Aboriginal Parties	experts to review the adequacy of any aspects of the Extraction Plan, or where such costs cannot be agreed, the costs determined by a dispute resolution process As described in the National Parks and Wildlife Regulation 2009
Registered Aboriginal	experts to review the adequacy of any aspects of the Extraction Plan, or where such costs cannot be agreed, the costs determined by a dispute resolution process

	development or controlling the environmental consequences of this impact
RFS	NSW Rural Fire Service
Road Maintenance	The document prepared by McCullough Robertson Lawyers and titled 'Road Maintenance
Agreement	Agreement, signed by CC Council on 1 July 2013 and by LakeCoal on 5 July 2013
ROM	Run-of-mine
RR	Regional NSW - Resources Regulator
SA NSW	Subsidence Advisory NSW
Safe, serviceable &	Safe means no danger to users who are present; serviceable means available for its
repairable	intended use; and repairable means damaged components can be repaired economically
Second Workings	Extraction of coal by longwall, miniwall, pillar extraction, pillar splitting or pillar reduction
<u> </u>	methods, and inclusive of any first workings methods that would generate more than
	20 mm of vertical subsidence at the surface
SEE Mod 1	Statement of Environmental Effects titled 'Chain Valley Colliery – Modification 1,
	Statement of Environmental Effects, Section 96 Modification to SSD-5465' dated April
	2014, as modified by the associated Response to Submissions dated 15 September 2014.
SEE Mod 2	Statement of Environmental Effects titled 'Chain Valley Colliery – Modification 2,
	Statement of Environmental Effects, Section 96 Modification to SSD-5465' dated 29 June
	2015, including the associated Response to Submissions dated 16 September 2015.
SEE (Mod 3)	Statement of Environmental Effects titled 'Statement of Environmental Effects, Chain
	Valley Colliery - Modification 3', dated May 2019, prepared by EMM Consulting, including
	the associated Response to Submissions dated August 2019 and prepared by EMM
	Consulting
SEE (Mod 4)	Statement of Environmental Effects titled "Statement of Environmental Effects, Chain
	Valley Colliery Modification 4" dated November 2020, prepared by Umwelt Consulting,
	including the associated Response to Submissions, dated April 2021 and prepared by
	Umwelt Consulting.
Site	All land within the Development Area (see Appendices 1 and 2)
SPB	Seagrass Protection Barrier is the area of land defined by:
	(a) on the surface by the extent of the seagrass beds; and
	(b) in the seam, where the seam is intersected by the lines drawn:
	 landwards from the landwards boundary of the seagrass beds; and
	 lakewards from the lakewards boundary of the seagrass beds,
	at an angle of 26.5 degrees from the vertical as illustrated in Figure 1A in Appendix 3
Statement of	The Applicant's commitments in Appendix 9
commitments	The Applicant's commitments in Appendix 5
Subsidence	The totality of subsidence effects, subsidence impacts and environmental consequences
Gubsideriee	of subsidence impacts
Subsidence effects	Deformation of the ground mass due to mining, including all mining-induced ground
	movements, such as vertical and horizontal displacement, tilt, strain and curvature
Subsidence impacts	Physical changes to the ground and its surface caused by subsidence effects, including
	tensile and shear cracking of the rock mass, localised buckling of strata caused by valley
	closure and upsidence and surface depressions or troughs
Subsidence Zone A	The area shown as Zone A in Figure 1 in Appendix 3 in which long-term stable mining
	systems generating no more than 20 mm of surface subsidence may be utilised
Subsidence Zone B	The area shown as Zone B in Figure 1 in Appendix 3 in which mining systems generating
	no more than 780 mm of surface subsidence may be utilised
Surface facilities sites	The Chain Valley Colliery surface facilities site; the Summerland Point ventilation shaft
	site; and any other site subject to existing or proposed surface disturbance associated
	with the development
TfNSW	Transport for NSW
Threatened Species	As defined under the Threatened Species Conservation Act 1995 and the Environment
•	Protection and Biodiversity Conservation Act 1999

SCHEDULE 2 ADMINISTRATIVE CONDITIONS

OBLIGATION TO MINIMISE HARM TO THE ENVIRONMENT

1. In addition to meeting the specific performance measures and criteria established under this consent, the Applicant must implement all reasonable and feasible measures to prevent, and if prevention is not reasonable and feasible, minimise, any material harm to the environment that may result from the construction and operation of the development, and any rehabilitation required under this consent.

TERMS OF CONSENT

- 2. The development may only be carried out:
 - (a) in compliance with the conditions of this consent:
 - (b) in accordance with the statement of commitments in Appendix 9;
 - (c) in accordance with the Subsidence Zones in Appendix 3;
 - (d) in accordance with all written directions of the Planning Secretary; and
 - (e) generally in accordance with the EIS, SEE (Mod 1), SEE (Mod 2), SEE (Mod 3) and SEE (Mod 4).
- 3. Consistent with the requirements in this consent, the Planning Secretary may make written directions to the Applicant in relation to:
 - (a) the content of any strategy, study, system, plan, program, review, audit, notification, report or correspondence submitted under or otherwise made in relation to this consent, including those that are required to be, and have been, approved by the Planning Secretary; and
 - (b) the implementation of any actions or measures contained in any such document referred to in condition 3(a).
- 4. The conditions of this consent and directions of the Planning Secretary prevail to the extent of any inconsistency, ambiguity or conflict between them and a document/s listed in condition 2(e). In the event of an inconsistency, ambiguity or conflict between any of the document/s listed in condition 2(e), the most recent document prevails to the extent of the inconsistency, ambiguity or conflict.

LIMITS ON CONSENT

Mining Operations

5. The Applicant may carry out mining operations on the site until 31 December 2027.

Note: Under this consent, the Applicant is required to rehabilitate the site and perform additional undertakings to the satisfaction of either the Planning Secretary or the RR. Consequently, this consent will continue to apply in all other respects other than the right to conduct mining operations until the rehabilitation of the site and these additional undertakings have been carried out satisfactorily.

Coal Extraction

6. The Applicant must not extract more than 2.1 million tonnes of ROM coal from the site in any calendar year.

Coal Transport - Public Roads

- 7. The Applicant must ensure that no laden coal trucks are dispatched from the site to public roads outside of the hours of 5:30 am to 5:30 pm, Monday to Friday, and not at all on Saturdays, Sundays or public holidays.
- 8. The Applicant must not dispatch from the site more than:
 - (a) 660,000 tonnes of product coal in any calendar year to the Port of Newcastle for export;
 - (b) 180,000 tonnes of product coal in any calendar year to domestic customers other than Vales Point Power Station;
 - (c) a total of 270 laden coal trucks per day by public roads;
 - (d) a total of 32 laden coal trucks per hour; and
 - (e) an average of 16 laden coal trucks per hour by public roads during peak hour periods, calculated monthly, until the intersection of M1 Motorway and Sparks Road Interchange (East Side unsignalised with stop sign) is upgraded to a signalised intersection.

Coal Transport – Vales Point Power Station

9. The Applicant must ensure that only private roads are used for the transport of coal by truck to Vales Point Power Station, except in an emergency. In an emergency, product coal may be transported by public roads,

with the prior written approval of the Planning Secretary, and subject to any restrictions that the Planning Secretary may impose.

- 10. The Applicant must restrict the transport of coal by truck to the Vales Point Power Station between 10 pm and 5:30 am to:
 - (a) 16 laden trucks per hour for the Spring and Autumn months; and
 - (b) zero during Winter months.

PLANNING AGREEMENT

11. Within 12 months of the date of this consent, unless otherwise agreed by the Planning Secretary, the Applicant must enter into a planning agreement with the CC Council in accordance with Division 6 of Part 4 of the EP&A Act that provides for payment to the CC Council for community enhancement purposes.

The agreement must include provision for those matters set out in condition 12 below.

If there is any dispute between the Applicant and CC Council relating to the preparation or implementation of the planning agreement, then either party may refer the matter to the Planning Secretary for resolution.

COMMUNITY ENHANCEMENT

- 12. The Applicant must pay CC Council \$0.035 for each tonne of product coal produced by the development for the purposes of improving public infrastructure and providing community projects for the communities of Summerland Point, Gwandalan, Chain Valley Bay and Mannering Park. Payments from the approval date of project approval 10_0161 must be:
 - (a) made by the end of March, for coal produced in the previous calendar year;
 - (b) made for each year that coal is produced by the colliery; and
 - (c) subject to indexation in accordance with the Australian Bureau of Statistics Consumer Price Index.
- 13. Deleted.
- 14. Deleted.

STRUCTURAL ADEQUACY

- 15. The Applicant must ensure that all new buildings and structures, and any alterations or additions to existing buildings and structure, that are part of the development are constructed in accordance with:
 - (a) the relevant requirements of the BCA; and
 - (b) any additional requirements of the SA NSW where the building or structure is located on land within declared Mine Subsidence Districts.

Notes:

- Under Part 8 of the EP&A Act, the Applicant is required to obtain construction and occupation certificates for the proposed building works;
- Part 8 of the EP&A Regulation sets out the requirements for the certification of the development; and
- Under section 21 of the Coal Mine Subsidence Compensation Act 2017, the Applicant is required to obtain the SA NSW's approval before constructing any improvements in a Mine Subsidence District.

DEMOLITION

16. The Applicant must ensure that all demolition work is carried out in accordance with *Australian Standard AS* 2601-2001: The Demolition of Structures, or its latest version.

OPERATION OF PLANT AND EQUIPMENT

- 17. All plant and equipment used on site, or to monitor the performance of the development must be:
 - (a) maintained in a proper and efficient condition; and
 - (b) operated in a proper and efficient manner.
- 18. Deleted

ROAD MAINTENANCE CONTRIBUTION

 The Applicant must pay Road Maintenance Fees to CC Council in accordance with its Road Maintenance Agreement with CC Council.

COMMUNITY CONSULTATIVE COMMITTEE

20. A Community Consultative Committee (CCC) must continue to operate for the development in accordance with the Department's *Community Consultative Committee Guidelines: State Significant Projects (2019).*The CCC must continue to operate during the life of the development, or other timeframe agreed by the Planning Secretary.

Notes:

- The CCC is an advisory committee only.
- In accordance with the Guidelines, the Committee should comprise an independent chair and appropriate representation from the Applicant, Affected Councils and the local community.
- 21. With the approval of the Planning Secretary, the Applicant may combine the CCC required by this consent with any similar CCC required by a consent or approval for any adjoining mine subject to common, shared or related ownership or management.

EVIDENCE OF CONSULTATION

- 22. Where conditions of this consent require consultation with an identified party, the Applicant must:
 - (a) consult with the relevant party prior to submitting the subject document;
 - (b) provide details of the consultation undertaken including:
 - i. the outcome of that consultation, matters resolved and unresolved; and
 - ii. details of any disagreement remaining between the party consulted and the Applicant and how the Applicant has addressed the matters not resolved.

STAGING, COMBINING AND UPDATING STRATEGIES, PLANS OR PROGRAMS

- 23. With the approval of the Planning Secretary, the Applicant may:
 - (a) prepare and submit any strategy, plan or program required by this consent on a staged basis (if a clear description is provided as to the specific stage and scope of the development to which the strategy, plan or program applies, the relationship of the stage to any future stages and the trigger for updating the strategy, plan or program);
 - (b) combine any strategy, plan or program required by this consent (if a clear relationship is demonstrated between the strategies, plans or programs that are proposed to be combined);
 - (c) update any strategy, plan or program required by this consent (to ensure the strategies, plans and programs required under this consent are updated on a regular basis and incorporate additional measures or amendments to improve the environmental performance of the development); and
 - (d) combine any strategy, plan or program required by this consent with any similar strategy, plan or program required by an adjoining mining consent or approval, in common ownership or management.
- 24. If the Planning Secretary agrees, a strategy, plan or program may be staged or updated without consultation being undertaken with all parties required to be consulted in the relevant condition in this consent.
- 25. If the Planning Secretary agrees, a strategy, plan or program may be staged without addressing particular requirements of the relevant condition of this consent if those requirements are not applicable to the particular stage.

APPLICATION OF EXISTING STRATEGIES, PLANS OR PROGRAMS

26. The Applicant must continue to apply existing management strategies, plans or monitoring programs approved prior to the approval of Modification 3, until the approval of a similar plan, strategy or program following the approval of Modification 3.

PROTECTION OF PUBLIC INFRASTRUCTURE

- 27. Unless the Applicant and the applicable authority agree otherwise, the Applicant must:
 - (a) repair, or pay the full costs associated with repairing, any public infrastructure^a that is damaged by carrying out the development; and
 - (b) relocate, or pay the full costs associated with relocating, any public infrastructure^a that needs to be relocated as a result of the development.

^a This condition does not apply to any damage to roads caused as a result of general road usage or to damage that has been compensated under the Mining Act 1992.

COMPLIANCE

28. The Applicant must ensure that all of its employees, contractors (and their sub-contractors) are made aware of, and are instructed to comply with, the conditions of this consent relevant to activities they carry out in respect of the development.

APPLICABILITY OF GUIDELINES

- 29. References in the conditions of this consent to any guideline, protocol, Australian Standard or policy are to such guidelines, protocols, Standards or policies in the form they are in as at the date of inclusion (or later update) in the condition.
- 30. However, consistent with the conditions of this consent and without altering any limits or criteria in this consent, the Planning Secretary may, in respect of ongoing monitoring and management obligations, agree to or require compliance with an updated or revised version of such a guideline, protocol, Standard or policy, or a replacement of them.

SCHEDULE 3 ENVIRONMENTAL CONDITIONS – GENERAL

TRANSPORT

Monitoring of Coal Transport

- 1. The Applicant must:
 - (a) keep accurate records of the amount of coal transported from the site (on a weekly basis); and
 - (b) make these records publicly available on its website at the end of each calendar quarter.

Road Works

- 2. The Applicant must upgrade the Ruttleys Road and Construction Road intersection within 6 months of the date of this consent, unless the Planning Secretary directs otherwise, by:
 - (a) installing additional signage on and adjacent to Construction Road prior to the intersection;
 - (b) repairing the surface of Construction Road as required and ensuring the edge seal of the left turn lane is of sufficient width to accommodate coal trucks;
 - (c) installing or replacing "Stop" signs in accordance with Austroads guidelines;
 - (d) repainting road line markings and raised pavements associated with this intersection; and
 - (e) installing barriers to prevent trucks parking on the gravel area adjacent to the intersection and the electricity substation located in the vicinity of this intersection.

The design and construction of these works must be undertaken in consultation with, and to the relevant satisfaction of, CC Council, TfNSW and Delta Electricity and to the satisfaction of the Planning Secretary.

Road Transport Protocol

- The Applicant must prepare a Road Transport Protocol to the satisfaction of the Planning Secretary. This protocol must:
 - (a) be prepared in consultation with TfNSW, NCC, CC Council and CCC and submitted to the Planning Secretary for approval within 6 months of the date of this consent;
 - (b) describe the designated haulage routes to be used (as shown in Appendix 5); the maximum number of road movements proposed and the haulage hours permitted under this consent;
 - (c) include a Traffic Management Plan, which includes:
 - procedures to ensure that drivers adhere to the designated haulage routes;
 - measures to maximise the use of a low frequency (regular) trucking schedule rather than an
 intermittently-high frequency (campaign) trucking schedule, especially during the morning
 peak hour;
 - contingency plans to apply when (for example) the designated haulage route is disrupted, including procedures for notifying relevant agencies and affected communities of the need to implement such contingency plans;
 - procedures to ensure that all haulage vehicles associated with the development are clearly distinguishable as Chain Valley Colliery coal haulage trucks;
 - details of procedures for receiving and addressing complaints from the community concerning traffic issues associated with truck movements to and from the site;
 - measures to ensure that the provisions of the Traffic Management Plan are implemented, eg driver training in the heavy vehicle driver's Code of Conduct and contractual agreements with heavy vehicle operators; and
 - procedures for ensuring compliance with and enforcement of the heavy vehicle driver's Code of Conduct;
 - (d) include a Code of Conduct for heavy vehicle drivers that addresses:
 - travelling speeds:
 - instructions to avoid grouping or convoying of trucks;
 - instructions to drivers not to overtake each other on the haulage route, as far as practicable, and to maintain appropriate distances between vehicles;
 - instruction to drivers to adhere to the designated haulage routes;
 - instruction to drivers to be properly safety conscious and to strictly obey all traffic regulations;
 - appropriate penalties for infringements of the Code.

The Applicant must implement the approved Road Transport Protocol as approved from time to time by the Planning Secretary.

- 4. Prior to 31 March 2014, and every 12 months thereafter for each calendar year in which coal haulage from the site is undertaken utilising public roads, unless the Planning Secretary directs otherwise, the Applicant must commission a suitably qualified person, whose appointment has been approved by the Planning Secretary at least one month prior to undertaking the audit, to conduct an Independent Traffic Audit of the development. This audit must:
 - (a) be undertaken without prior notice to the Applicant, and in consultation with TfNSW, NCC, CC Council and the CCC;
 - (b) assess the impact of the development on the performance and safety of the road network, including a review of:
 - haulage records;
 - accident records on the haulage route, infringements relating to the code of conduct and any incidents involving haulage vehicles;
 - · community complaints register; and
 - (c) assess the effectiveness of the Road Transport Protocol; and, if necessary, recommend measures to reduce or mitigate any adverse (or potentially adverse) impacts.
- 5. Within 1 month of receiving the audit report, or as otherwise agreed by the Planning Secretary, the Applicant must submit a copy of the report to the Planning Secretary, with a detailed response to any of the recommendations contained in the audit report, including a timetable for the implementation of any measures proposed to address the recommendations in the audit report.

A summary of the audit report must be included in the Annual Review.

Alternative Coal Transport Options

- 6. Prior to 31 December 2014, and every three years thereafter, the Applicant must prepare and submit to the Planning Secretary for approval, a study of the reasonable and feasible options to reduce or eliminate the use of public roads to transport coal from the development, unless otherwise agreed by the Planning Secretary. The assessment must include:
 - (a) an analysis of the capital, construction and operating costs of the alternative transport options; and
 - (b) quantified social and environmental impacts associated with road and rail transport.

NOISE

Noise Impact Assessment Criteria

7. The Applicant must ensure that the noise generated by the development at any residence on privatelyowned land does not exceed the criteria for the location in Table 1 nearest to that residence.

Table 1: Noise Criteria dB(A)

Location	Day	Evening	Nig	ght
Location	L _{Aeq(15 min)}	L _{Aeq(15 min)}	L Aeq(15 min)	L _{A1(1 min)}
R8	38	38	38	45
R11	49	49	49	54
R12	49	49	49	53
R13	43	43	43	49
R15	36	36	36	45
R19	37	37	37	45
R22	46	46	46	46
all other privately-owned land	35	35	35	45

Notes:

- To interpret the locations referred to in Table 1, see Appendix 6 and the EIS; and
- Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 8 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has a written agreement with the relevant landowner to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Operating Conditions

- 8. The Applicant must:
 - implement best management practice, including all reasonable and feasible noise mitigation measures, to minimise the construction, operational and transport noise generated by the development;
 - regularly assess the noise monitoring and meteorological data and relocate, modify, and/or stop operations on site to ensure compliance with the relevant conditions of this consent;
 - (c) minimise the noise impacts of the development during meteorological conditions under which the noise limits in this consent do not apply (see Appendix 8);
 - (d) use its best endeavours to achieve the long-term noise goals in Table 2, where reasonable and feasible, and report on progress towards achieving these goals in each Annual Review;
 - (e) carry out a comprehensive noise audit of the development in conjunction with each independent environmental audit; and
 - (f) prepare an action plan to implement any additional reasonable and feasible onsite noise mitigation measures identified by each audit:

to the satisfaction of the Planning Secretary.

Table 2: Long-term Noise Goals dB(A)

Location	Day	Evening	Night
Location	L _{Aeq(15 min)}	L _{Aeq(15 min)}	L _{Aeq(15 min)}
R11 – R13	41	41	41
R22	40	40	40

Notes:

- To interpret the locations referred to in Table 2, see Appendix 6 and the EIS; and
- Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 8 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

Noise Management Plan

- The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
 - (a) be prepared in consultation with the EPA and submitted to the Planning Secretary for approval within 4 months of the date of this consent, unless otherwise agreed by the Planning Secretary;
 - (b) describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this consent;
 - (c) describe the proposed noise management system in detail including the mitigation measures that would be implemented to minimise noise during construction and operations, including on and off site road noise generated by vehicles associated with the development; and
 - (d) include a monitoring program that:
 - uses attended monitoring to evaluate the compliance of the development against the noise criteria in this consent;
 - evaluates and reports on:
 - the effectiveness of the on-site noise management system; and
 - compliance against the noise operating conditions; and
 - defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.

AIR QUALITY

Odour

10. The Applicant must ensure that no offensive odours are emitted from the site, as defined under the POEO

Air Quality Criteria

11. The Applicant must ensure that all reasonable and feasible avoidance and mitigation measures are employed so that particulate matter emissions generated by the development do not cause exceedances of the criteria listed in Table 3 at any residence on privately-owned land.

Table 3: Air quality criteria

Pollutant	Averaging period	Crite	rion
Particulate matter < 2.5 µm (PM _{2.5})	Annual	^{а, с} 8 µg/m³	
Farticulate matter < 2.5 µm (FW2.5)	24 hour	^b 25 μg/m ³	
Particulate matter < 10 µm (PM ₁₀)	Annual	^{a, c} 25 μg/m ³	
Fatticulate matter < 10 μm (FW10)	24 hour	^b 50 μg/m ³	
Total suspended particulate (TSP) matter	Annual	a, c 90 	ug/m³
^d Deposited dust	Annual	^b 2 g/m ² /month	^a 4 g/m ² /month

Notes:

- ^a Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).
- b Incremental impact (i.e. incremental increase in concentrations due to the development on its own).
- ^c Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary.
- ^d Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air Determination of Particulate Matter Deposited Matter Gravimetric Method.
- 11A. The air quality criteria in Table 3 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to exceed the air quality criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Operating Conditions

- 12. The Applicant must:
 - (a) implement best practice air quality management at the site, including all reasonable and feasible measures to minimise the off-site odour, fume and dust emissions generated by the development;
 - (b) implement best practice management to minimise the risk of spontaneous combustion and related emissions;
 - (c) implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site:
 - (d) operate an air quality management system on site to ensure compliance with the relevant conditions of this consent;
 - (e) minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events (see note c to Table 3 above):
 - regularly assess the air quality monitoring data, and modify operations on site to ensure compliance with the relevant conditions of this consent,

to the satisfaction of the Planning Secretary.

Air Quality Management Plan

- 13. The Applicant must prepare an Air Quality Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
 - (a) be prepared in consultation with the EPA, and submitted to the Planning Secretary for approval within 6 months of the date of this consent;
 - describe the measures that would be implemented to ensure compliance with the relevant air quality criteria and operating conditions of this consent;
 - (c) describe the measures that would be implemented to minimise the release of greenhouse gas emissions from the site:
 - (d) describe the proposed on-site air quality management system; and
 - (e) include an air quality monitoring program that:
 - · is capable of evaluating the operating conditions of this consent;
 - evaluates and reports on:
 - the effectiveness of the air quality management system; and
 - compliance against the air quality operating conditions;
 - defines what constitutes an air quality incident and includes a protocol for identifying and notifying the Department and relevant stakeholders of any air quality incidents.

The Applicant must implement the Air Quality Management Plan as approved by the Planning Secretary.

METEOROLOGICAL MONITORING

- 14. During the life of the development, the Applicant must ensure that there is a suitable meteorological station operating in the vicinity of the site that:
 - (a) complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline; and
 - (b) is capable of continuous real-time measurement of temperature lapse rate in accordance with the NSW Industrial Noise Policy, unless a suitable alternative is approved by the Planning Secretary following consultation with the EPA.

SOIL & WATER

Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain the necessary water licences for the development.

Water Supply

15. The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of mining operations to match its available water supply, to the satisfaction of the Planning Secretary.

Water Pollution

16. Unless an EPL authorises otherwise, the Applicant must comply with Section 120 of the POEO Act.

Sewage Management

17. The Applicant must manage sewage generated by the development in accordance with the requirements of an EPL.

Water Management Plan

- 18. The Applicant must prepare a Water Management Plan for the surface facilities sites to the satisfaction of the Planning Secretary. This plan must be prepared in consultation with DPIE Water and EPA, by suitably qualified and experienced persons whose appointment has been endorsed by the Planning Secretary and submitted to the Planning Secretary for approval within 6 months of the date of this consent. This plan must include:
 - (a) a comprehensive water balance for the development that includes details of:
 - sources and security of water supply;
 - water make in the underground workings;
 - water transfers from the underground operations to the surface;
 - · water use; and
 - any water discharges;
 - (b) management plans for the surface facilities sites, that include:
 - a detailed description of water management systems for each site, including:
 - clean water diversion systems;

- erosion and sediment controls: and
- any water storages;
- measures to minimise potable water use and to reuse and recycle water;
- measures to manage acid sulphate soils, if encountered;
- activities that would involve ground disturbance at the site; and
- monitoring and reporting procedures.
- (c) a Surface Water Management Plan which:
 - includes baseline data on surface water flows and quality of Swindles Creek;
 - details surface water impact assessment criteria, including trigger levels for investigating any
 potentially adverse impacts on surface water resources or surface water quality;
 - provides a program to monitor:
 - surface water discharges;
 - surface water flows and quality; and
 - channel stability;
- (d) a Ground Water Monitoring Program which includes a program to:
 - monitor and report groundwater inflows to underground workings;
 - predict, manage and monitor impacts to nearby groundwater bores on privately-owned land that may be impacted by the development; and
- (e) a detailed review of surface water management at the site, with particular reference to the water storages within the dirty water management system, to:
 - determine whether the capacity, integrity, retention time and management of the dirty water storages (particularly the final Pollution Control Dam) are sufficient to ensure that water discharged from the site meets the EPL limits and surface water impact assessment criteria within the Surface Water Management Plan; and
 - propose any appropriate changes to the surface water management system.

The Applicant must implement the Water Management Plan as approved by the Planning Secretary.

Note: The Planning Secretary may require the Applicant to implement upgrades and other changes identified under paragraph (e), in accordance with condition 3 of Schedule 2.

BIODIVERSITY

Biodiversity Enhancement Strategy

19. The Applicant must implement a Biodiversity Enhancement Strategy as described in the EIS and summarised in Table 4. in consultation with BCD, and to the satisfaction of the Planning Secretary.

Table 4: Summary of the Biodiversity Enhancement Strategy

Area	Offset Type	Minimum Size/Amount
Biodiversity Enhancement Area	Enhancement and restoration measures, including weed and rubbish removal, return of natural hydrological regime and regeneration with native endemic species.	3 ha (in total) of Swamp Sclerophyll Floodplain Forest and Swamp Oak Floodplain Forest endangered ecological communities within the surface facilities sites

Note: To identify the Biodiversity Enhancement Area referred to in Table 4 see the applicable figures in Appendix 7.

The Applicant must implement its preferred option of the three options set out in new dot point 1 of the Terrestrial Ecology section of its Statement of Commitments by 1 December 2016, following consultation with BCD and to the satisfaction of the Planning Secretary.

Biodiversity Management Plan

- 20. The Applicant must prepare a Biodiversity Management Plan for the surface facilities sites, for all areas that are not, or will not, be subject to condition 7 of schedule 4, to the satisfaction of the Planning Secretary. This plan must:
 - be prepared by a suitably qualified person approved by the Planning Secretary; in consultation with BCD, and submitted to the Planning Secretary within 6 months of the date of this consent;
 - (b) establish baseline data for the existing habitat in the Biodiversity Enhancement Area and elsewhere on the site;
 - (c) describe the short, medium, and long term measures that would be implemented to:
 - manage the impacts of clearing vegetation;

- manage the remnant vegetation and habitat in the Biodiversity Enhancement Area and elsewhere on the site; and
- implement the Biodiversity Enhancement Strategy, including detailed performance and completion criteria:
- (d) include a program to monitor and report on the effectiveness of these measures, and progress against the detailed performance and completion criteria;
- (e) identify the potential risks to the successful implementation of the Biodiversity Enhancement Strategy, and the contingency measures that would be implemented to mitigate these risks; and
- (f) include details of who would be responsible for monitoring, reviewing, and implementing the plan.

The Applicant must implement the Biodiversity Management Plan as approved by the Planning Secretary.

20A. Within 3 months of the approval of MOD 2, the Applicant must revise the Biodiversity Management Plan to incorporate the measures required to implement its commitments described in new dot point 2 of the Terrestrial Ecology section of its Statement of Commitments, and submit it to the Planning Secretary for approval.

HERITAGE

Protection of Aboriginal Heritage

21. The Applicant must ensure that the development does not cause any direct or indirect impact on any identified heritage item located outside the approved disturbance area, beyond those predicted in the documents listed in condition 2(e) of Schedule 2.

Heritage Management Plan

- 21A. The Applicant must prepare a Heritage Management Plan for the development to the satisfaction of the Planning Secretary. This Plan must:
 - be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Planning Secretary;
 - (b) be prepared in consultation with BCD and Registered Aboriginal Parties;
 - (c) include consideration of the Aboriginal and non-Aboriginal cultural context and significance of the site:
 - (d) describe the procedures and management measures to be implemented on the site or within any offset area to:
 - ensure all workers receive suitable Aboriginal cultural heritage inductions prior to carrying out any activities which may cause impacts to Aboriginal objects or Aboriginal places, and that suitable records are kept of these inductions;
 - ii. protect, monitor and manage identified non-Aboriginal heritage, Aboriginal objects and Aboriginal places (including any proposed archaeological investigations of potential subsurface objects and salvage of objects within the approved disturbance area) in accordance with the commitments made in the document/s listed in condition 2(e) of Schedule 2 and including the ongoing monitoring of site 45-7-0189 at Summerland Point;
 - iii. protect non-Aboriginal heritage, Aboriginal objects and Aboriginal places located outside the approved disturbance area from impacts of the development;
 - iv. manage the discovery of suspected human remains and any new Aboriginal objects or Aboriginal places, including provisions for burials, over the life of the development;
 - v. maintain and manage reasonable access for relevant Aboriginal stakeholders to Aboriginal objects and Aboriginal places (outside of the approved disturbance area); and
 - vi. facilitate ongoing consultation and involvement of Registered Aboriginal Parties in the conservation and management of Aboriginal cultural heritage on the site; and
 - (e) include a strategy for the care, control and storage of Aboriginal objects salvaged on site, both during the life of the development and in the long term.

The Applicant must implement the Heritage Management Plan approved by the Planning Secretary.

VISUAL

Visual Amenity and Lighting

- 22. The Applicant must:
 - (a) minimise visual impacts, and particularly the off-site lighting impacts, of the Surface facilities sites;
 - (b) take all reasonable and feasible measures to further mitigate off-site lighting impacts from the development; and

(c) ensure that all external lighting associated on site complies with Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting,

to the satisfaction of the Planning Secretary.

WASTE

- 23. The Applicant must:
 - (a) minimise and monitor the waste generated by the development;
 - (b) ensure that the waste generated by the development is appropriately stored, handled and disposed of: and
 - (c) report on waste management and minimisation in the Annual Review, to the satisfaction of the Planning Secretary.

BUSHFIRE MANAGEMENT

- 24. The Applicant must:
 - (a) ensure that the development is suitably equipped to respond to any fires on site; and
 - (b) assist the Rural Fire Service and emergency services as much as possible if there is a fire in the vicinity of the Surface facilities sites.

REHABILITATION

Rehabilitation Objectives

25. The Applicant must rehabilitate the site in accordance with the conditions imposed on the mining lease(s) associated with the development under the *Mining Act 1992*. This rehabilitation must be generally consistent with the proposed rehabilitation strategy described in the EIS, and comply with the objectives in Table 5.

Table 5: Rehabilitation Objectives

Table 5. Renabilitation Objectives			
Feature	Objective		
Mine site (as a whole)	Safe, stable and non-polluting.		
	 Final land use compatible with surrounding land uses. 		
Surface infrastructure	To be decommissioned and removed, unless the RR agrees otherwise.		
Portals and ventilation shafts	 To be decommissioned and made safe and stable. 		
	 Retain habitat for threatened species (eg bats), where practicable. 		
Other land affected by the development	Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of:		
	- local native plant species (unless the RR agrees		
	otherwise); and - a landform consistent with the surrounding environment.		
Della factions and account of his			
Built features damaged by	Repair to pre-mining condition or equivalent unless:		
mining operations	 the owner agrees otherwise; or 		
	 the damage is fully restored, repaired or compensated 		
	under the Coal Mine Subsidence Compensation Act 2017.		
Community • Ensure public safety.			
•	Minimise the adverse socio-economic effects associated with		
	mine closure.		

Notes:

- These rehabilitation objectives apply to all subsidence impacts and environmental consequences caused by underground mining taking place after the granting of project approval MP 10_0161, and to all development surface infrastructure that is part of the development, whether constructed prior to or following the date of this consent.
- Rehabilitation of subsidence impacts and environmental consequences caused by mining which took place prior to
 the date of project approval (MP 10_0161) may be subject to the requirements of other approvals (eg under a mining
 lease or a Subsidence Management Plan approval).

Progressive Rehabilitation

26. The Applicant must carry out the rehabilitation of the site progressively, that is, as soon as reasonably practicable following disturbance.

Rehabilitation Management Plan

27. The Applicant must prepare a Rehabilitation Management Plan for the development, in accordance with the conditions imposed on the mining lease(s) associated with the development under the *Mining Act 1992*. This plan must:

- (a) be prepared in consultation with BCD. DPIE Water, CC Council, LMCC and the CCC:
- (b) be submitted to the RR within 12 months of the date of approval of this development consent;
- (c) be prepared in accordance with any relevant RR guideline and be consistent with the rehabilitation objectives in the EIS and in Table 5:
- (d) describe how the performance of the rehabilitation would be monitored and assessed against the objectives in Table 5;
- describe the process whereby additional measures would be identified and implemented to ensure the rehabilitation objectives are achieved;
- (f) provide for detailed mine closure planning, including measures to minimise socio-economic effects due to mine closure, to be conducted prior to the site being placed on care and maintenance; and
- (g) be integrated with the other management plans required under this consent.

Note: The Rehabilitation Management Plan should address all land impacted by the development whether prior to, or following, the date of this consent.

EXPLORATION ACTIVITIES AND SURFACE INFRASTRUCTURE

Exploration Activities and Minor Surface Infrastructure Management Plan

- 28. Prior to carrying out exploration activities on the site under this consent that would cause temporary surface disturbance, or exploration activities within the waters or lake bed of Lake Macquarie, or the construction and/or upgrade of minor surface infrastructure on the site, the Applicant must prepare an Exploration Activities and Minor Surface Infrastructure Management Plan for the development to the satisfaction of the Planning Secretary. This Plan must:
 - (a) be prepared by a suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary;
 - (b) be prepared in consultation with MEG, NSW Maritime Division of TfNSW, NSW Fisheries and BCD:
 - (c) include a description of the measures to be implemented for:
 - i. managing exploration activities;
 - ii. managing construction and operation of minor surface infrastructure and associated access tracks;
 - iii. consulting with and if necessary compensating affected landowners;
 - iv. assessing noise, air quality, traffic, biodiversity, heritage, public safety and other impacts;
 - v. beneficial re-use or flaring of drained hydrocarbon gases, wherever practicable;
 - vi. avoiding significant impacts and minimisation of impacts generally;
 - vii. avoiding or minimising impacts on threatened species, populations or their habitats and EECs;
 - viii. minimising clearance and disturbance of native vegetation (including seagrasses);
 - ix. minimising and managing erosion and sedimentation; and
 - x. rehabilitating disturbed areas.

The Applicant must implement the Exploration Activities and Minor Surface Infrastructure Management Plan as approved by the Planning Secretary.

SCHEDULE 4 ENVIRONMENTAL CONDITIONS – UNDERGROUND MINING

SUBSIDENCE

The Applicant must ensure that vertical subsidence within the High Water Mark Subsidence Barrier and
within seagrass beds is limited to a maximum of 20 millimetres (mm). If at any stage predicted subsidence
levels are exceeded within these areas, an ecological monitoring program shall be initiated to assess the
impacts to ecological communities and threatened species and if appropriate, offsets are to be provided for
any impacts detected.

Performance Measures - Natural Environment

2. The Applicant must ensure that the development does not cause any exceedance of the performance measures in Table 6 to the satisfaction of the Planning Secretary.

Table 6: Subsidence Impact Performance Measures - Natural and Heritage Features

Biodiversity	- Natural and Hemage Features	
Threatened species or endangered populations	Negligible environmental consequences	
Seagrass beds	Negligible environmental consequences including: negligible change in the size and distribution of seagrass beds; negligible change in the functioning of seagrass beds; and negligible change to the composition or distribution of seagrass species within seagrass beds.	
Benthic communities	Minor environmental consequences, including minor changes to species composition and/or distribution.	
Mine workings		
First workings under an approved Extraction Plan beneath any feature where performance measures in this table require negligible environmental consequences	To remain long-term stable and non-subsiding.	
Second workings	To be carried out only in accordance with an approved Extraction Plan.	

Notes:

- The Applicant will be required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in the various management plans that are required under this consent (see Condition 7 below).
- Measurement and/or monitoring of compliance with performance measures and performance indicators is to be
 undertaken using generally accepted methods that are appropriate to the environment and circumstances in which
 the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In
 the event of a dispute over the appropriateness of proposed methods, the Planning Secretary will be the final arbiter.
- The requirements of this condition only apply to the impacts and consequences of mining operations, construction or demolition undertaken following the date of approval of this consent.

Offsets

- 3. If the Applicant exceeds the performance measures in Table 6 and the Planning Secretary determines that:
 - (a) it is not reasonable or feasible to remediate the impact or environmental consequence; or
 - the remediation measures implemented by the Applicant have failed to satisfactorily remediate the impact or environmental consequence;

then the Applicant must provide a suitable offset to compensate for the impact or environmental consequence to the satisfaction of the Planning Secretary.

Note: Any offset required under this condition must be proportionate with the significance of the impact or environmental consequence.

Performance Measures - Built Features

4. The Applicant must ensure that the development does not cause any exceedances of the performance measures in Table 7, to the satisfaction of the Planning Secretary.

Table 7: Subsidence Impact Performance Measures – Built Features

Built Features	Performance Measure
Trinity Point Marina Development Other built features	 Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated.
	Damage must be fully repaired, replaced or fully compensated.
Public Safety	
Public Safety.	Negligible additional risk.

Notes:

- The Applicant will be required to define more detailed performance indicators for each of these performance measures in Built Features Management Plans or a Public Safety Management Plan (see Condition 7 below).
- Measurement and/or monitoring of compliance with performance measures and performance indicators is to be
 undertaken using generally accepted methods that are appropriate to the environment and circumstances in which
 the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In
 the event of a dispute over the appropriateness of proposed methods, the Planning Secretary will be the final arbiter.
- The requirements of this condition only apply to the impacts and consequences of mining operations undertaken following the date of this development consent.
- Requirements regarding safety or serviceability do not preclude preventative actions or mitigation being taken prior to
 or during mining in order to achieve or maintain these outcomes.
- Requirements under this condition may be met by measures undertaken in accordance with the Coal Mine Subsidence Compensation Act 2017.
- 5. Any dispute between the Applicant and the owner of any built feature over the interpretation, application or implementation of the subsidence performance measures in Table 7 is to be settled by the Planning Secretary, following consultation with the SA NSW and MEG. Any decision by the Planning Secretary shall be final and not subject to further dispute resolution under this consent.

Multi-Seam Mining Feasibility Investigation

- 6. Prior to the submission of an Extraction Plan related to the Chain Valley Bay mining area as shown in Appendix 3, the Applicant must prepare a detailed Multi-Seam Mining Feasibility Investigation to the satisfaction of the Planning Secretary. This plan must:
 - be prepared in consultation with MEG by suitably qualified and experienced persons whose appointment has been endorsed by the Planning Secretary;
 - (b) assess the extent of the soft claystone floor/roof conditions within former workings in the Great Northern and Wallarah Seams;
 - (c) assess the stability of remnant coal pillars within former workings in the Great Northern and Wallarah Seams;
 - (d) give particular consideration to the risks of irregular subsidence, pillar run and long-term subsidence leading to subsidence outside of the predicted angle of draw;
 - (e) include revised multi-seam subsidence predictions for the proposed second workings; and
 - (f) recommend final design of the second workings and any necessary adaptive management measures.

Extraction Plan

- 7. The Applicant must prepare an Extraction Plan for all second workings on site, to the satisfaction of the Planning Secretary. Each Extraction Plan must:
 - (a) be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Planning Secretary;
 - (b) be approved by the Planning Secretary before the Applicant carries out any second workings covered by the plan;
 - (c) include detailed plans of existing and proposed first and second workings and any associated surface development, including any applicable adaptive management measures;
 - (d) include detailed performance indicators for each of the performance measures in Tables 6 and 7;
 - (e) provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, incorporating any relevant information obtained since this consent;
 - (f) describe the measures that would be implemented to ensure compliance with the performance measures in Tables 6 and 7, and manage or remediate any impacts and/or environmental consequences;
 - (g) include a Built Features Management Plan, which has been prepared in consultation with RR and the owners of affected public infrastructure, to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which

- addresses in appropriate detail all items of public infrastructure and all classes of other built features:
- has been prepared following appropriate consultation with the owner/s of potentially affected feature/s:
- recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate all predicted impacts on potentially affected built features in a timely manner; and;
- (h) include a Benthic Communities Management Plan, which has been prepared in consultation with BCD, LMCC, and DPI Fisheries, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on benthic communities, and which includes:
 - surveys of the lake bed to enable contours to be produced and changes in depth following subsidence to be accurately measured;
 - benthic species surveys within the area subject to second workings, as well as control sites
 outside the area subject to second workings (at similar depths) to establish baseline data on
 species number and composition within the communities;
 - a program of ongoing seasonal monitoring of benthic species in both control and impact sites;
 - development of a model to predict likely impact of increased depth and associated subsidence impacts and effects, including but not limited to light reduction and sediment disturbance, on benthic species number and benthic communities composition, incorporating the monitoring and survey data collected; and
 - updating the model every 2 years using the most recent monitoring and survey data;
- (i) include a Seagrass Management Plan, which has been prepared in consultation with BCD, LMCC, and DPI Fisheries, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on seagrass beds, and which includes:
 - a program of ongoing monitoring of seagrasses in both control and impact sites; and
 - a program to predict and manage subsidence impacts and environmental consequences to seagrass beds to ensure the performance measures in Table 6 are met;
- (j) include a Public Safety Management Plan, which has been prepared in consultation with RR, to ensure public safety;
- (k) include a Subsidence Monitoring Program which has been prepared in consultation with RR, to:
 - provide data to assist with the management of the risks associated with subsidence;
 - validates the subsidence predictions;
 - analyses the relationship between the predicted and resulting subsidence effects and predicted and resulting impacts under the plan and any ensuing environmental consequences; and
 - informs the contingency plan and adaptive management process;
- (I) include a contingency plan that expressly provides for adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Tables 6 and 7, or where any such exceedance appears likely;
- (m) include appropriate revisions to the Rehabilitation Management Plan required under Condition 27 of Schedule 3; and
- (n) include a program to collect sufficient baseline data for future Extraction Plans.

The Applicant must implement the Extraction Plan as approved by the Planning Secretary.

- 8. The Applicant must ensure that the management plans required under conditions 7(g)-(j) above include:
 - (a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this consent; and
 - (b) a detailed description of the measures that would be implemented to remediate predicted impacts.

First Workings

9. The Applicant may carry out first workings within Subsidence Zones A and B as shown in Appendix 3, other than in accordance with an approved Extraction Plan, provided that the first workings are designed to remain stable and non-subsiding in the long-term and do not generate more than 20 mm of vertical subsidence at the surface, except insofar as they may be impacted by approved second workings.

Note: The intent of this condition is to ensure that first workings are built to geotechnical and engineering standards sufficient to ensure long-term stability, with negligible direct subsidence impacts.

9A. Within 3 months of the approval of MOD 1, the Applicant must produce and subsequently implement a Built Features Management Plan that considers surface infrastructure potentially affected by the first workings of the Underground Linkage between Chain Valley Colliery and Mannering Colliery, including WCS's MP01 sewer rising main, TransGrid's electricity transmission assets and infrastructure associated with the Vales Point Power Station, to the satisfaction of the Planning Secretary.

Payment of Reasonable Costs

10. The Applicant must pay all reasonable costs incurred by the Department to engage suitably qualified, experienced and independent experts to review the adequacy of any aspect of an Extraction Plan.

SCHEDULE 5 ADDITIONAL PROCEDURES

NOTIFICATION OF LANDOWNERS

- As soon as practicable after obtaining monitoring results showing:
 - (a) an exceedance of any relevant criteria in Schedule 3, the Applicant must notify affected landowners in writing of the exceedance, and provide regular monitoring results to each affected landowner until the development is again complying with the relevant criteria; and
 - (b) an exceedance of any relevant air quality criteria in Schedule 3, the Applicant must send a copy of the NSW Health fact sheet entitled "Mine Dust and You" (NSW Health, 2017) (as may be updated from time to time) to the affected landowners and/or existing tenants of the land (including the tenants of any mine-owned land).

INDEPENDENT REVIEW

2. If an owner of privately-owned land considers the development to be exceeding the relevant criteria in Schedule 3, then he/she may ask the Planning Secretary in writing for an independent review of the impacts of the development on his/her land.

If the Planning Secretary is satisfied that an independent review is warranted, then within 2 months of the Planning Secretary's decision the Applicant must:

- (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Planning Secretary, to:
 - consult with the landowner to determine his/her concerns;
 - conduct monitoring to determine whether the development is complying with the relevant criteria in Schedule 3; and
 - if the development is not complying with these criteria then identify the measures that could be implemented to ensure compliance with the relevant criteria; and
- (b) give the Planning Secretary and landowner a copy of the independent review.

SCHEDULE 6 ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING

ENVIRONMENTAL MANAGEMENT

Environmental Management Strategy

- 1. The Applicant must prepare an Environmental Management Strategy for the development to the satisfaction of the Planning Secretary. This strategy must:
 - (a) provide the strategic framework for environmental management of the development;
 - (b) identify the statutory approvals that apply to the development;
 - (c) set out the role, responsibility, authority and accountability of all key personnel involved in the environmental management of the development;
 - (d) set out the procedures to be implemented to:
 - keep the local community and relevant agencies informed about the operation and environmental performance of the development;
 - · receive record, handle and respond to complaints;
 - resolve any disputes that may arise during the course of the development;
 - respond to any non-compliance and any incident;
 - respond to emergencies; and
 - (e) include:
 - references to any strategies, plans and programs approved under the conditions of this consent;
 - a clear plan depicting all the monitoring to be carried out under the conditions of this consent.

The Applicant must implement the Environmental Management Strategy as approved by the Planning Secretary.

Adaptive Management

2. The Applicant must assess and manage development-related risks to ensure that there are no exceedances of the criteria and performance measures in this consent. Any exceedance of these criteria or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation.

Where any exceedance of these criteria or performance measures has occurred, the Applicant must, at the earliest opportunity:

- (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur;
- (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and
- (c) implement reasonable remediation measures as directed by the Planning Secretary.

Management Plan Requirements

- Management plans required under this consent must be prepared in accordance with relevant guidelines, and include:
 - (a) a summary of relevant background or baseline data;
 - (b) details of:
 - the relevant statutory requirements (including any relevant approval, licence or lease conditions);
 - any relevant limits or performance measures and criteria; and
 - the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;
 - (c) any relevant commitments or recommendations identified in the document/s listed in condition 2(e) of Schedule 2:
 - (d) a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;
 - (e) a program to monitor and report on the:
 - impacts and environmental performance of the development; and
 - effectiveness of the management measures set out pursuant to condition 2(e) of Schedule 2:
 - (f) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;
 - (g) a program to investigate and implement ways to improve the environmental performance of the development over time;
 - (h) a protocol for managing and reporting any:
 - incident, non-compliance or exceedance of any impact assessment criterion or performance criterion:

- complaint: or
- failure to comply with other statutory requirements;
- (i) public sources of information and data to assist stakeholders in understanding environmental impacts of the development; and
- (j) a protocol for periodic review of the plan.

Note: The Planning Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.

4. The Applicant must ensure that management plans prepared for the development are consistent with the conditions of this consent and any EPL issued for the site.

REVISION OF STRATEGIES, PLANS AND PROGRAMS

- Within three months of:
 - (a) the submission of an incident report under condition 6;
 - (b) the submission of an Annual Review under condition 8;
 - (c) the submission of an Independent Environmental Audit under condition 9; or
 - (d) the approval of any modification of the conditions of this consent (unless the conditions require otherwise).

the suitability of existing strategies, plans and programs required under this consent must be reviewed by the Applicant.

If necessary, to either improve the environmental performance of the development, cater for a modification or comply with a direction, the strategies, plans and programs required under this consent must be revised, to the satisfaction of the Planning Secretary. Where revisions are required, the revised document must be submitted to the Planning Secretary for approval within six weeks of the review.

Note: This is to ensure strategies, plans and programs are updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the development.:

REPORTING AND AUDITING

Incident Notification

6. The Applicant must immediately notify the Department and any other relevant agencies immediately after it becomes aware of an incident. The notification must be in writing via the Department's Major Projects website and identify the development (including the development application number and name) and set out the location and nature of the incident.

Non-Compliance Notification

7. Within seven days of becoming aware of a non-compliance, the Applicant must notify the Department of the non-compliance. The notification must be in writing via the Department's Major Projects website and identify the development (including the development application number and name), set out the condition of this consent that the development is non-compliant with, why it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.

Note: A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance.

Annual Review

- 8. By the end of March in each year after the commencement of the development, or other timeframe agreed by the Planning Secretary, a report must be submitted to the Department reviewing the environmental performance of the development, to the satisfaction of the Planning Secretary. This review must:
 - (a) describe the development (including any rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year;
 - (b) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, including a comparison of these results against the:
 - 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 document/s listed in condition 2(e) of Schedule 2:
 - (c) identify any non-compliance or incident which occurred in the previous calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence;
 - (d) evaluate and report on:
 - the effectiveness of the noise and air quality management systems; and
 - compliance with the performance measures, criteria and operating conditions of this consent;
 - (e) identify any trends in the monitoring data over the life of the development;
 - (f) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and

(g) describe what measures will be implemented over the next calendar year to improve the environmental performance of the development.

Copies of the Annual Review must be submitted to the Affected Councils and made available to the CCC and any interested person upon request.

Independent Environmental Audit

- 9. By the end of February 2022, and every three years after, unless the Planning Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development. The audit must:
 - led by a suitably qualified, experienced and independent auditor whose appointment has been endorsed by the Planning Secretary;
 - (b) be led and conducted by a suitably qualified, experienced and independent team of experts (including any be expert in field/s specified by the Planning Secretary) whose appointment has been endorsed by the Planning Secretary;
 - (c) be carried out in consultation with the relevant agencies and the CCC;
 - (d) assess the environmental performance of the development and whether it is complying with the relevant requirements in this consent, water licences and mining leases for the development (including any assessment, strategy, plan or program required under these approvals);
 - (e) review the adequacy of any approved strategy, plan or program required under the abovementioned approvals and this consent;
 - (f) recommend appropriate measures or actions to improve the environmental performance of the development and any assessment, strategy, plan or program required under the abovementioned approvals and this consent; and
 - (g) be conducted and reported to the satisfaction of the Planning Secretary.
- 10. Within three months of commencing an Independent Environmental Audit, or other timeframe agreed by the Planning Secretary, the Applicant must submit a copy of the audit report to the Planning Secretary, and any other NSW agency that requests it, together with its response to any recommendations contained in the audit report, and a timetable for the implementation of the recommendations. The recommendations must be implemented to the satisfaction of the Planning Secretary.

Monitoring and Environmental Audits

11. Any condition of this consent that requires the carrying out of monitoring or an environmental audit, whether directly or by way of a plan, strategy or program, is taken to be a condition requiring monitoring or an environmental audit under Division 9.4 of Part 9 of the EP&A Act. This includes conditions in respect of incident notification, reporting and response, non-compliance notification, compliance report and independent audit.

For the purposes of the condition, as set out in the EP&A Act, "monitoring" is monitoring of the development to provide data on compliance with the consent or on the environmental impact of the development, and an "environmental audit" is a periodic or particular documented evaluation of the development to provide information on compliance with the consent or the environmental management or impact of the development.

12. Noise and/or air quality monitoring under this consent may be undertaken at suitable representative monitoring locations instead of at privately-owned residences or other locations listed in Schedule 3, providing that these representative monitoring locations are set out in the respective management plan/s.

ACCESS TO INFORMATION

- 13. Until the completion of all rehabilitation required under this consent, the Applicant must:
 - (a) make the following information and documents (as they are obtained, approved or as otherwise stipulated within the conditions of this consent) publicly available on its website:
 - the documents referred to in condition 2(e) of Schedule 2 of this consent;
 - all current statutory approvals for the development;
 - all approved strategies, plans and programs required under the conditions of this consent;
 - the proposed staging plans for the development if the construction, operation or decommissioning of the development is to be staged;
 - minutes of CCC meetings;
 - regular reporting on the environmental performance of the development in accordance with the reporting requirements in any plans or programs approved under the conditions of this consent;
 - a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs;
 - a summary of the current progress of the development;
 - contact details to enquire about the development or to make a complaint;

- a complaints register, updated monthly;
- the Annual Reviews of the development; audit reports prepared as part of any Independent Environmental Audit of the development and the Applicant's response to the recommendations in any audit report; and
- any other matter required by the Planning Secretary; and keep such information up to date, to the satisfaction of the Planning Secretary. (b)

APPENDIX 1 SCHEDULE OF LAND

Notes:	
1.	All proposed secondary extraction for the Project (Mining Extension 1) is to occur under Lake
	Macquarie.
2.	The surface facilities for the Colliery are limited to "pit top area" adjacent to Vales Point Power Station,
	and the "ventilation shaft site" at Summerland Point.
3.	Refer to Figure 1 of Appendix 2 for the Site.

Project Related Surface Facilities					
Pit	Pit Top Area Ventilation shaft site				
Lot Deposited Plan		Lot	Deposited Plan		
Α	379918	1	226133		
В	379918				
С	349733				
Α	187570				
1B	339441				

All other areas within the Site				
Lot	Deposited Plan	Lot	Deposited Plan	
7339	1167067	20	708344	
7330	1148105	19	708344	
593	727722	18	708344	
594	727722	17	708344	
D	349733	34	714879	
1	410653	33	714879	
23	708344	32	714879	
21	708344	31	714879	
2	1043151	64	31306	
426	755266	65	31306	
427	755266	66	31306	
136	755266	67	31306	
2	515214	68	31306	
1	515214	69	31306	
1	214300	70	31306	
2	214300	71	31306	
167	755266	72	31306	
1	388154	73	31306	
144	661695	74	31306	
19	25593	75	31306	
20	25593	76	31306	
21	25593	77	31306	
22	25593	78	31306	
23	25593	79	31306	
24	25593	139	31306	
25	25593	140	31306	
26	25593	141	31306	
27	25593	142	31306	
58	31306	143	31306	
59	31306	144	31306	
60	31306	145	31306	
61	31306	146	31306	
62	31306	147	31306	
63	31306	148	31306	
149	31306	175	31306	
150	31306	176	31306	
151	31306	177	31306	
152	31306	178	31306	
153	31306	179	31306	
154	31306	180	31306	

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155	31306	181	31306
156	31306	187	31306
157	31306	188	31306
158	31306	189	31306
159	31306	190	31306
160	31306	191	31306
161	31306	192	31306
	31306		31306
162		193	
163	31306	194	31306
164	31306	195	31306
165	31306	238	31306
166	31306	239	31306
167	31306	240	31306
168	31306	241	31306
169	31306	242	31306
170	31306	46	31322
171	31306	47	31322
172	31306	48	31322
173	31306	78	31322
174	31306	4	981106
243	31306	3	981104
244	31306	11	13120
245	31306	12	13120
246	31306	13	13120
247	31306	14	13120
248	31306	15	13120
249	31306	16	13120
250	31306	17	13120
251	31306	18	13120
252	31306	19	13120
253	31306	20	13120
254	31306	21	13120
255	31306	22	13120
256	31306	23	13120
257	31306	24	13120
258	31306	60	13120
259	31306	30	13123
37	31322	31	13123
38	31322	A	368634
39	31322		
		100	1065718
40	31322	102	1065718
41	31322	20	1113256
42	31322	7329	1148149
43	31322	5	981103
44	31322	9	13120
45	31322	100	713777
32	13123	25	13120
33	13123	26	13120
34	13123	27	13120
35	13123	28	13120
36	13123	29	13120
37	13123		
		1	1221849
38	13123	2	1221849
39	13123	3	1221849
40	13123	4	1074358
41	13123	-	
			93941
168	13123		93945
182	31306	10	1235493
183	31306	11	1235493
184	31306	9	1235493
185	31306	189	8055
186	31306	252	8055
	1	252	5555

78	13123	186	8055
119	13123	127	13123
103	13123	47	13120
15	13123	2	806513
2	204202	135	8055
105	13123	117	8055
122	13123	2	551787
109	13123	45	15556
6	519261	71	15556
1	621171	100	790729
2	1013763	1	551787
111	13123	69	27749
69	13123	87	8055
13	13123	39	15556
3	250973	76	15556
124	13123	202	8055
23	13123	104	8055
802	1038413	197	8055
721	537942	101	790729
116	13123	53	27749
191	880592	49	27749
126	13123	254	8055
131	13123	81	8055
822	588493	199	8055
3	621171	138	8055
772	619779	41	15556
7	13120	12	15556
91	880881	44	27749
45	13120	25	27749
41	872109	54	15556
3	13120	126	8055
99	13123	1482	562711
42	872109	52	15556
37	13120	208	8055
2	621171	113	8055
39	13120	70	27749
49	13120	56	27749
153	17367	24	15556
773	619779	228	8055
771	619779	88	8055
112	13123	132	8055
82	13123	60	15556
43	13123	17	28068
141	13123	56	13123
120	13123	20	13123
108	13123	76	13123
5 66	981103	72	13123
14	13123	152 5	17367
106	28068	205	519261
45	13123 13123	92	1017819 13123
50	13123	522	543408
3	981104	80	13123
1		521	+
	542486		543408
44	13123	30	13120

	T		
862	557889	83	13123
2	542486	34	
75	13123	36	
49	13123	351	
73	13123	32	
56	13120	101	
58	13120	8	524374
147	13123	102	
1	806513	86	
35	13120	821	
43	13120	6	13120
5	13120	2	579042
42	13120	2	270423
8	13120	6	270423
1	13120	1	270423
33	13120	4	270423
31	13120	1	1107356
46	13120	2	1107356
18	527120	1693	1 1110053
145	13123	1693	3 1110053
55	13120	1692	2 1110053
54	13120	2144	4 1124129
9	13120	731:	1 1141467
28	13120	7300	6 1146817
2	13120	101	. 1165194
450	818534	154	17367
3	579042	5	270423
48	13120	42	1073017
44	13120	60	1074161
84	13123	872	733417
29	13120	51	27749
52	13120	103	15556
100	713777	11	13123
4	13120	12	13123
1	579042	21	13123
51	13120	43	1073017
146	13123	41	1073017
38	13120	61	1074161
155	17367	63	
57	13120	62	
50	13120	3	270423
7	524374	1	1088536
861	557889	202	
40	13120	201	
144	13123	139	
911	747550	14	
53	13120	46	
912	747550	113	
352	840188	21	
41	13120	119	
4	981106	230	
13	15556	25	
260	8055	211	
124	8055	112	
38	27749	142	
	21173	142	5055

157	8055	227	8055
48	15556	28	15556
27	27749	109	15556
198	8055	142	15556
195	8055	223	8055
782	1060935	77	15556
812	816616	215	8055
32	15556	2	375836
155	8055	31	27749
134	8055	43	15556
130	8055	59	27749
75	15556	224	8055
15	15556	53	15556
3	15556	107	8055
256	8055	117	15556
26	27749	88	15556
51	15556	202	1020262
232	8055	236	8055
205	8055	19	15556
164	8055	1	250973
10	15556	47	27749
128	8055	115	8055
136	8055	89	8055
86	15556	106	8055
201	843074	35	27749
38	15556	133	8055
1	561577	34	27749
833	598304	154	8055
235	8055	42	27749
112	15556	72	15556
220	8055	21	15556
40	27749	207	8055
65	15556	98	8055
225	8055	127	8055
125	8055	120	8055
65	27749	48	27749
226	8055	101	15556
194	8055	101	8055
192	8055	234	8055
57	15556	33	524726
209	8055	832	598304
36	15556	156	8055
2061	1011261	191	1046133
121	8055	111	8055
147	8055	42	15556
115	15556	237	8055
871	733417	219	8055
47	15556	57	27749
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52	27749	196	8055
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128	13123	136	15556
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107	13123	101	844302
203	1020262	137	15556
79	13123	131	859693
15	28068	126	15556
70	13123	187	15556
100	13123	6	251160
95	13123	3	13123
148	13123	55	17367
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109	8055	135	15556
106	15556	124	15556
140	8055	186	15556
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63	17367		53	17367
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137	17367		38	17367
117	17367		143	17367
152	854877		141	852383
98	17367		160	13123
121	17367		75	17367
151	17367		161	13123
119 B	17367		71	17367
	365476			17367
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99	17367	+	56	17367
165	17367	+	166	17367
61	17367	+	159	17367
135	17367	+	104	17367
165	13123	+	42	17367
7	1228566	+	79	17367
6	1228566		1572	1043970
5	1228566	+	10	1071069
4	1228566	+	3991	1136246
3	1228566	+	7322	1141840
2	1228566		243	8055
1	1228566		241	8055
8	1228566		172	8055
4	28068		2	803077
71	13123		3	568311
-				

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99	15556	185	8055
1	1185308	180	8055
2	1185308	183	8055
249	8055	93	13123
240	8055	152	13123
178	8055	192	880592
2	568311	115	13123
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С	25385	4	250973
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В	25385	157	13123
245	8055	51	13123
175	8055	54	13123
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3	1074358	193	8055
2	1074358	30	15556
751	1099436	66	27749
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753	1099436	9	15556
7309	1141468	14	15556
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5	1074358	105	8055
121	13123	123	8055
10	28068	58	27749
143	13123	74	15556
154	13123	50	27749
47	13123	61	15556
98	13123	233	8055
104	13123	110	15556

125	13123	43	27749
65	13123	102	8055
22	13123	2	15556
14	13123	46	27749
3	28068	17	15556
151	13123	60	27749
110	13123	41	27749
16	13123	29	15556
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156	17367	20	15556
204	1017819	8	15556
68	13123	203	8055
142	13123	68	27749
96	13123	49	15556
64	13123	93	8055
123	13123	1	15556
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873	733417	151	734618
150	13123	22	15556
90	13123	62	15556
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13	28068	21	27749
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42	13123	96	8055
7	13123	137	8055
153	13123	105	15556
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114	15556	192	1046133
37	27749	50	15556
61	27749	100	8055
44	15556	32	524726
66	15556	27	15556
231	8055	201	8055
216	8055	159	8055
70	15556	107	15556
108	8055	64	15556
217	8055	33	15556
116	8055	95	8055
229	8055	24	27749
129	8055	114	8055
29	27749	111	15556
238	8055	7	15556
2	561577	204	8055
5	15556	259	8055
30	27749	118	15556
239	8055	632	872639
55	15556	1	13123
59	15556	148	17367
4	15556	161	17367
82	740968	6	13123
37	15556	158	13123
18	15556	222	833454
221	8055	105	17367
68	15556	12	17367
253	8055	395	755242
			1

131	8055	A	365476
62	27749	69	17367
2062	1011261	50	17367
141	15556	162	13123
138	15556	70	17367
133	15556	48	17367
45	654334	81	17367
132	15556	387	755242
129	15556	54	17367
131	15556	160	17367
98	15556	144	17367
130	17367	124	17367
59	17367	74	17367
134	17367	112	17367
37	17367	102	17367
127	17367	139	13123
73	17367	51	17367
24	17367	40	17367
103	17367	101	17367
13	17367	2	251160
397	755242	109	17367
7015	1119454	223	833454
470	1118245	141	17367
7323	1141840	138	17367
102	1165194	9	28068
60	17367	500	755242
35	17367	145	17367
39	17367	62	17367
7074	1029683	44	17367
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100	17367		
136	17367		

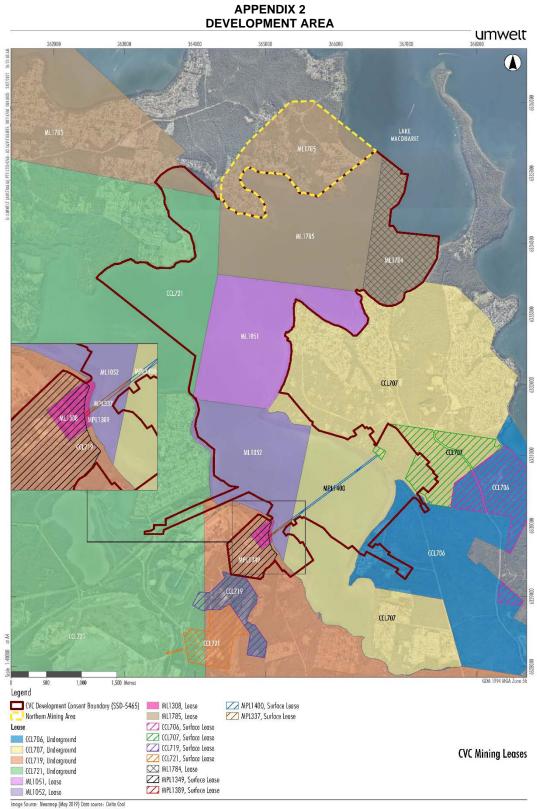


Figure 1: Chain Valley Extension Project – Development Application Area and Lease Plan (The Site)

APPENDIX 3 DEVELOPMENT LAYOUT **umwelt** SUNSHINE MIRRABOOKA Lake Macquarie Lake Macquarie te Conservation Area Lake Macquarie State Conservation Area Vales Point Power Station

Chain Valley Colliery Development Consent Boundary Zone A - Long term stable mining systems generating up to 20 mm surface subsidence Zone B - Mining systems generating up to a maximum of 780 mm vertical susbsidence Chain Valley Colliery Modification 4 Figure 1: Mining Areas Subsidence Management Zones

- High Water Mark Subsidence Barrier

State Conservation Area

Seagrass Protection Barrier

39

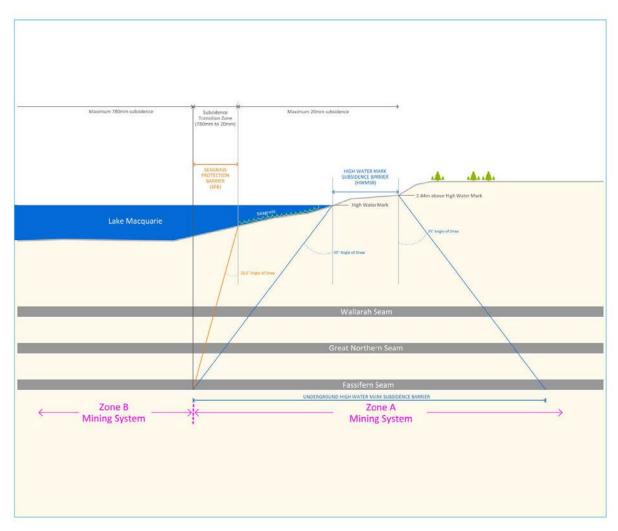


Figure 1A: High Water Mark Subsidence Barrier and Seagrass Protection Barrier

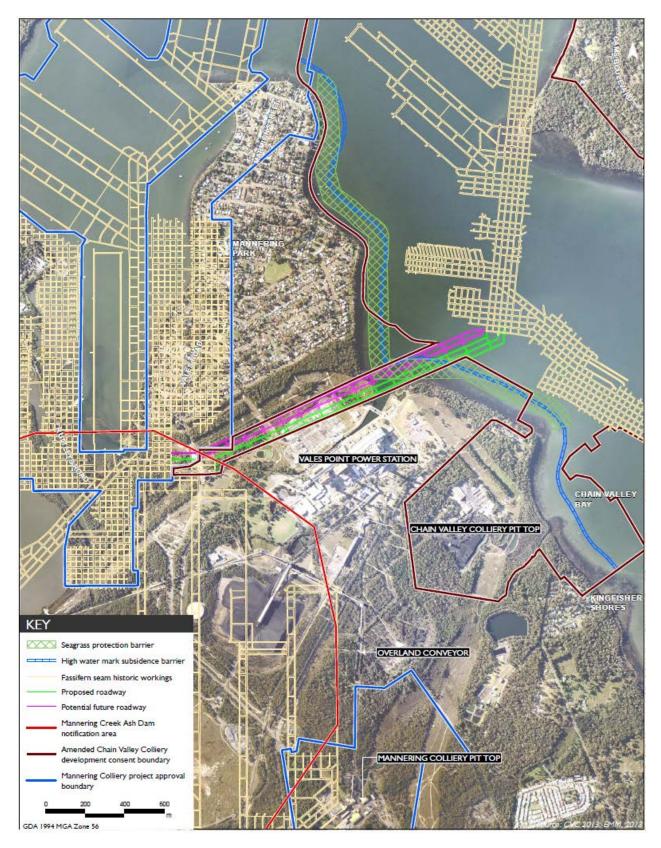


Figure 2: Location of the underground linkage to Mannering Colliery

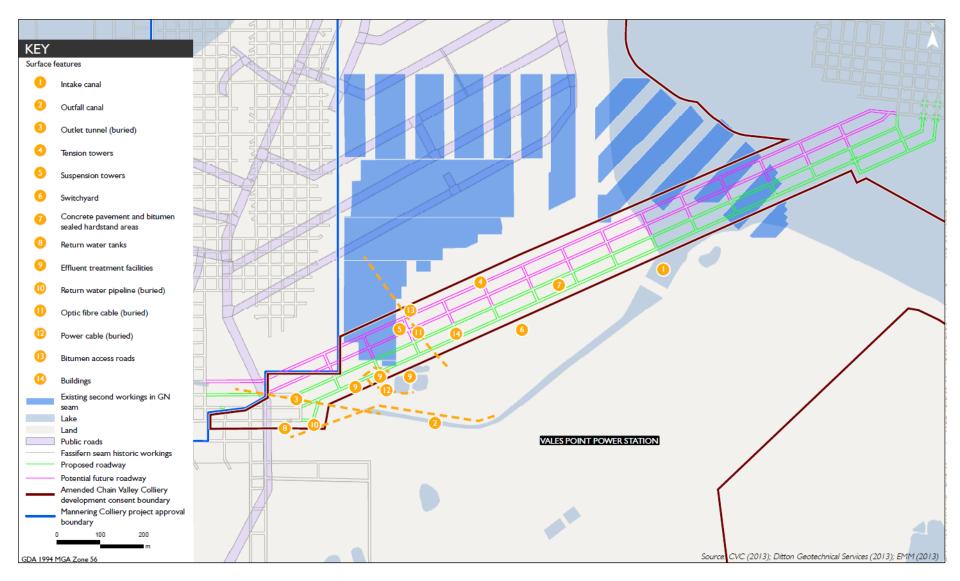
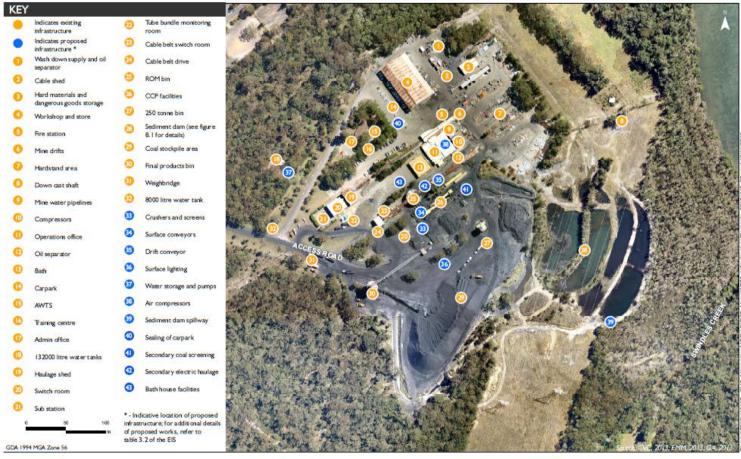


Figure 3: Location of the underground linkage and surface infrastructure

APPENDIX 4 KEY SURFACE FACILITIES



EMP PHIA POWER LINE

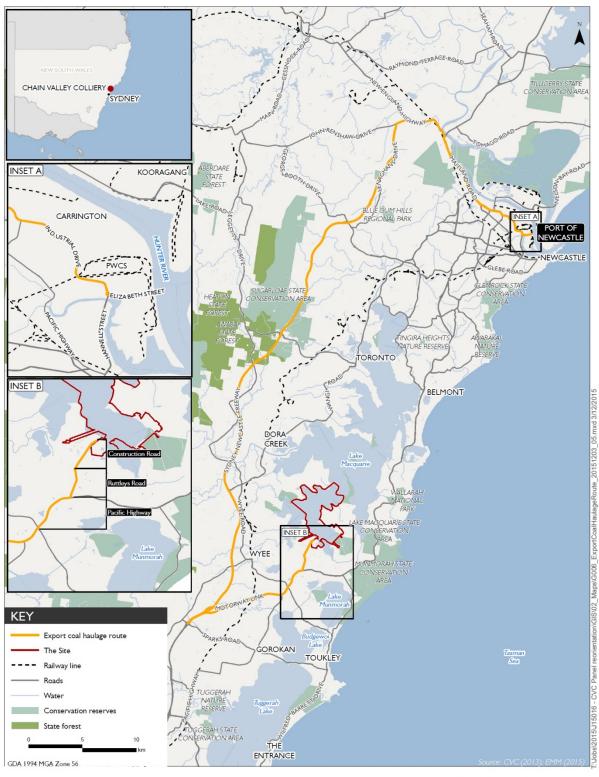
Mine pit top infrastructure elements

Chain Valley Colliery Mining Extension | Project - Environmental Impact Statement

Figure 2.4

Figure 1 : General Arrangement of the Chain Valley Colliery surface facilities site

APPENDIX 5 COAL HAULAGE ROUTE – PUBLIC ROADS



EMM

Export coal haulage route

Figure 1: Export Coal Haulage Route

APPENDIX 6 NOISE RECEIVER LOCATIONS

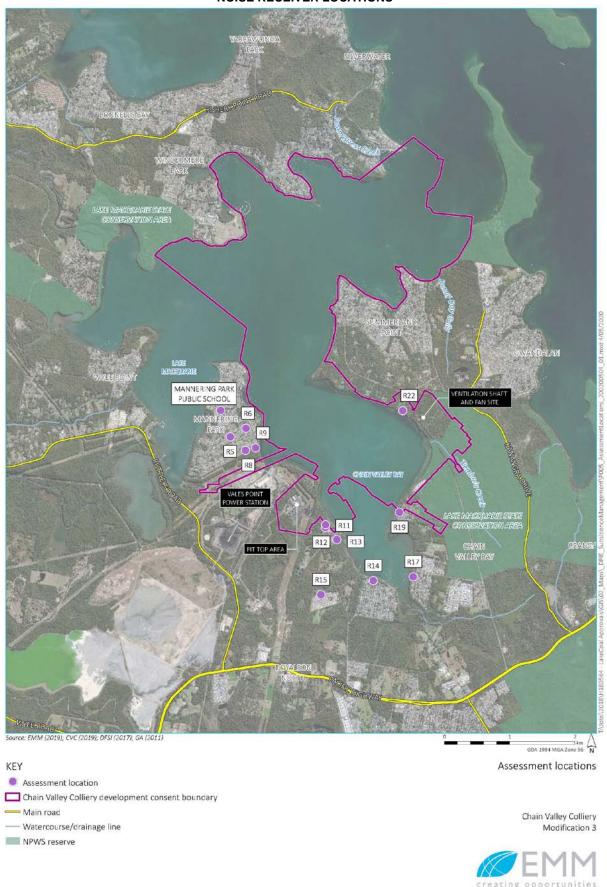


Figure 1: Noise Receiver Locations

APPENDIX 7 BIODIVERSITY ENHANCEMENT AREA





Terrestrial vegetation communities and EECs within the Colliery's supporting infrastructure areas

Chain Valley Colliery Mining Extension | Project - Environmental Impact Statement

Figure 1: Location of the Biodiversity Enhancement Area, shown in red and orange hatching

APPENDIX 7A ASSET PROTECTION ZONES



Figure 1. Location of asset protection zones

Asset protection zones Chain Valley Colliery - Modification 2

APPENDIX 8 NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

- 1. The noise criteria in Table 1 of the conditions are to apply under all meteorological conditions except the following:
 - (a) during periods of rain or hail;
 - (b) average wind speed at microphone height exceeds 5 m/s;
 - (c) wind speeds greater than 3 m/s measured at 10 m above ground level; or
 - (d) temperature inversion conditions greater than 3°C/100 m.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions must be that recorded by the meteorological station described in condition 14 of schedule 3.

Compliance Monitoring

- 3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this consent.
- 4. This monitoring must be carried out at least 4 times in each calendar year (ie at least once every 3 months), unless the Planning Secretary directs otherwise.
- 5. Unless otherwise agreed with the Planning Secretary, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
 - (a) monitoring locations for the collection of representative noise data;
 - (b) meteorological conditions during which collection of noise data is not appropriate;
 - (c) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
 - (d) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

APPENDIX 9 STATEMENT OF COMMITMENTS

Item Commitment

Groundwater

In addition to the management and mitigation measures undertaken at the Colliery for groundwater as described in the WMP, the following commitments specific to the Proposal will be undertaken. Some commitments are already undertaken under the WMP. Great Southern Energy Pty Limited will:

- assess whether abnormal or significant groundwater inflow changes occur in the active panels;
- maintain the water flow monitoring appliances used to measure pumped water volumes to and from the Colliery in good working order;
- maintain and plot records of daily total Colliery water pumping and annually communicate an interpretation of the findings within the Annual Review. A copy of the Annual Review will be supplied to DPIE Water;
- measure water levels and quality within private bores, where access is possible, in relevant areas to assess if any adverse effects occur due to subsidence from the Proposal; and
- develop groundwater assessment criteria and triggers, response protocols and contingency measures.

Although it is not anticipated that private bore yields would be impacted due to subsidence, should such a situated arise, Great Southern Energy Pty Limited would provide an alternative water supply until the impacted bore recovers.

Any monitored or reported adverse impacts on the yield, saturated thickness or quality of a private registered bore will be investigated by Great Southern Energy Pty Limited. In the event of a groundwater level drop of over 2 m for a period of two months or more, a notable increase in iron hydroxide, or an adverse change in salinity as a consequence of subsidence, Great Southern Energy Pty Limited will enter into negotiations with the affected landowners and SA NSW with the intent of formulating an agreement which provides for one, or a combination of:

- re-establishment of saturated thickness in the affected bore(s) through bore deepening;
- establishment of additional bores to provide a yield at least equivalent to the affected bore prior to mining;
- provision of access to alternative sources of water; and/or
- compensation to reflect increased water extraction costs (eg. due to lowering pumps or installation of additional or alternative pumping equipment).

Surface water

Management and monitoring of surface water will continue to be undertaken in accordance with the Colliery's WMP, which will be reviewed and updated as required to include the commitments made below. Great Southern Energy Pty Limited will:

- update the WMP to include any changes as a result of all modifications;
- limit the main underground pumps to a maximum pump out rate of 10.5 ML/day within 12 months of approval;
- request an amendment of EPL1770 to include a condition on the daily discharge volume limit stating that "Exceedance of the volume limit for Point 1 is permitted only if the discharge from Point 1 occurs solely as a result of rainfall at the premises exceeding 10 mm during the 24 hours immediately prior to commencement of the discharge";
- undertake daily measurements of discharge volumes and report publicly on a monthly basis via Great Southern Energy Pty Limited's website;
- continue collection of baseline water quality data to aid in the development of appropriate discharge water quality trigger values;
- engage suitably qualified expert to conduct an assessment of the metals contained within discharge water in accordance with the ANZECC water quality guidelines and provide this assessment to the EPA by 31 December 2013;
- investigate water saving measures to minimise the amount of potable water required from CC Council for Colliery operations;
- quantify the groundwater storage capacity in the Great Northern and Wallarah Seams;
- continue effluent monitoring regime of receiving soils from the AWTS in accordance with the parameters and testing frequencies identified in the Colliery's WMP. The

- results of this monitoring program will be reviewed by a suitably qualified expert and used to determine the appropriateness of the existing irrigation area to receive this effluent:
- develop a program to monitor creek line channel stability and the health of riparian vegetation within Swindles Creek. Monitoring will be undertaken in accordance with Section 8.5.2 of the Surface Water Impact Assessment (EIS Appendix E) and incorporated into the Colliery's WMP or Biodiversity Management Plan; and
- record monitoring data in accordance with the Colliery's WMP and EPL 1770.
 Monitoring data will be interpreted as it is received to ensure appropriate operational guidance on monitoring water quality within desired parameters.

 Results of water quality monitoring will be reported in the Annual Review and made available to the CCC, as well as CC Council and LMCC.

Noise

Management and monitoring of noise will continue to be undertaken in accordance with the Colliery's NMP, which will be reviewed and updated as required to include the commitments made below. Great Southern Energy Pty Limited will:

- continue attended compliance monitoring on site which will be used to identify potential hot spots and primary noise sources;
- continue real-time noise monitoring alerts to site personnel to enable implementation of any required rapid noise management initiatives;
- manage potential non-compliance through a noise complaint handling and response system, including the identification of responsible sources to enable targeted remedial action;
- assess if further noise mitigation options for the ventilation fans are reasonable and feasible following the receipt of attenuation proposals; and
- discuss potential management measures or agreement options with the landowner at 275 Cams Boulevard, following receipt of proposals from acoustics specialists.

In addition to the above, Great Southern Energy Pty Limited is committed to the progressive implementation of feasible measures to target long-term noise goals which are designed to reduce noise emissions from the Colliery. Long-term options for investigation include:

- modification to belt/movement alarms;
- investigation of surface conveyer and coal preparation equipment, to determine if noise reductions are possible;
- identifying sound attenuation options for the surface bulldozer and front-end loader;
- strategic placement of acoustic barriers;
- attenuation for the surface screener/shaker;
- installation of quiet rollers for surface conveyor belts:
- acoustic treatments around compressors; and
- the use of a conveyor stacker for product coal stockpiling.

Air Quality and greenhouse gases

Management and monitoring of air quality and greenhouse gases will continue to be undertaken in accordance with the Colliery's AQGHGMP, which will be reviewed and updated as required to include the commitments made below Great Southern Energy Pty Limited will:

- investigate the use of a stacker to replace hauling between current conveyor system and stockpiles;
- undertake GHG monitoring comprising measurement of carbon dioxide and methane at the ventilation shaft and fan sites; and
- record and report annual diesel, oil, grease, acetylene and electricity use to fulfil National Greenhouse and Energy Reporting Scheme requirements.

Traffic and transport

Management and monitoring of traffic and transport will continue to be undertaken in accordance with the Colliery's RTP. In addition, Great Southern Energy Pty Limited will continue to investigate alternative options for transporting export coal to the Port of Newcastle, specifically the preferred rail transport option, requiring the construction of a private haul road to the VPPS coal unloading facility and associated infrastructure upgrades. In addition, Great Southern Energy Pty Limited will investigate options to reduce peak hour traffic would be investigated including potentially limiting the peak hourly volumes of the Colliery truck traffic which would be permitted to travel via this intersection should the Colliery not be using rail transport for export coal by five years from the granting of development consent. Alternatively, a pro-rata financial contribution to the cost of installing traffic signals at the southbound intersection of the F3 and Sparks Road interchange could be made commensurate with the percentage of Colliery generated traffic using the intersection.

Subsidence

Management and monitoring of subsidence will continue to be undertaken in accordance with the Colliery's SMP or Extraction Plans, which will be reviewed and

updated as required to include the commitments made below. Great Southern Energy Pty Limited will:

- provide raw subsidence survey data to BCD within 7 days of completion;
- undertake six-monthly bathymetric surveys of the lake bed to determine actual subsidence and undertake a comparison with predicted levels. Should measured subsidence significantly exceed predicted levels, Great Southern Energy Pty Limited will review future secondary extraction designs to limit future impacts to acceptable levels;
- install a new foreshore survey line above the first and second workings panels
 where the underground linkage passes beneath them and possibly extending from
 the foreshore to the point of connection with the MC workings;
- inspect existing conditions in the Fassifern Seam and undertake geotechnical and geological mapping in the roadways proximate to the proposed linkage in both CVC and MC workings;
- complete representative borehole core drilling and sampling of the Fassifern Seam floor at the start and finishing ends of the underground linkage and where the headings pass beneath the SPB. Development below the foreshore will be limited to two headings only until floor conditions can be confirmed;
- develop infrastructure monitoring and management plans in consultation with infrastructure owners and other relevant stakeholders;
- re-establish and re-survey Survey Line 24;
- install a suitable survey line at the starting end above Great Northern Seam first workings to provide early warning monitoring data for the tension towers and switchyard structures;
- monitor tension and suspension towers and switchyard conductor suspension frames directly above the panels, foreshore and adjacent inlet canal wall;
- ensure that a monitoring and management plan for the MP01 sewer rising main is in place prior to commencement of mining that may impact CC Council's infrastructure; and
- complete an annual subsidence report and make this report publicly available on the Colliery's website.

Marine ecology

Management and monitoring of marine ecology will continue to be undertaken in accordance with the Colliery's BCMP and SGMP, which will be reviewed and updated as required to include the commitments made below. Great Southern Energy Pty Limited will

- revise the BCMP to include the sampling locations in the assessment of the Proposal:
- undertake annual benthic surveys for the Site, or as required under the BCMP;
- commission additional independent sampling and analysis to validate results obtained during monitoring, and review future panel design if impacts due to subsidence are determined to be moderate or greater;
- revise the SGMP to include the transect locations utilised in the assessment of the Proposal;
- continue annual seagrass surveys/monitoring;
- continue six-monthly subsidence surveys (bathymetric surveys) and land-based surveys;
- include results from the BCMP and SGMP within the Colliery's Annual Review; and
- make the Annual Review and annual subsidence surveys available on the Colliery's website

Terrestrial ecology

In addition to the management and mitigation measures undertaken at the Colliery for terrestrial ecology as described in the BMP, the following commitments specific to the Proposal will be undertaken. Some commitments are already undertaken under the BMP. Great Southern Energy Pty Limited will:

- investigate one of the following options in consultation with BCD to offset the biodiversity impacts arising from the proposed modification:
 - provide \$10,000 of funding, which is equivalent to the biodiversity being lost (i.e. 5 credits x \$2,000 per credit) to existing environmental programs at the site which benefits the Swamp Sclerophyll EEC; or
 - consult with BCD to identify a suitable conservation program and provide \$10,000 of funding; or
 - o purchase and retire 5 credits on the Biobanking register.
- update the BMP to include the following:
 - the completion of pre-disturbance surveys in the survey area for Black-eyed Susan, Leafless Tongue Orchid and Variable Midge Orchid during their flowering periods (July to December, November to February and September to October, respectively);

- pre-disturbance surveys by an ecologist to determine the important components of vegetation communities and fauna habitats that should be preferentially retained in the APZs:
- installation of delineation fencing around threatened flora populations (if found) to ensure their protection during development and maintenance of the APZs:
- o condition monitoring for threatened flora populations (if found);
- o retention of hollow-bearing trees in the APZs, where possible, with details to be included in a hollow tree register;
- installation of nest boxes (or salvaged hollows) within the APZs under the supervision of a suitably qualified ecologist or wildlife carer to replace hollows where hollow-bearing trees cannot be retained;
- o measures for APZ maintenance that include weed control;
- clearing of hollow-bearing trees (if required) under the supervision of a suitably qualified ecologist;
- any injured fauna would be taken to the nearest veterinary hospital for treatment before release; and
- relocation of suitable hollow-bearing felled trees adjacent to the APZs to create additional fauna habitat;
- undertake the design of the dam embankment and spillway works in consultation with an ecologist to minimise potential impacts on the Swamp Oak Floodplain Forest EEC;
- ensure pre-clearing surveys are undertaken by an ecologist to minimise the
 potential impact to fauna and significant vegetation prior to clearing works being
 undertaken within the embankment and spillway area;
- clearly delineate the clearing footprint and cordon off surrounding vegetation as a 'no go' zone during works to the dam embankment and spillway;
- minimise disturbance areas where possible by ensuring all stockpiling of materials, parking of machinery etc. is undertaken in previously cleared areas:
- ensure that, wherever possible, dead standing timber and fallen timber will be avoided by any clearing works, or if required to be removed, be relocated into suitable habitat areas nearby;
- ensure all equipment used for the earthworks associated with the dam embankment and spillway will be cleaned of excess soil potentially containing pathogens and weed seeds prior to entering the Site;
- install sediment fencing surrounding the proposed earthwork areas, in accordance with a site-specific erosion and sediment control plan for the works;
- ensure that in the event that sedimentation dam water is released from Dam 10
 prior to the works being undertaken, it will be undertaken in a controlled manner
 over a number of days to ensure that the release does not result in significant
 erosion and sedimentation to the Swamp Oak Floodplain Forest;
- continue the management and monitoring of flora and fauna in accordance with the BMP for the life of the mine, including:
 - the condition and composition of the Swamp Oak Floodplain Forest area;
 - the condition of vegetation adjacent to the ventilation shaft and fans:
 - the location and distribution of weed infestations; and
 - the abundance and distribution of feral animal use.
- noxious weeds will be removed and continually controlled from the pit top area, allowing for natural regeneration of vegetation;
- weed invasion will be monitored as part of the Colliery's BMP; and
- the condition of the EEC areas will be monitored through the Colliery's BMP.

Heritage

Management and monitoring of heritage will continue to be undertaken in accordance with the Colliery's HMP, which will be reviewed and updated as required to

include the commitments made below. Great Southern Energy Pty Limited will:

- review and revise the HMP to remove site #45-7-0154 and incorporate any other changes as a result of the proposed modification;
- update the HMP following approval of the Proposal to include the extended area to which it relates:
- ensure that should unanticipated Aboriginal or historic heritage artefacts be found during dam embankment and diversion works, work will cease and the site assessed by an archaeologist; and
- ensure that in the unlikely event that skeletal remains are found during dam
 embankment and diversion works, work will cease immediately in the area and the
 NSW Police Coroner called to determine if the material is of Aboriginal origin. BCD
 and relevant Aboriginal community stakeholders will be notified if the remains are
 positively identified as being of Aboriginal origin to determine their appropriate

management prior to works recommencing.	
Management and monitoring of waste will continue to be undertaken in accordance with the Colliery's Waste Management Standard. In addition, Great Southern Energy Pty Limited will continue to try and improve its waste volumes and waste management practices in line with its objective for 60% of all wastes generated at the Colliery (excluding wastewater) to be recyclable or reusable.	
Management and monitoring of hazards will continue in accordance with the Colliery's existing hazard management measures. Periodic review of the effectiveness of existing measures will occur in accordance with the Colliery's safety management system and additional measures implemented as warranted.	
Management and monitoring of visual impacts will continue to be undertaken in accordance with the Colliery's existing commitment. In addition, Great Southern Energy Pty Limited will: ensure additional surface lighting at the Colliery complies with AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting.	
 Management and monitoring of soils will continue to be undertaken in accordance with the Colliery's WMP, which will be reviewed and updated as required to include the commitments made below. Great Southern Energy Pty Limited will: prevent disturbance of ASS where practicable during any construction activities; prepare an ASSMP where there is potential that ASS will be disturbed; test and handle any ASS disturbed in accordance with the ASSMP and treat or dispose of to an appropriately licensed facility; limit the area of any disturbance at the surface infrastructure sites and period of exposure; implement site management procedures such as watering of disturbed areas and unsecured stockpiles; ensure relevant licences and management plans are in place for the correct storage and handling of hydrocarbons; maintain suitable bunding around all hazardous liquid storage areas; maintain oil separation facilities on the wash down sump for the treatment of oily water; and remove all waste oil from site and dispose via a licensed external waste collection company. 	
nd Rehabilitation will be undertaken in accordance with the Colliery's RMP and the MOP in force at the time. Detailed management and monitoring proposals for final rehabilitation will be included within a Mine Closure Plan to be prepared at least two years prior to cessation of mining activities.	
Great Southern Energy Pty Limited will contribute \$0.035/t of coal from the Colliery into a dedicated community fund to improve public infrastructure and for the provision of community projects in the surrounding communities of Chain Valley Bay, Mannering Park, Summerland Point and Gwandalan.	
 Great Southern Energy Pty Limited will continue to implement management measures and monitoring programs to prevent or minimise negative impacts and enhance positive impacts in accordance with its Environment and Community Policy. Great Southern Energy Pty Limited will: maintain open and constructive communication with affected individuals and groups; participate in the CCC; provide environmental monitoring data and other relevant information in a timely manner via the Great Southern Energy Pty Limited website; be responsive to community issues and actual and/or perceived impacts from the Colliery's activities; work in partnership with stakeholders to address community needs; ensure effective management of Great Southern Energy Pty Limited's social impacts; liaise regularly with relevant government agencies and councils; provide regular Colliery updates with landowners and local residents through the CCC; continue payments, throughout the life of the Proposal, to the community fund established; and 	

Other

Great Southern Energy Pty Limited will commit to only carrying out mining operations consistent with the development consent granted pursuant to this Proposal.

Modification 3 Commitments

Great Southern Energy Pty Limited will undertake environmental management incorporating the requirements of any modification and in accordance with the existing environmental management processes of the various approvals, licences and management plans that apply to the development.

Great Southern Energy Pty Limited will apply to the EPA to vary EPL 1770 to reflect the corresponding development consent tonnage limits within EPL 1770's Mining for Coal and Coal Works activities tonnage ranges.

Great Southern Energy Pty Limited will commission and undertake detailed geotechnical assessments by a suitably qualified geotechnical engineer as part of the company's detailed mine plan design process.



Appendix 2: EPL 1770

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		1	Environmental Compliance Coordinator	Page 102 of 114
DOCUMENT UNCONTROLLED WHEN PRINTED				



Licence - 1770

Licence Details	
Number:	1770
Anniversary Date:	01-April

Licensee

GREAT SOUTHERN ENERGY PTY LTD

PO BOX 7115

MANNERING PARK NSW 2259

Premises

CHAIN VALLEY COLLIERY

CONSTRUCTION ROAD

CHAIN VALLEY BAY NSW 2259

Scheduled Activity

Coal works

Mining for coal

Fee Based Activity	<u>Scale</u>
Coal works	> 2000000-5000000 T annual handing capacity
Mining for coal	> 2000000-3500000 T annual production capacity

Contact Us
NSW EPA
4 Parramatta Square
12 Darcy Street
PARRAMATTA NSW 2150
Phone: 131 555
Email: info@epa.nsw.gov.au
Locked Bag 5022
PARRAMATTA NSW 2124



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Licence - 1770

Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 132 of the Act);
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).



Licence - 1770

The EPA publication "A Guide to Licensing" contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

GREAT SOUTHERN ENERGY PTY LTD

PO BOX 7115

MANNERING PARK NSW 2259

subject to the conditions which follow.



Licence - 1770

1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Coal works	Coal works	> 2000000 - 5000000 T annual handing capacity
Mining for coal	Mining for coal	> 2000000 - 3500000 T annual production capacity

A1.2 The licensee must not extract by mining activities more than 2.1 million tonnes of ROM coal from the premises in any calendar year in line with Development Consent SSD5465 MOD 4.

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details	
CHAIN VALLEY COLLIERY	
CONSTRUCTION ROAD	
CHAIN VALLEY BAY	
NSW 2259	

THE LICENSED PREMISES IS AS DEFINED IN THE FOLLOWING PLANS, "DELTA COAL CHAIN VALLEY COLLIERY, SURFACE EPA PREMISES PLAN, DRG NO:C1SO165_2, 10 AUGUST 2021" AND "DELTA COAL CHAIN VALLEY COLLIERY, FIGURE 1 PROJECT OVERVIEW, DRG NO:C1S0165_1, 10 AUGUST 2021", WHICH SHOWS THE UNDERGROUND COAL WORKINGS PREMISES BOUNDARIES VIA A LIME GREEN LINE ALONG WITH THE EASTINGS AND NORTHINGS AT "TURNAROUND" LOCATIONS. THESE PLANS ARE SAVED AS EPA DOCUMENT NO. DOC21/691135.

A3 Other activities

A3.1 This licence applies to all other activities carried on at the premises, including:



Licence - 1770

Ancillary Activity	
Sewage Treatment Systems	

A4 Information supplied to the EPA

A4.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:

- a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the
- b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

	=-
4	ır

EPA identi-	Type of Monitoring	Type of Discharge	Location Description
fication no.	Point	Point	
25	Air Monitoring Point Particulate Matter PM10 Thermo Fisher Scientific TEOM 1405		TEOM Monitor located on the site of the Mannering Park Sewage Treatment Plant, shown as "EPA25" on the plan titled "Delta Coal - Chain Valley Colliery - Figure 1 - Project Overview", which as been filed as EPA document DOC21/691135

- P1.2 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.
- P1.3 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

Water and land

EPA Identi-	Type of Monitoring Point	Type of Discharge Point	Location Description
fication no.			



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1	Discharge to waters Discharge quality and volume monitoring	Discharge to waters Discharge quality and volume monitoring	Discharge to waters and monitoring from final settlement pond, gravity fed discharge pipe as identified in plan titled "Delta Coal Chain Valley Colliery, Surface EPA Premises Plan, DRG No: C1S0165_2" 10 August 2021 and saved as EPA Document DOC21/691135.
27	Discharge to waters Discharge quality and volume monitoring	Discharge to waters Discharge quality and volume monitoring	Discharge to waters via dam spillway from final settlement pond adjacent to EPA Point 1 as identified in plan titled "Delta Coal Chain Valley Colliery, Surface EPA Premises Plan, DRG No: C1S0165_2" 10 August 2021 and saved as EPA Document DOC21/691135.

P1.4 The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.

Noise/Weather

EPA identi- fication no.	Type of monitoring point	Location description
9	Noise monitoring	Noise monitoring site R8 as defined in Development Consent SSD-5465 (MOD 3), located at 109 Griffith Street, MANNERING PARK, 2259
12	Noise monitoring	Noise monitoring site R11 as defined in Development Consent SSD-5465 (MOD 3), located at 35 Lakeshore Avenue, CHAIN VALLEY BAY, 2259
13	Noise monitoring	Noise monitoring site R12 as defined in Development Consent SSD-5465 (MOD 3), located at 20 Lakeshore Avenue, Kingfisher Shores, CHAIN VALLEY BAY, 2259
14	Noise monitoring	Noise monitoring site R13 as defined in Development Consent SSD-5465 (MOD 3), located at 33 Karoola Avenue, Kingfisher Shores, CHAIN VALLEY BAY, 2259
16	Noise monitoring	Noise monitoring site R15 as defined in Development Consent SSD-5465 (MOD 3), located at Short Street, Macquarie Shores, CHAIN VALLEY BAY, 2259
20	Noise monitoring	Noise monitoring site R19 as defined in Development Consent SSD-5465 (MOD 3), located at 2 Sunset Parade, CHAIN VALLEY BAY, 2259



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23	Noise monitoring	Noise monitoring site R22 as defined in Development Consent SSD-5465 (MOD 3), located at 275a Cams Boulevard, CHAIN VALLEY BAY, 2259
26	Meteorological Station	Mannering Colliery Meteorological Station, Ruttleys Road, Doyalson 2259.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

- L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.
- L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.
- L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.
- L2.4 Water and/or Land Concentration Limits

POINT 1,27

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Faecal Coliforms	colony forming units per 100 millilitres				200
рН	рН				6.5-8.5
Total suspended solids	milligrams per litre				50



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L3 Volume and mass limits

- L3.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of:
 - a) liquids discharged to water; or;
 - b) solids or liquids applied to the area;

must not exceed the volume/mass limit specified for that discharge point or area.

Point	Unit of Measure	Volume/Mass Limit
1	kilolitres per day	12161
27	kilolitres per day	12161

L3.2 The volumetric daily discharge limit for the premises is the combined discharge measured at EPA discharge points 1 and 27 and must not exceed 12161 kilolitres per day.

L4 Waste

L4.1 The licensee must not cause, permit or allow any waste to be received at the premises, except the wastes expressly referred to in the column titled "Waste" and meeting the definition, if any, in the column titled "Description" in the table below.

Any waste received at the premises must only be used for the activities referred to in relation to that waste in the column titled "Activity" in the table below.

Any waste received at the premises is subject to those limits or conditions, if any, referred to in relation to that waste contained in the column titled "Other Limits" in the table below.

This condition does not limit any other conditions in this licence.

Code	Waste	Description	Activity	Other Limits
NA	General or Specific exempted waste	Waste that meets all the conditions of a resource exemption under Clause 92 of the Protection of the Environment Operations (Waste) Regulation 2014.	As specified in each particular resource recovery exemption	NA

L5 Noise limits

L5.1 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 12

•	Measurement frequency	Noise level dB(A)
parameter		



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Day	Day-LAeq (15 minute)	-	49
Evening	Evening-LAeq (15 minute)	-	49
Night	Night-LAeq (15 minute)	-	49
Night	Night-LA1 (1 minute)	-	54

POINT 13

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	49
Evening	Evening-LAeq (15 minute)	-	49
Night	Night-LAeq (15 minute)	-	49
Night	Night-LA1 (1 minute)	-	53

POINT 14

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	43
Evening	Evening-LAeq (15 minute)	-	43
Night	Night-LAeq (15 minute)	-	43
Night	Night-LA1 (1 minute)	-	49

POINT 16

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	36
Evening	Evening-LAeq (15 minute)	-	36
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	45

POINT 20

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	37
Evening	Evening-LAeq (15 minute)	-	37
Night	Night-LAeq (15 minute)	-	37



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Night	Night-LA1 (1 minute)	-	45

POINT 23

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	46
Evening	Evening-LAeq (15 minute)	-	46
Night	Night-LAeq (15 minute)	-	46
Night	Night-LA1 (1 minute)	-	46

POINT 9

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	38
Night	Night-LA1 (1 minute)	-	45

- L5.2 The licensee must ensure that noise generated on the premises does not exceed:
 - a) 35 LAeq(15min) during the day, evening or night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1; and
 - b) 45 LA1(1min) during the night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1.

Note: The licensee may provide to the EPA written evidence of any agreement with a landholder which is subject to the above noise limits. The written evidence may be submitted with a licence variation to remove the landholder from the above tables.

- L5.3 For the purpose of condition L5.1 and condition L5.2:
 - (a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays;
 - (b) Evening is defined as the period 6pm to 10pm, and
 - (c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.
- L5.4 The noise limits set out in condition L5.1 and condition L5.2 apply under all meterorological conditions except for any one of the following:



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- (a) Wind speeds greater than 3 metres/second at 10 metres above ground level; or
- (b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at
- 10 metres above ground level; or
- (c) Stability category G temperature inversion conditions.
- (d) Or as defined under the NSW EPA Noise Policy for Industry 2017.
- L5.5 For the purpose of condition L5.4:
 - (a) the meteorological data to be used for determining meteorological conditions is the data recorded at the meteorological station identified in this licence as EPA Identification Point 26.
 - (b) Stability category temperature inversion conditions are to be determined in accordance with the NSW EPA Noise Policy for Industry 2017.
- Note: The weather station must be designed, commissioned and operated in a manner to obtain the necessary parameters required under the above condition.
- L5.6 For the purpose of determining the noise generated at the premises the licensee must use a Class 1 or Class 2 noise monitoring device as defined by AS IEC61672.1 and AS IEC61672.2-2004, or other noise monitoring equipment accepted by the EPA in writing.
- L5.7 To determine compliance:
 - 1. With the L_{Aeq(15 min)} noise limits in condition L5.1 and condition L5.2, the licensee must locate noise monitoring equipment;
 - (a) within 30 metres of a dwelling facade (but not closer than 3 metres) where any dwelling on the property is situated more then 30 metres from the property boundary that is closest to the premises;
 - (b) approximately on the boundary where any dwelling is situated 30 metres or less from the property boundary that is closest to the premises, or, where applicable,
 - (c) within approximately 50 metres if the boundary of a national park or nature reserve.
 - 2. With the LA1(1 minute) noise limits in condition L5.1 and L5.2, the noise monitoring equipment must be located within 1 metre of a dwelling facade.
 - 3. With the noise limits in condition L5.1 and condition L5.2, the noise monitoring equipment must be located;
 - (a) at the most affected point at a location where there is no dwelling at the location, or
 - (b) at the most affected point within an area at a location prescribed by conditions L5.7 1(a) or L5.7 1(b).
- L5.8 A non-compliance of condition L5.1 or condition L5.2 will still occur where noise generated from the premises in excess of the appropriate limit is measured;
 - a) at a location other than an area prescribed by conditions L5.7 1(a) and L5.7 1(b), and /or
 - b) at a point other than the most affected point at a location.
- L5.9 For the purposes of determining the noise generated at the premises all applicable modification factors as described in the NSW EPA Noise Policy for Industry 2017 must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.



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4 Operating Conditions

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.

This includes:

- a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
- b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

- O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:
 - a) must be maintained in a proper and efficient condition; and
 - b) must be operated in a proper and efficient manner.

O3 Dust

- O3.1 The premises must be maintained in a condition which minimises or prevents the emission of dust on or from the premises.
- O3.2 Activities occurring in or on the premises must be carried out in a manner that will minimise the generation of wind-blown or traffic generated dust.
- O3.3 All trafficable areas, coal stockpile(s) and storage areas, and vehicle manoeuvring areas in or on the premises must be maintained, at all times, in a condition that will minimise the generation of dust.
- O3.4 All vehicles transporting coal from the premises must be covered immediately after loading to prevent wind blown emissions and spillage.
 - Note: Vehicles transporting coal on the private haul road from Chain Valley Colliery to Vales Point Power station are exempt from covering their load if surface coal moisture is above 8%.
- O3.5 Activities occurring in or on the premises must be carried out in a manner that will minimise the tracking of dust from the premises.

O4 Effluent application to land

- O4.1 An area must be provided for the use of effluent from the office building sewage treatment system. The design of the effluent irrigation area must be in accordance with the EPA's Environmental Guideline: Use of Effluent by Irrigation.
- O4.2 The quantity of wastewater applied to the utilisation area(s) must not exceed the capacity of the utilisation area(s) to effectively utilise the effluent.



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For the purpose of this condition. "effectively utilise" includes the ability of the soil to absorb the nutrient, salt and hydraulic loads and the applied organic material without causing harm to the environment.

O5 Emergency response

Note: The licensee must maintain, and implement as necessary, a current Pollution Incident Response Management Plan (PIRMP) for the premises. The PIRMP must be developed in accordance with the requirements in Part 5.7A of the *Protection of the Environment Operations* (POEO) Act 1997 and POEO Regulations. The licensee must keep the incident response plan on the premises at all times. The incident response plan must document systems and procedures to deal with all types of incidents (e.g. spills, explosions or fire) that may occur at the premises or that may be associated with activities that occur at the premises and which are likely to cause harm to the environment. The PIRMP must be tested annually or following a pollution incident.

O6 Processes and management

Bunding

O6.1 All above ground tanks containing material that is likely to cause environmental harm must be bunded or have an alternative spill containment system in place.

O6.2 Bunds must:

- a) have walls and floors constructed of impervious materials;
- b) be of sufficient capacity to contain 110% of the volume of the tank (or 110% volume of the largest tank where a group of tanks are installed);
- c) have floors graded to a collection sump; and
- d) not have a drain valve incorporated in the bund structure,

or be constructed and operated in a manner that achieves the same environmental outcome.

O7 Waste management

- O7.1 The licensee must ensure that any liquid and/or non liquid waste generated and/or stored at the premises is assessed in accordance with the EPA Waste Classification Guidelines as in force from time to time.
- O7.2 The licensee must ensure that waste identified for recycling is stored separately from other waste.

O8 Other operating conditions

Sewage Treatment

- O8.1 All sewage generated on the premises must be directed, collected and treated by the sewage treatment system(s).
- O8.2 The licensee is responsible for the correct operation of the sewage treatment system(s) on their premises.



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- O8.3 Correct operation involves regular supervision and system maintenance. The licensee must be aware of the system requirements and must ensure that the necessary service contracts are in place.
- O8.4 The sewage treatment system(s) must be serviced by a suitably qualified and experienced waste water technician at least once each quarterly period and a minimum of four times per year.
- O8.5 The licensee must record each inspection and any actions required or recommended by the technician; including all results from tests performed on the sewage treatment system(s) by the technician as defined in Condition O8.4.
- O8.6 All treated sewage that is discharged from the premises must be discharged through licensed discharge point "EPA Identification no. 1", as defined in condition P1.3.

5 Monitoring and Recording Conditions

M1 Monitoring records

- M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.
- M1.2 All records required to be kept by this licence must be:
 - a) in a legible form, or in a form that can readily be reduced to a legible form;
 - b) kept for at least 4 years after the monitoring or event to which they relate took place; and
 - c) produced in a legible form to any authorised officer of the EPA who asks to see them.
- M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
 - a) the date(s) on which the sample was taken;
 - b) the time(s) at which the sample was collected;
 - c) the point at which the sample was taken; and
 - d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

- M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:
- M2.2 Air Monitoring Requirements

POINT 25

Pollutant	Units of measure	Frequency	Sampling Method
Particulate matter	micrograms per cubic metre	Continuous	AM-22



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M2.3 Water and/ or Land Monitoring Requirements

POINT 1

Pollutant	Units of measure	Frequency	Sampling Method
Biochemical oxygen demand	milligrams per litre	Once a month (min. of 4 weeks)	Grab sample
Enterococci	colony forming units per 100 millilitres	Once a month (min. of 4 weeks)	Grab sample
Faecal Coliforms	colony forming units per 100 millilitres	Once a month (min. of 4 weeks)	Grab sample
рН	рН	Once a month (min. of 4 weeks)	Grab sample
Total suspended solids	milligrams per litre	Once a month (min. of 4 weeks)	Grab sample

POINT 27

Pollutant	Units of measure	Frequency	Sampling Method
Enterococci	colony forming units per 100 millilitres	Daily during any discharge	Grab sample
Faecal Coliforms	colony forming units per 100 millilitres	Daily during any discharge	Grab sample
pH	рН	Daily during any discharge	Grab sample
Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample

M3 Testing methods - concentration limits

- M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:
 - a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
 - b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
 - c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2021* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".



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M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

M4 Environmental monitoring

Requirement to monitor noise

- M4.1 To determine compliance with condition L5.1, attended noise monitoring must be undertaken in accordance with conditions L5.7 and L5.8, and
 - (a) at each one of the locations listed in condition L5.1;
 - (b) occur quarterly within the reporting period of the Environment Protection Licence with at least 2 months between monitoring periods;
 - (c) occur during each day, evening and night period as defined in the NSW Industrial Noise Policy (EPA 2000) for a minimum of 15 minutes for three of the quarters;
 - (d) the night time 15 minute attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am;
 - (e) the night time LA1 (1 min) attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am;
 - (f) one quarterly monitoring must occur during each day, evening and night period as defined in the NSW EPA Noise Policy for Industry 2017 for a minimum of 1.5 hours during the day; 30 minutes during the evening; and 1 hours during the night, and
 - (g) each quarterly monitoring must be undertaken on a different day(s) of the week not including Saturdays, Sundays and public holidays; and
 - (h) these monitoring conditions take effect in the 2015 Reporting period.

Note: The intention of this condition is that quarterly monitoring be undertaken at each sensitive receiver. That at each sensitive receiver monitoring is undertaken over a range of different days excluding weekends and public holidays during the reporting period so as to be representative of operating hours. That night time 15 minute attended monitoring and the LA1 (1min) monitoring for three of the quarters be undertaken at worst case being the most stable atmospheric conditions and when noise would be most intrusive to sleep. All of the sensitive receivers do not have to be monitored on the same day, evening and night for sub condition f.

M4.2 For the Annual Reporting Period ending March 2015 the EPA will accept all monitoring required by the current Department of Planning and Environment consent (usually quarterly monitoring for noise as dB(A) Leq15minutes) for compliance with noise monitoring requirements in this licence, as a single report attached to the Annual Return for the premises.

M5 Weather monitoring

M5.1 At the point(s) identified below, the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1 of the table below, using the corresponding sampling method, units of measure, averaging period and sampling frequency, specified opposite in the Columns 2, 3, 4 and 5 respectively.



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POINT 26

Parameter	Sampling method	Units of measure	Averaging period	Frequency
Rainfall	AM-4	millimetres	24 hours	Continuous
Wind Direction at 10 metres	AM-2 & AM-4	Degrees	1 hour	Continuous
Wind Speed	AM-2 & AM-4	metres per second	1 hour	Continuous
Temperature at 10 metres	AM-4	degrees Celsius	1 hour	Continuous
Sigma Theta	AM-2 & AM-4	Degrees	15 minutes	Continuous
Relative humidity	AM-4	percent	1 hour	Continuous

M5.2 The licensee may use the Vales Point Power Station Meteorological Station to determine compliance with condition M5.1, provided the licensee has authority from Sunset Power International Pty Ltd to access meteorological data at all times.

M6 Recording of pollution complaints

- M6.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.
- M6.2 The record must include details of the following:
 - a) the date and time of the complaint;
 - b) the method by which the complaint was made;
 - c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
 - d) the nature of the complaint;
 - e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
 - f) if no action was taken by the licensee, the reasons why no action was taken.
- M6.3 The record of a complaint must be kept for at least 4 years after the complaint was made.
- M6.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M7 Telephone complaints line

- M7.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.
- M7.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.



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- M7.3 The preceding two conditions do not apply until 3 months after: the date of the issue of this licence.
- M7.4 The licensee must notify the EPA with contact details of personnel capable of a timely response to emergencies or any other exigent circumstances.
 - (a) the nominated contact must be available at all times.
 - (b) contact details must include a telephone number and must be current.
 - (c) such notification must be made within 14 days of receiving this licence.

M8 Requirement to monitor volume or mass

- M8.1 For each discharge point or utilisation area specified below, the licensee must monitor:
 - a) the volume of liquids discharged to water or applied to the area;
 - b) the mass of solids applied to the area;
 - c) the mass of pollutants emitted to the air;
 - at the frequency and using the method and units of measure, specified below.

POINT 1

Frequency	Unit of Measure	Sampling Method
Continuous during discharge	kilolitres per day	In line instrumentation

POINT 27

Frequency	Unit of Measure	Sampling Method
Continuous during discharge	kilolitres per day	In line instrumentation

6 Reporting Conditions

R1 Annual return documents

- R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:
 - 1. a Statement of Compliance,
 - 2. a Monitoring and Complaints Summary,
 - 3. a Statement of Compliance Licence Conditions,
 - 4. a Statement of Compliance Load based Fee,
 - 5. a Statement of Compliance Requirement to Prepare Pollution Incident Response Management Plan,
 - 6. a Statement of Compliance Requirement to Publish Pollution Monitoring Data; and
 - 7. a Statement of Compliance Environmental Management Systems and Practices.

At the end of each reporting period, the EPA will provide to the licensee notification that the Annual Return is due.



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R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

- R1.3 Where this licence is transferred from the licensee to a new licensee:
 - a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
 - b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

- R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
 - a) in relation to the surrender of a licence the date when notice in writing of approval of the surrender is given; or
 - b) in relation to the revocation of the licence the date from which notice revoking the licence operates.
- R1.5 The Annual Return for the reporting period must be supplied to the EPA via eConnect *EPA* or by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').
- R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.
- R1.7 Within the Annual Return, the Statements of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
 - a) the licence holder; or
 - b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

R2 Notification of environmental harm

- Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.
- R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.
- R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which they became aware of the incident.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:



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- a) where this licence applies to premises, an event has occurred at the premises; or
- b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
- and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.
- R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.
- R3.3 The request may require a report which includes any or all of the following information:
 - a) the cause, time and duration of the event;
 - b) the type, volume and concentration of every pollutant discharged as a result of the event;
 - c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
 - d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort:
 - e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
 - f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
 - g) any other relevant matters.
- R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

R4 Other reporting conditions

Noise Monitoring Report

- R4.1 The licensee must submit to the EPA a noise compliance assessment report at the end of each reporting period. The report must be submitted with the Environment Protection Licence Annual Return. The report must be prepared by a suitably qualified and experienced acoustical consultant which:
 - (a) details the noise monitoring undertaken in accordance with condition M4;
 - (b) assesses compliance with noise limits presented in condition L5.1 and condition 5.2; and
 - (c) outlines any management actions taken within the monitoring period to address any exceedences of limits contained in condition L5.1 and condition L5.2.

Note: The licensee must provide the EPA with one report, but this report may be a combination of the monitoring undertaken by the licensee as part of their quarterly monitoring program as required by the Project Approval SSD-5456 and must include LA1(1min).

7 General Conditions



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G1 Copy of licence kept at the premises or plant

- G1.1 A copy of this licence must be kept at the premises to which the licence applies.
- G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.
- G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

G2 Contact number for incidents and responsible employees

- G2.1 The licensee must operate 24-hour telephone contact lines for the purpose of enabling the EPA to directly contact one or more representatives of the licensee who can:
 - a) respond at all times to incidents relating to the premises; and
 - b) contact the licensee's senior employees or agents authorised at all times to:
 - i) speak on behalf of the licensee; and
 - ii) provide any information or document required under this licence.
- G2.2 The licensee is to inform the EPA in writing of the appointment of any subsequent contact persons, or changes to the person's contact details as soon as practicable and in any event within fourteen days of the appointment or change.

G3 Other general conditions

G3.1 Completed Programs

Program	Description	Completed Date
Coal Mine Particulate Matter Control Best Practice	Requires licensee to conduct a site specific Best Management Practice (BMP) determination to identify ways to reduce particle emissions.	28-September-2012
Assessment of Potential Impacts of Metals in wastewater	The licensee must conduct an assessment of metals detected in wastewater discharges from the mine in accordance with the ANZECC water quality guidelines. To obtain a greater understanding of the type and concentration of metals discharged in mine water and entering the receiving waters. To limit the concentration of metals discharged in mine water within ANZECC guidelines.	23-October-2013
Air Quality Monitoring	The licensee must evaluate best locations and install monitoring devices as defined in Project Approval MP10_0161 under the Environent Planning & Assessment Act 1979.	31-December-2013
PRP4 - Upgrade to Clean and Dirty Water Management System	The licensee must review and upgrade separation of the Clean and Dirty Water Management System and review and upgrade bunding.	14-August-2015



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PRP5 - Remediation of Dam Wall and Spillway formalisation	The licensee must design and remediate the dam wall on the final control pond and formalise a spillway to prevent dam seepage and to ensure that volumetric discharge can be monitored	27-February-2015
PRP 6 Upgrade to Sewage Treatment Systems	Assessment of options for improved disinfection of effluent from STP on licenced premises.	06-January-2015
PRP7 Sewage Treatment System Concept Design	Provide the EPA with a Concept Design and Timetable for Implementation of Upgrade to the Sewage Treatment System	19-February-2016

8 Pollution Studies and Reduction Programs

U1 PRP 8 - Connection of Bathouse Wastewater to Sewer

U1.1 Background

The licensee has historically treated and disposed of effluent and grey water generated by activities at the premises through the surface water management system. The licensee has committed to undertaking scoping works and planning pathways to enable the connection of the bathhouse wastewater at the premises to the Central Coast Council sewer. The EPA understands that in 2021 the licensee was granted approval by Central Coast Council to undertake the necessary works to discharge effluent and grey water generated at the bathhouse to sewer.

Deliverables

The licensee must undertake all works proposed and specified under the planning approval by Central Coast Council to enable all bathhouse effluent and greywater to be disposed to the Central Coast Council sewerage network by no later than Friday 26 August 2022.

Upon completion of the sewerage connection the licensee must provide the EPA with a letter report identifying all works completed under this PRP.

U2 PRP 9 - Office Area Wastewater Sytem Upgrades to Best Practice

U2.1 Background

Wastewater from the premises office is currently managed by a sewage treatment system that employs surface irrigation of effluent via an above ground sprinkler system. The EPA understand that the sewage treatment system services around four office staff. The EPA understand that the effluent currently irrigated is not disinfected. The EPA considers that the current effluent irrigation system is in need of upgrades to reduce any potential impact to public health and the environment.

Deliverables

The licensee must gain any necessary approvals and upgrade the current sewage management system servicing the office building to a current best practice sewage management system. This may include



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upgrades to the effluent irrigation system to sub-surface irrigation or other best practice methods. The licensee must upgrade the current wastewater management system servicing the office building to best practice by no later than Friday 26 August 2022.

Upon completion of all works required by this PRP the licensee must supply the EPA with a letter report identifying all works and actions taken to upgrade the office building sewage management system.



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Dictionary

General Dictionary

3DGM [in relation
to a concentration
limit]

Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples

Act Means the Protection of the Environment Operations Act 1997

activity Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment

Operations Act 1997

actual load Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009

AM Together with a number, means an ambient air monitoring method of that number prescribed by the

Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales.

AMG Australian Map Grid

anniversary date The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a

licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the

commencement of the Act.

annual return Is defined in R1.1

Approved Methods Publication

Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009

assessable pollutants

Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009

BOD Means biochemical oxygen demand

CEM Together with a number, means a continuous emission monitoring method of that number prescribed by

the Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales.

COD Means chemical oxygen demand

composite sample

Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples

collected at hourly intervals and each having an equivalent volume.

cond. Means conductivity

environment Has the same meaning as in the Protection of the Environment Operations Act 1997

environment protection legislation Has the same meaning as in the Protection of the Environment Administration Act 1991

EPA Means Environment Protection Authority of New South Wales.

fee-based activity classification

Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations

(General) Regulation 2009.

general solid waste Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act

(non-putrescible) 199



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flow weighted composite sample

Means a sample whose composites are sized in proportion to the flow at each composites time of collection

general solid waste (putrescible)

Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environmen t Operations Act

199

grab sample

Means a single sample taken at a point at a single time

hazardous waste

Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act

1997

licensee

Means the licence holder described at the front of this licence

load calculation protocol

Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009

local authority

Has the same meaning as in the Protection of the Environment Operations Act 1997

material harm

Has the same meaning as in section 147 Protection of the Environment Operations Act 1997

MBAS

Means methylene blue active substances

Minister

Means the Minister administering the Protection of the Environment Operations Act 1997

mobile plant

Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act

1997

motor vehicle

Has the same meaning as in the Protection of the Environment Operations Act 1997

റുദ

Means oil and grease

percentile [in relation to a concentration limit of a sample] Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.

plant

premises

Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.

pollution of waters [or water pollution]

Has the same meaning as in the Protection of the Environment Operations Act 1997

Means the premises described in condition A2.1

public authority

Has the same meaning as in the Protection of the Environment Operations Act 1997

regional office

Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence

reporting period

For the purposes of this licence, the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 months. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.

restricted solid waste

Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act

scheduled activity

Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997

special waste

Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

TM

Together with a number, means a test method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.



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Means total suspended particles TSP Means total suspended solids TSS Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or Type 1 substance more of those elements Type 2 substance Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements utilisation area Means any area shown as a utilisation area on a map submitted with the application for this licence waste Has the same meaning as in the Protection of the Environment Operations Act 1997 waste type Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non putrescible), special waste or hazardous waste

Ms Debbie Maddison

Environment Protection Authority

(By Delegation)

Date of this edition: 10-November-2000



Licence - 1770

End	N	lotes
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- 1 Licence varied by notice 1008662, issued on 24-Oct-2001, which came into effect on 24-Oct-2001.
- 2 Licence transferred through application 141163, approved on 24-Apr-2002, which came into effect on 20-Apr-2002.
- 3 Licence varied by notice 1026573, issued on 16-Apr-2003, which came into effect on 11-May-2003.
- 4 Condition A1.3 Not applicable varied by notice issued on <issue date> which came into effect on <effective date>
- 5 Licence varied by notice 1104492, issued on 11-Dec-2009, which came into effect on 11-Dec-2009.
- 6 Licence varied by notice 1502571 issued on 21-Dec-2011
- 7 Licence varied by notice 1504446 issued on 15-Apr-2013
- 8 Licence varied by notice 1516485 issued on 20-Aug-2013
- 9 Licence varied by notice 1519380 issued on 26-Sep-2014
- 10 Licence varied by notice 1527706 issued on 15-May-2015
- 11 Licence varied by notice 1535160 issued on 30-Oct-2015
- 12 Licence varied by notice 1540199 issued on 08-Jun-2016
- 13 Licence transferred through application 1578021 approved on 01-Apr-2019 , which came into effect on 02-Apr-2019
- 14 Licence varied by notice 1593319 issued on 30-Sep-2021

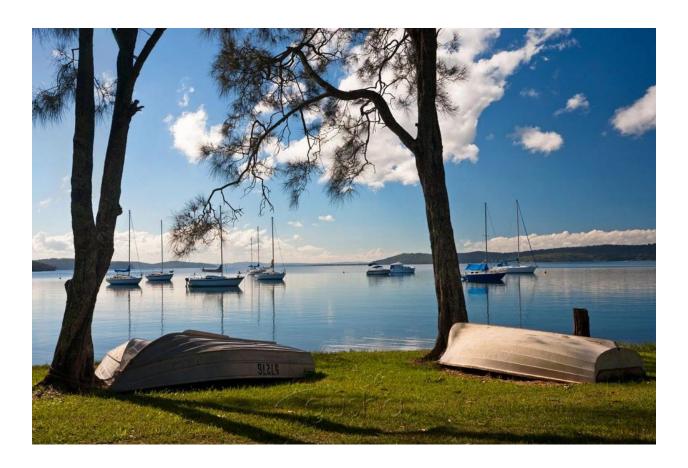


Appendix 3: Seagrass Monitoring Report (2022)

Review Date	Next Review Date	Revision No	Document Owner	Page			
		1	Environmental Compliance Coordinator	Page 103 of 114			
DOCUMENT UNCONTROLLED WHEN PRINTED							

Great Southern Energy Pty Ltd (T/A Delta Coal) Mannering & Chain Valley Collieries

Seagrass Survey of Chain Valley Bay, Summerland Point, Bardens Bay and Crangan Bay, Lake Macquarie, NSW



by Dr Emma Laxton

June 2022

J.H. & E.S. Laxton - Environmental Consultants P/L

170 Warrimoo Avenue, St Ives, Sydney, 2075. Australia T: 0429 85589. Email: emmalaxton07@gmail.com

Summary

From 2011, fourteen stations in Chain Valley Bay, ten off Summerland Point and four in Crangan Bay were surveyed for seagrass cover. In 2014 six stations in Bardens Bay were added to the sampling schedule, and by 2018, 50 seagrass transects were being surveyed.

The average length of transects in Chain Valley Bay, Summerland Point and Brightwaters were 56.9m, 59.9m and 55.1m respectively. The average length of transect in Bardens Bay was 26.6m. The transects with the greatest length were Transects E9 (152m), F2 (131m) and S4 (105m). The transects with the shortest lengths were Transects T2, C6 and A6, all approximately 14m in length.

At the time of the survey, water temperatures above seagrass beds ranged from 15.05°C to 17.04°C, with a mean water temperature of 15.92°C. Conductivity ranged from 50.38 mS/cm to 50.53 mS/cm. Mean conductivity was 50.47 mS/cm. Salinity ranged from 33.02 ppt to 33.12 ppt. Mean salinity was 33.07 ppt. Turbidity ranged from 8.6 NTU to 9.2 NTU, with a mean of 8.84 NTU. pH ranged from 7.78 to 7.98. Mean pH was 7.93. Dissolved oxygen (% saturation) ranged from 97.8% to 128.2%. Mean dissolved oxygen was 104.9% saturation. Super saturation of dissolved oxygen was the result of oxygen production by the seagrass and epiphytic algae.

The growth form of *Zostera capricorni* in the Summerland Point, Frying Pan Bay and Sugar Bay region and the Crangan Bay region was predominantly short leaved. The growth form of *Z. capricorni* in Chain Valley Bay and Bardens Bay was long leaved.

Since 2008, seagrass coverage has been increasing throughout the study area, and percentage cover has been consistent since 2012. Initial seagrass coverage at transect E6 was 17.74% in 2008. In 2021, percent seagrass cover had risen to 99.78%. Initial seagrass cover at transect T3 was 46.2%. Coverage has now increased to 98%. In June 2022, seagrass cover ranged from 81 percent to 100 percent. The seagrasses were in good condition, with most seagrasses lightly fouled with epiphytic algae or with no fouling.

The increase in percent cover of seagrasses marks the decrease in bare ground in the study area:

- from 38.13 percent in 2011 to 6.36 percent in 2022 in the Summerland Point, Frying Pan Bay and Sugar Bay region
- from 13.32 percent in 2011 to 0.58 percent in 2022 in the Chain Valley Bay region
- a decrease of bare ground in the Crangan Bay region from 26.98 percent in 2011 to 2.50 percent in 2022
- Seagrass cover in Bardens Bay has been around 95 percent since 2011.

The brown seaweed *Cystophyllum onustum* was observed at many transects such as E2, E9, E10, T6, C1-C5 and L1. The alga *Codium fragile* was also observed near transect C1. Mats of green algae were present on the seabed at transect E6. The bivalve mollusc *Pinna menkei* was recorded within several transects such as E2, E4, E5, C3, S3, S5 and A1.

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1. Introduction

Lake Macquarie is the largest saline lake in New South Wales. It lies on the central coast between Sydney and Newcastle within the local government areas of Central Coast Council and Lake Macquarie Council. Lake Macquarie has a catchment of 700 square kilometers and a water surface area of 125 square kilometers (Bell & Edwards, 1980). The lake has a permanent entrance to coastal waters at Swansea and has an average depth of around 6 meters (Laxton, 2005).

The catchment of Lake Macquarie is largely rural with large areas of bushland and grazing land. The shoreline of Lake Macquarie is heavily urbanized, especially the eastern, western and northern shorelines. The region has a relatively long history of coal mining and power generation, with mining occurring since the late 1800s and the first power station at Lake Macquarie commencing operations in 1958.

Chain Valley Colliery is situated on the southern shores of Lake Macquarie near Mannering Park, NSW. The mine has been operating since 1963. Mining is continuing within the Chain Valley Coal Lease Area using the miniwall method. Prior to mining, there were three economically viable seams in the lease area, namely the Wallarah seam (not mined since 1997); the Great Northern seam, and the Fassifern seam. In 2018 Chain Valley Colliery went into voluntary receivership and was taken over by Great Southern Energy Pty Ltd (trading as Delta Coal) to provide coal for Vales Point Power Station.

Delta Coal is currently mining the Fassifern Seam beneath Lake Macquarie. As part of the protection of the lake foreshore, the mining leases require a protection zone. This zone, known as the High Water Mark (HWM) Subsidence Barrier, was calculated using a 35° angle of draw from the depth of mining. The zone is approximately 130 meters wide. J.H. & E.S. Laxton – Environmental Consultants P/L was engaged by Mr. Keith Harris of Chain Valley Colliery in 2007 to assess the potential effects of pillar extraction mining beneath Lake Macquarie on seagrasses, benthic fauna and bathymetry. The studies were supervised by:

- Mr Chris Ellis of LDO Group from 2012 to 2015
- Mr Wade Covey from 2016 to 2018
- Mr Chris Armit from 2019 to 2020, and
- Mr Lachlan McWha in 2021 and 2022.

2. Factors affecting the depth of Water in Lake Macquarie

The bathymetric chart (**Figure 2.1**) of Lake Macquarie shows water depths relative to AHD. The actual depth of water above the lakebed varied greatly, between 0 and 1.3m above AHD over a year.

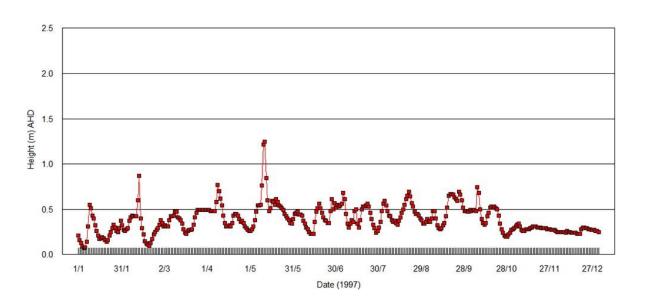


Figure 2.1 Water level changes in a coastal lagoon with an entrance open to coastal waters.

Water depths in coastal saline lakes with an open entrance to coastal waters vary due to combinations of the following factors:

- The body of Lake Macquarie is subject to tidal influence. The height of the tidal prism at Swansea Head may reach almost 2m (during spring tides) but by the time the body of the lake is reached, the tidal prism has been reduced to around 0.05m.
- The height of coastal waters and coastal lakes are influenced by changes in atmospheric pressure. The Tasman Sea acts as a huge barometer. When the atmospheric pressure is high the sea surface is depressed. This causes water to drain from Lake Macquarie causing the depth of water in the body of the lake to decrease. When the atmospheric pressure over the Tasman Sea is low, the surface of the sea bulges upwards. This raising of sea level causes water to flow into Lake Macquarie, increasing the water depth.
- Low pressure systems in the Tasman Sea almost always generate strong winds and coastal rainfall. The strong winds cause large swells to form that impact the coast.
 Wave setup at the entrance to Lake Macquarie causes the water level in the lake to rise as large volumes of seawater enter the system.
- Rainfall during a period of low atmospheric pressure causes runoff into catchment rivers and streams to increase. When this extra water reaches the body of Lake Macquarie, the water level rises in proportion to the runoff volume. This water is prevented from exiting the lake by wave setup at the entrance and the state of the tide. Under these circumstances, the level of the lake can rise to heights of a meter or more above AHD.

3. Seagrass survey Method

The seagrass survey was conducted on the 25th and 26th June 2022.

A Sony Handycam 6.1 megapixel video camera (DCR-SR300E) fitted with a wide conversion X0.7 lens (VCL-HG737C) was inserted into an underwater housing. The underwater housing was mounted vertically in the centre of a 1m long surfboard. This rig was towed alongside a work boat.

The water depth along most of the transect lines ranged from around 0.5 to 1.8m. Transect lines were photographed from the outer end to the inner end.

The video was examined by viewing still frames approximately every 1m along the transect. The following information was recorded:

- 1. The transect number and the date the video was taken.
- 2. The percentage areas occupied by the following plants and animals in each still photograph or quadrat:
 - (a) % area occupied by long leaved seagrass Zostera capricorni;
 - (b) % area occupied by short leaved seagrass Zostera capricorni;
 - (c) % area occupied by the small seagrass Halophila ovalis;
 - (d) degree of fouling of the seagrass leaves by algae 1=no fouling, 2=light fouling, 3=heavy fouling;
 - (e) % area occupied by the large brown alga (Sargassum sp., Hormosira banksii or Cystoseira trinodis);
 - (f) % area occupied by filamentous and thallous algae (green or brown algae);
 - (g) Number of the large bivalve *Pinna menkei*;
 - (h) % area of uncolonised ground (bare ground, no macroscopic epibenthos).

4. Locations of permanent seagrass transects

Figures 4.1, 4.2 and 4.3 show the location of seagrass transects in Chain Valley Bay, Summerland Point, Bardens Bay, Brightwaters and Crangan Bay. From 2018 to 2022, a total of 50 transects were photographed annually:

- Transects E1 to E16 are established experimental transects in Chain Valley Bay and Summerland Point (Figure 4.1)
- Transects T1 to T8 are established experimental transects along Summerland Point (Figure 4.1)
- Transects C1 to C4 are established control stations in Crangan Bay (Figure 4.1)
- Transect L1 was established in Chain Valley Bay in 2015 (Figure 4.1)
- Transects A1 to A6 are establised experimental stations in Bardens Bay. They were first surveyed in 2014 (**Figure 4.2**)
- Transects C5 to C6 were established in 2018 (Figure 4.3)
- Transects F1 to F7 in Brightwaters Bay were established in 2018 (Figure 4.3), and

• Transects S1 to S6 were established in Sugar Bay in 2018 (Figure 4.3).



Figure 4.1 Locations of Transects in Chain Valley Bay, Summerland Point and Crangan Bay, Lake Macquarie.



Figure 4.2 Locations of Transects A1 to A6 in Bardens Bay, Lake Macquarie established in 2014.



Figure 4.3 Location of transects C5-C6, F1-F7 and S1-S6 in Lake Macquarie established in 2018.

Transects in Crangan Bay were for biological purposes only and were surveyed by handheld GPS only.

Table 4.1 Coordinates of inner and outer ends of permanent seagrass transects in Chain Valley Bay

Transect No.	Easting	Northing	Transect No.	Easting	Northing
E1 Inner	56363985.56	6331796.12	E1 Outer	56364003.66	6331816.06
E2 Inner	56364035.74	6331701.21	E2 Outer	56364076.97	6331716.45
E3 Inner	56363953.19	6331404.63	E3 Outer	56364027.57	6331417.71
E4 Inner	56364220.41	6331078.04	E4 Outer	56364259.92	6331122.01
E5 Inner	56365005.52	6330163.60	E5 Outer	56365034.44	6330225.24
E6 Inner	56365118.34	6329788.72	E6 Outer	56365174.56	6329802.58
E7 Inner	56385350.74	6332350.32	E7 Outer	56365297.96	6332344.97
E8 Inner	56365128.31	6331795.44	E8 Outer	56365096.58	6331811.56
E9 Inner	56365040.02	6331607.80	E9 Outer	56364913.26	6331523.98
E10 Inner	56365422.82	6331427.70	E10 Outer	56365394.86	6331361.84
E11 Inner	56365554.10	6331410.24	E11 Outer	56365524.31	6331343.51
E12 Inner	56365749.60	6331328.35	E12 Outer	56365735.31	6331284.62
E13 Inner	56365990.71	6331278.46	E13 Outer	56365970.44	6331190.80
E14 Inner	56366447.51	6331046.57	E14 Outer	56366370.49	6330984.28
E15 Inner	56366657.26	6330098.71	E15 Outer	56366610.88	6330167.27
E16 Inner	56366310.52	6329644.48	E16 Outer	56366272.93	6329666.33
T1 inner	56365439.70	6333217.30	T1 outer	56365442.62	6333264.67
T2 inner	56365402.69	6333100.83	T2 outer	56365388.27	6333100.67
T3 inner	56365400.34	6332951.79	T3 outer	56365384.15	6332949.28
T4 inner	56365377.42	6332816.19	T4 outer	56365357.10	6332831.62
T5 inner	56365350.31	6332990.09	T5 outer	56365309.37	6332575.63
T6 inner	56365347.91	6332380.19	T6 outer	56365300.00	6332337.91
T7 inner	56365320.68	6332207.46	T7 outer	56365267.96	6332206.74
T8 inner	56365336.86	6332262.46	T8 outer	56365295.11	6332270.42
L1 inner	56364292.62	6330367.65	L1 outer	56364304.40	6330399.71

Table 4.2 Coordinates of inner and outer ends of permanent seagrass transects off Summerland Point

Transect No.	Easting	Northing	Transect No.	Easting	Northing
C5 inner	56365676.16	6333038.68	C5 outer	56365702.98	6333084.58
C6 inner	56366045.20	6332831.77	C6 outer	56366058.95	6332870.63
F1 inner	56366320.96	6333281.31	F1 outer	56366285.58	6333249.79
F2 inner	56366342.19	6333330.55	F2 outer	56366290.92	6333450.31
F3 inner	56366611.11	6333163.11	F3 outer	56366621.00	6333228.01
F4 inner	56366968.01	6333242.46	F4 outer	56366918.81	6333285.18
F5 inner	56367106.95	6333361.98	F5 outer	56367068.97	6333421.28

	F6 inner	56367271.10	6333493.19	F6 outer	56367202.42	6333522.83
ſ	F7 inner	56367402.36	6333682.09	F7 outer	56367374.73	6333694.93

Table 4.3 Coordinates of inner and outer ends of permanent seagrass transects in Bardens Bay.

Transect No.	Easting	Northing	Transect No.	Easting	Northing
A1 inner	56364006.28	6333892.16	A1 outer	56364048.43	6333899.34
A2 inner	56363979.36	6334006.51	A2 outer	56364002.16	6334013.22
A3 inner	56363918.06	6334157.90	A3 outer	56363927.53	6334165.80
A4 inner	56363633.48	6334426.20	A4 outer	56363660.06	6334425.14
A5 inner	56363686.18	6335068.50	A5 outer	56363688.41	6335049.82
A6 inner	56364434.63	6334566.67	A6 outer	56364422.84	6334560.15

Table 4.4 Coordinates of inner and outer ends of permanent seagrass transects in Crangan Bay.

Transect No.	Easting	Northing	Transect No.	Easting	Northing
C1 Inner	56368596	6332235	C1 Outer	56368616	6332250
C2 Inner	56368619	6332147	C2 Outer	56368658	6332151
C3 Inner	56368524	6331811	C3 Outer	56368538	6331806
C4 Inner	56368467	6331435	C4 Outer	56368486	6331421

Table 4.5 Coordinates of inner and outer ends of permanent seagrass monitoring transects off Brightwaters.

Transect No.	Easting	Northing	Transect No.	Easting	Northing
S1 inner	56365009.02	6334470.41	S1 outer	56365077.72	6334481.77
S2 inner	5636642.29	6334943.57	S2 outer	56364673.53	6334939.82
S3 inner	56365017.76	6335008.93	S3 outer	56365041.97	6334932.70
S4 inner	56365235.10	6334992.86	S4 outer	56365217.43	6334889.31
S5 inner	56365575.20	6334709.08	S5 outer	36365569.66	6334693.44
S6 inner	56366144.58	6334765.21	S6 outer	56366172.04	6334761.92

5. Transect lengths

The length of each permanent transect is shown in **Table 5.1**.

 Table 5.1
 Transect lengths in Chain Valley Bay, Summerland Point, Bardens Bay and Brightwaters

Chain Valley Bay

Transect Number	Length (m)	Transect Number	Length (m)
Transect E1	26	Transect E2	44
Transect E3	75	Transect E4	59
Transect E5	67	Transect E6	57
Transect E7	52	Transect E8	35
Transect E9	152	Transect E10	71
Transect E11	73	Transect E12	46
Transect E13	89	Transect E14	98
Transect E15	82	Transect E16	44
Transect T1	47	Transect T2	14
Transect T3	16	Transect T4	25
Transect T5	49	Transect T6	63
Transect T7	52	Transect T8	42
Transect L1	20		

Summerland Point

Transect Number	Length (m)	Transect Number	Length (m)
Transect C5	41	Transect C6	13
Transect F1	47	Transect F2	130
Transect F3	65	Transect F4	65
Transect F5	70	Transect F6	74
Transect F7	30		

Bardens Bay

Transect Number	Length (m)	Transect Number	Length (m)
Transect A1	42	Transect A2	24
Transect A3	34	Transect A4	26
Transect A5	18	Transect A6	13

Brightwaters

Transect Number	Length (m)	Transect Number	Length (m)
Transect S1	69	Transect S2	31
Transect S3	79	Transect S4	105
Transect S5	16	Transect S6	27

The average length of transects in Chain Valley Bay, Summerland Point and Brightwaters was 56.9m, 59.9m and 55.1m respectively. The average length of transect in Bardens Bay was 26.6m. The transects with the greatest lengths were Transects E9 (152m), F2 (131m) and S4 (105m) (**Table 5.1**). The transects with the shortest lengths were Transects T2, C6 and A6, all approximately 14m in length (**Table 5.1**).

6. Physical characteristics of water in Lake Macquarie – June 2022

The physical characteristics of the waters above the seagrass beds in Lake Macquarie were measured on 26th June 2022 off Bardens Bay and Sugar Bay using a calibrated Yeo-Kal 618RU Analyser. Units of measurement were Temperature (TEMP) - degrees Celsius; Conductivity (COND) - mS/cm; Salinity (SAL) - parts per thousand; pH; Dissolved Oxygen - % saturation and mg/L; and Turbidity (TURB) - NTU.

The physical characteristics of the bottom water at each transect in Bardens Bay and Sugar Bay, Lake Macquarie are shown in **Table 6.1** and were as follows:

- Water Temperature ranged from 15.05°C at Transect S3 to 17.04°C at Transect A1.
 Mean water temperature was 15.92°C.
- Conductivity ranged from 50.38 mS/cm at Transect A1 to 50.53 mS/cm at Transect E1. Mean conductivity was 50.47 mS/cm.
- Salinity ranged from 33.02 ppt at Transect A1 to 33.12 ppt at Transect A5. Mean salinity was 33.07 ppt.
- Turbidity ranged from 8.6 NTU at Transect S3 to 9.2 NTU at Transect A1. Mean turbidity was 8.84 NTU.
- pH ranged from 7.78 at Transect A1 to 7.98 at Transect S4. Mean pH was 7.93.
- Dissolved oxygen (% saturation) ranged from 97.8% at Transect S5 to 128.2% at Transect S3. Mean dissolved oxygen was 104.9% saturation. Super saturation of dissolved oxygen was the result of oxygen production by the seagrass and epiphytic algae.

 Table 6.1
 Physical characteristics of waters above seagrasss beds, Lake Macquarie - June 2022

Bardens Bay

Station	Temperature °C	Conductivity mS/cm	Salinity ppt	Dissolved Oxygen % sat	Dissolved Oxygen mg/L	рН	Turbidity NTU
A1	17.04	50.38	33.02	98.2	7.60	7.78	9.2
A2	16.68	50.41	33.04	103.8	8.14	7.88	9.1
А3	16.29	50.52	33.11	103.3	7.73	7.92	8.7
A4	16.13	50.47	33.07	109.1	9.60	7.94	8.9
A5	15.75	50.53	33.12	113.1	12.24	7.96	8.9
A6	16.33	50.51	33.09	107.3	8.73	7.94	8.9

Sugar Bay Brightwaters

Station	Temperature °C	Conductivity mS/cm	Salinity ppt	Dissolved Oxygen % sat	Dissolved Oxygen mg/L	рН	Turbidity NTU
S1	15.69	50.49	33.07	99.1	7.77	7.91	8.91
S2	15.30	50.52	33.10	101.5	8.43	7.97	8.67
S3	15.05	50.40	33.03	128.2	9.67	7.97	8.60
S4	15.39	50.45	33.05	98.4	8.33	7.98	8.80
S5	15.74	50.45	33.08	97.8	8.22	7.98	8.75
S6	15.70	50.46	33.10	99.4	8.35	7.95	8.68

7. Plant and animal species monitored in the study area

Plate 7.1 provides information about the plants monitored in the seagrass surveys of Lake Macquarie, NSW.

Plate 7.1 Plant species found in the study area of Lake Macquarie (2007 - 2022).



Kingdom: Plantae
Phylum: Magnoliophyta
Class: Liliopsida
Order: Potamogetonales
Family: Zosteraceae
Genus: Zostera
Species: Z. capricorni

Remarks: Zostera capricorni is a species of eelgrass native to the seacoasts of New Guinea, Queensland, New South Wales, Victoria, South Australia, Norfolk Island and the North Island of New Zealand. It was first discovered at Moreton Bay in Queensland in 1875.



Kingdom: Plantae

Phylum:MagnoliophytaClass:LiliopsidaOrder:HydrocharitalesFamily:Hydrocharitaceae

Genus: Halophila Species: H. ovalis

Remarks: Halophila ovalis commonly known as paddle weed, spoon grass or dugong grass, is a seagrass in the family Hydrocharitaceae. It is a small herbaceous plant that occurs in seabeds and other saltwater environments in the Indo-Pacific. First seen at Transect E6 in Chain Valley Bay on 12th June 2010.



Kingdom: Plantae
Phylum: Phaeophyta
Class: Phaeophyceae

Order: Fucales

Family: Hormosiraceae
Genus: Hormosira
Species: H. banksii

Remarks: Hormosira banksii, also known as Neptune's necklace, Neptune's pearls, sea grapes, or bubbleweed is a species of brown alga native to Australia and New Zealand. It is abundant on low-energy rocky reefs at midtide levels, where it outcompetes other algal species due to its high tolerance to desiccation. First recorded at Transect C1 in Crangan Bay on 12th June 2010.



Kingdom: Plantae
Phylum: Phaeophyta
Class: Phaeophyceae

Order: Fucales

Family: Sargassaceae Genus: Sargassum

Remarks: Sargassum is a genus of brown macroalgae in the order Fucales. Numerous species are distributed throughout the temperate and tropical oceans of the world, where they generally inhabit shallow water and coral reefs, and the genus is widely known for its planktonic species.



Kingdom: Plantae
Phylum: Phaeophyta
Class: Phaeophyceae

Order: Fucales

Family: Cystoseiraceae
Genus: Cystoseira
Species: C. trinodis

Synonym: Cystophyllum onustum

Remarks: A macroalgae widespread in Australia and the Indo-Pacific region. The plants vary considerably in size and form, with tall thin plants up to 1.5m high in very sheltered and estuarine waters, or more compact thicker-stemmed plants up to 30cm high in oceanic reef pools. Characterised by small peg-like projections on the lower parts of the main branches.



Kingdom: Plantae
Phylum: Chlorophyta
Class: Ulvophyceae
Order: Bryopsidales
Family: Codiaceae
Genus: Codium
Species: C. fragile

Remarks: The cylindrical, forked, dark green fronds of *C. fragile* grow to 30 cm long. When the plant is under water, fine hairs can be seen over the surface of the branches. This is a species of temperate regions, found subtidally and in intertidal pools often on rough coasts. Small red algae are often found growing on *C.* fragile, giving a pink colour to the fronds.



Kingdom: Plantae

Green filamentous algae

Remarks: Filamentous algae are colonies of microscopic plants that link together to form threads or mesh-like filaments. These primitive plants normally grow on the surface of hard objects or other substrates under the water but they can break loose and form floating mats.

8. Seagrass characteristics and fouling levels measured in surveys

The following plates show the various growth characteristics of the seagrass *Zostera capricorni* in regard to leaf length. In the study area, due to environmental factors, *Zostera capricorni* either had short leaf growth (**Plate 8.1**) or was long leaved (**Plate 8.4**). The plates also show the level of fouling of seagrass beds by filamentous algae and other algal species. In this study, fouling is described as No (Level 1), Low (Level 2) or Heavy (Level 3) (**Plates 8.1- 8.6**).



Plate 8.1 Short leaved sea grass with level 1 fouling (no fouling).



Plate 8.2 Short leaved seagrass with level 2 fouling (low fouling).



Plate 8.3 Short leaved seagrass with level 3 fouling (heavy fouling)

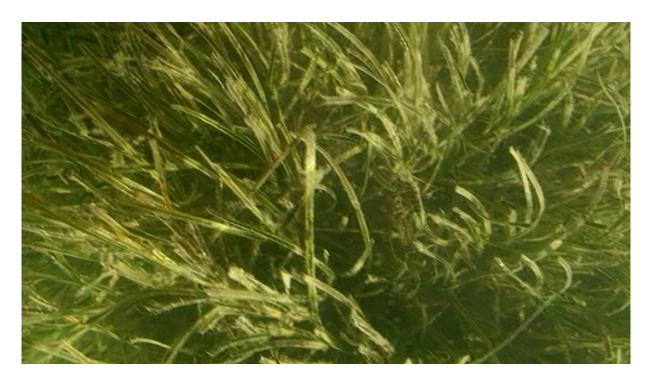


Plate 8.4 Long leaved seagrass with level 1 fouling (no fouling).



Plate 8.5 Long leaved seagrass with level 2 fouling (low fouling).



Plate 8.6 Long leaved seagrass with level 3 fouling (heavy fouling)



Plate 8.7 Algal mat and bareground.

9. Analysis of quadrats along permanent transects

Figures 9.1 to **9.6** show annual changes in the percentage cover of seagrass in the Chain Valley Bay, Summerland, Bardens Bay, Crangan Bay and Sugar Bay regions. In June 2019, seagrass cover at the transects ranged from 24.7 percent at transect S1 to 100 percent at transects C5 and F1 (**Table 9.1**, **Figures 9.6 and 9.3**). By June 2022, seagrass cover ranged from 81 percent at transect T6 to 100 percent at transects E3, E11, E12 and E13 (**Tables 9.1-9.6**).

In June 2022, the seagrasses were in good condition, with most seagrasses lightly fouled with epiphytic algae or with no fouling (**Appendix 1**). The presence of algae on the seagrass was a factor of water temperature and nutrient levels.

The brown seaweed *Cystophyllum onustum* (**Plate 7.1**) was observed at many transects such as E2, E9, E10, T6, C1-C5 and L1. The alga *Codium fragile* was also observed near transect C1 (**Plate 7.1**). Mats of green algae were present on the seabed at transect E6. The bivalve mollusc *Pinna menkei* (**Plate 7.2**) was recorded within several transects such as E2, E4, E5, C3, S3, S5 and A1.

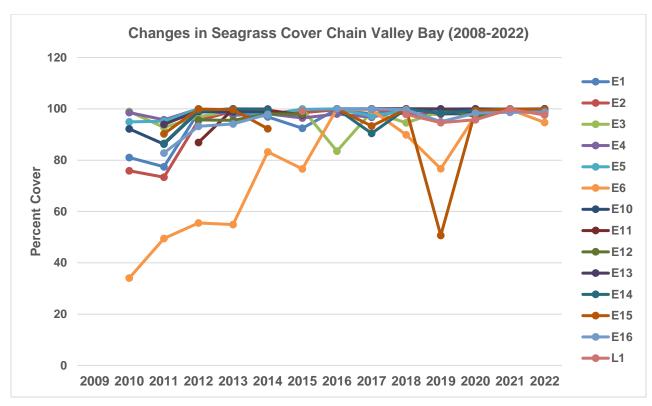


Figure 9.1 Changes in percent cover of seagrass in Chain Valley Bay (2008-2022)

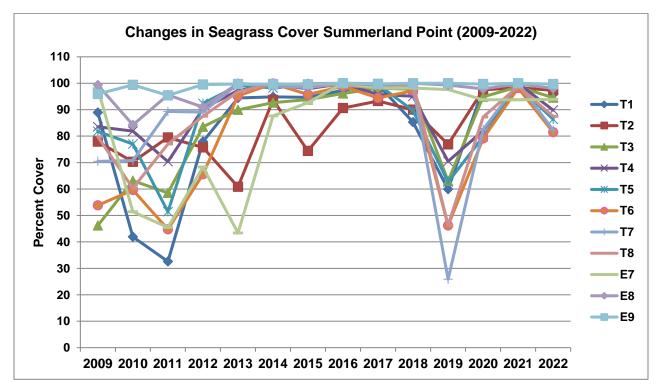


Figure 9.2 Changes in percent cover of seagrass along Summerland Point (2009-2022)

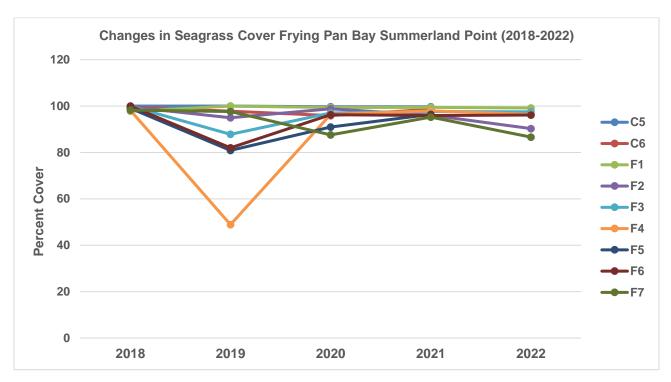


Figure 9.3 Changes in percent cover of seagrass along Frying Pan Bay Summerland Point (2018-2022)

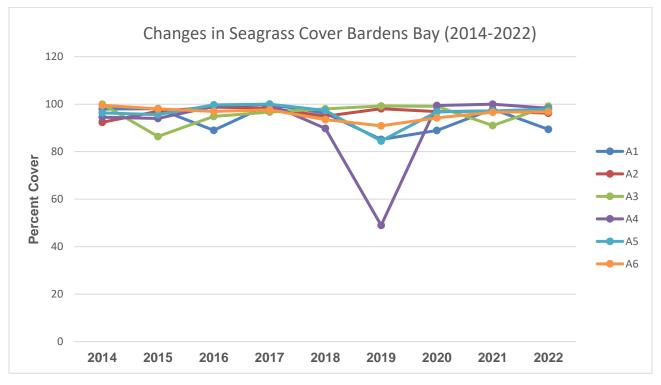


Figure 9.4 Changes in percent cover of seagrass in Bardens Bay (2014-2022)

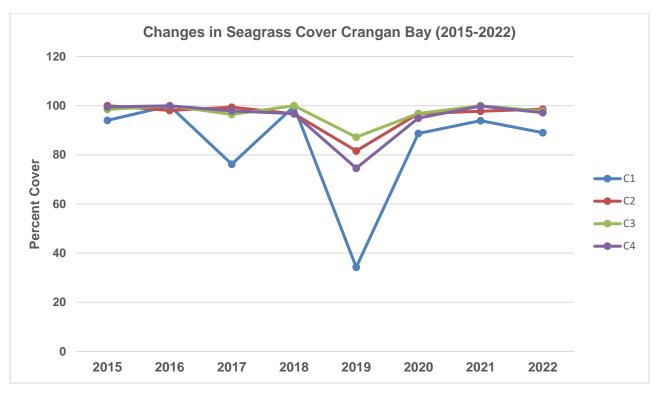


Figure 9.5 Changes in percent cover of seagrass in Crangan Bay (2015-2022)

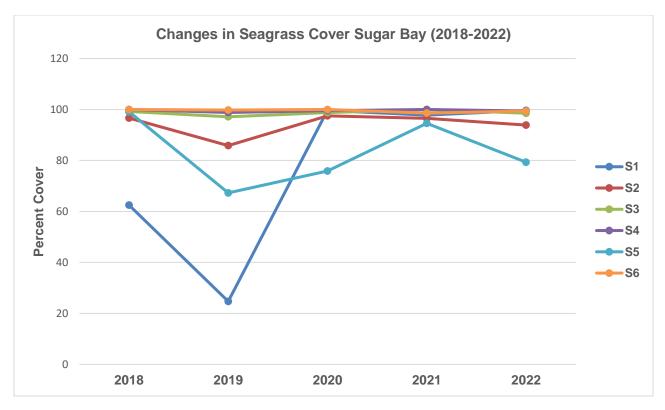


Figure 9.6 Changes in percent cover of seagrass in Sugar Bay (2018-2022)

Changes in the percentage area of the substratum covered by seagrasses in the study area in 2010 to 2022, compared with the 2008 values are shown in **Table 9.1**. The table shows that since 2008, seagrass coverage has been increasing throughout the study area, and percentage cover has been consistent since 2012. At transects where the percentage area of substratum covered was relatively low, such as Transects E6 (17.74%), T3 (46.20%) and T6 (53.82%), seagrass coverage has increased by about 82%, 52% and 44% respectively.

Table 9.1 Changes in percent cover of the substratum by seagrasses in Lake Macquarie (2008-2022)

Chain Valley Bay 2008 to 2021

Transect E1	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	84.15	81.01	77.75	98.62	99.44	92.44	99.88	97.96	97.87	99.12	99.04	99.34
% no seagrass	15.85	18.99	22.25	1.38	0.56	7.56	0.12	2.04	2.13	0.88	0.96	0.66
Transect E2	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	83.72	75.87	73.38	95.49	99.09	98.49	99.71	100.0	97.94	97.94	98.53	99.26
% no seagrass	16.28	24.13	26.62	4.49	0.91	1.51	0.29	0.00	2.06	2.06	1.47	0.37
Transect E3	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	98.29	98.97	92.76	96.97	99.16	100.0	83.53	98.90	94.56	98.97	100.0	99.93
% no seagrass	1.71	1.03	7.24	1.54	0.84	0.00	16.47	1.10	5.44	1.03	0.00	0.66
Transect E4	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	80.16	98.54	95.74	100.0	97.50	96.43	98.01	96.76	99.71	99.85	98.82	98.68
% no seagrass	19.84	1.46	4.26	0.00	2.50	3.57	1.99	3.24	0.29	0.15	1.18	0.88
Transect E5	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	95.88	94.93	95.19	100.0	98.82	99.82	100.0	97.22	99.41	98.97	100.0	100.0
% no seagrass	4.12	5.07	4.81	0.00	1.18	0.18	0.00	2.78	0.59	1.03	0.00	0.00
Transect E6	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	17.74	34.06	49.56	55.51	54.93	76.62	100.0	99.56	89.91	76.69	97.35	99.78
% no seagrass	82.16	65.94	50.44	44.49	45.07	23.38	0.00	0.44	10.09	23.31	2.65	0.00
Transect E7	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	97.93	51.40	45.47	68.31	43.38	92.65	100.0	98.16	98.16	97.65	93.75	93.75
% no seagrass	2.07	48.60	54.53	31.69	56.62	7.35	0.00	1.84	1.84	2.35	6.25	6.18
Transect E8	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	99.32	84.26	95.56	90.96	99.93	99.85	100.0	99.34	100.0	99.34	97.87	99.78
% no seagrass	0.68	15.74	4.44	9.04	0.07	0.15	0.00	0.66	0.00	0.66	2.13	0.00
Transect E9	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	95.94	99.39	95.51	99.49	99.71	99.56	100.0	99.78	100.0	100.0	99.71	100.0
% no seagrass	4.06	0.61	4.49	0.51	0.29	0.44	0.00	0.22	0.00	0.00	0.29	0.00
Transect E10	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	97.94	92.21	86.25	98.99	98.82	NS	100.0	100.0	100.0	98.21	97.94	100.0
% no seagrass	2.06	7.79	13.75	1.01	1.18		0.00	0.00	0.00	1.79	2.06	0.00
Transect E11	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass			86.93	99.85	99.49	NS	100.0	100.0	100.0	98.94	99.63	100.0
% no seagrass			13.07	0.15	0.51	_	0.00	0.00	0.00	1.06	0.37	0.00

Transect E12	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass			95.68	95.53	98.09	NS	100.0	100.0	100.0	97.0	99.26	100.0
% no seagrass			7.32	4.47	1.91		0.00	0.00	0.00	3.0	0.74	0.00
Transect E13	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass			93.97	99.26	100.0	NS	100.0	100.0	100.0	99.95	100	99.71
% no seagrass			6.03	0.74	0.00		0.00	0.00	0.00	0.05	0.00	0.29
Transect E14	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass			86.54	99.34	100.0	NS	100.0	90.44	100.0	98.24	99.41	99.78
% no seagrass			13.46	0.56	0.00		0.00	9.56	0.00	1.76	0.59	0.22
Transect E15	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass			90.29	99.93	99.66	NS	100.0	93.31	99.85	50.66	99.34	100.0
% no seagrass			9.71	0.07	0.34		0.00	6.69	0.15	49.34	0.66	0.00
Transect E16	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass			82.79	93.22	94.12	NS	100.0	99.94	99.71	95.0	98.31	98.75
% no seagrass			17.21	6.78	5.88		0.00	0.06	0.29	5.0	1.69	1.25
Transect T1	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	88.94	41.90	32.60	77.91	94.41	94.65	97.35	99.47	85.29	59.92	97.87	90.96
% no seagrass	11.06	58.10	67.40	22.09	5.59	5.35	2.65	0.53	14.71	40.08	2.13	7.06
Transect T2	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	77.91	70.29	7.95	75.74	60.83	74.41	90.59	93.31	90.00	76.87	97.50	98.31
% no seagrass	22.09	29.71	92.05	24.26	39.17	25.59	9.41	6.69	10.00	23.13	2.5	1.32
Transect T3	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	46.20	63.16	58.53	83.53	89.93	93.82	96.10	98.19	97.57	63.01	94.85	98.68
% no seagrass	53.80	36.84	41.47	16.47	10.07	6.18	3.90	1.81	2.43	36.99	5.14	1.32
Transect T4	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	83.51	81.89	70.37	90.37	97.28	97.94	99.85	95.76	95.07	70.44	82.06	99.93
% no seagrass	16.49	18.01	29.63	9.63	2.72	2.06	0.15	4.24	4.93	29.56	17.94	0.07
Transect T5	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	81.78	77.00	51.40	92.35	99.12	99.41	98.82	99.56	89.63	62.65	79.71	98.97
% no seagrass	18.22	23.00	48.60	7.65	0.88	0.59	1.18	0.44	10.37	37.35	20.29	1.03
Transect T6	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	53.82	59.63	44.77	65.59	95.22	95.74	98.82	94.41	97.13	46.18	79.12	98.16
% no seagrass	46.18	40.37	53.23	34.41	4.78	4.26	1.18	5.59	2.87	53.82	20.88	1.84
Transect T7	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	97.93	70.79	89.34	89.09	99.78	98.38	100.0	99.85	98.97	25.88	82.50	100.0
% no seagrass	2.07	29.51	10.66	10.91	0.22	1.62	0.00	0.15	1.03	74.12	17.50	0.00
Transect T8	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	95.94	60.29	76.99	87.64	96.76	99.26	99.26	98.24	100.0	46.32	87.21	98.82
% no seagrass	4.06	39.71	23.01	13.26	3.24	0.74	0.74	1.76	0.00	53.68	12.79	1.18
Transect L1	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass						99.12	99.71	97.87	97.87	94.63	95.74	99.85
% no seagrass						0.88	0.29	2.13	2.13	5.37	4.26	0.15

Chain Valley Bay 2022

Transect E1	2022						
% seagrass	98.81						
% no seagrass	1.19						
Transect E2	2022						
% seagrass	98.74						
% no seagrass	1.26						
Transect E3	2022						
% seagrass	100.0						
% no seagrass	0.00						
Transect E4	2022						
% seagrass	98.68						
% no seagrass	1.32						
Transect E5	2022						
% seagrass	99.54						
% no seagrass	0.46						
Transect E6	2022						
% seagrass	94.71						
% no seagrass	5.29						
Transect E7	2022						
% seagrass	93.90						
% no seagrass	6.10						
Transect E8	2022						
% seagrass	98.09						
% no seagrass	1.91						
Transect E9	2022						
% seagrass	99.71						
% no seagrass	0.29						
Transect E10	2022						
% seagrass	99.72						
% no seagrass	0.28						
Transect E11	2022						
% seagrass	100						
% no seagrass	0.00						
Transect E12	2022						
% seagrass	100						
% no seagrass	0.00						
Transect E13	2022						
% seagrass	100						
% no seagrass	0.00						
Transect E14	2022						
% seagrass	99.63						
% no seagrass	0.37	<u> </u>					

Transect E15	2022						
% seagrass	99.78						
% no seagrass	0.22						
Transect E16	2022						
% seagrass	98.75						
% no seagrass	1.25						
Transect T1	2022						
% seagrass	95.81						
% no seagrass	4.19						
Transect T2	2022						
% seagrass	97.35						
% no seagrass	2.65						
Transect T3	2022						
% seagrass	94.56						
% no seagrass	5.44						
Transect T4	2022						
% seagrass	89.85						
% no seagrass	10.15						
Transect T5	2022						
% seagrass	86.40						
% no seagrass	13.6						
Transect T6	2022						
% seagrass	81.47						
% no seagrass	18.53						
Transect T7	2022						
% seagrass	82.28						
% no seagrass	17.72						
Transect T8	2022						
% seagrass	87.50						
% no seagrass	12.50						
Transect L1	2022						
% seagrass	97.65						
% no seagrass	2.35						

Summerland Point 2018-2022

Transect C5	2018	2019	2020	2021	2022				
% seagrass	100.0	100.0	99.71	99.71	99.71				
% no seagrass	0.00	0.00	0.29	0.00	0.29				
Transect C6	2018	2019	2020	2021	2022				
% seagrass	99.56	97.76	95.88	98.60	98.09				
% no seagrass	0.44	2.24	4.11	1.25	1.91				
Transect F1	2018	2019	2020	2021	2022				
% seagrass	97.81	100.0	99.34	99.41	99.19				
% no seagrass	2.19	0.00	0.66	0.59	0.81				
Transect F2	2018	2019	2020	2021	2022				
% seagrass	99.63	94.93	98.82	96.03	90.29				
% no seagrass	0.37	5.07	1.18	2.13	9.71				
Transect F3	2018	2019	2020	2021	2022				
% seagrass	99.93	87.82	97.06	97.65	97.53				
% no seagrass	0.07	12.18	2.94	2.35	2.47				
Transect F4	2018	2019	2020	2021	2022				
% seagrass	98.16	48.90	96.40	97.94	96.40				
% no seagrass	1.84	51.1	3.60	2.06	3.60				
Transect F5	2018	2019	2020	2021	2022				
% seagrass	99.04	80.80	90.96	96.40	90.66				
% no seagrass	0.96	19.2	9.04	3.53	9.34				
Transect F6	2018	2019	2020	2021	2022				
% seagrass	100.0	81.99	96.25	95.96	96.10				
% no seagrass	0.00	18.01	3.75	3.97	3.90				
Transect F7	2018	2019	2020	2021	2022				
% seagrass	98.24	97.65	87.57	95.22	86.62				
% no seagrass	1.76	2.35	12.43	4.78	13.38				

Bardens Bay 2014 to 2022

Transect A1	2014	2015	2016	2017	2018	2019	2020	2021	2022		
% seagrass	97.97	98.09	88.97	99.85	96.18	85.15	88.88	97.87	89.41		
% no seagrass	2.03	1.91	11.03	0.15	3.82	14.85	11.10	1.91	10.59		
Transect A2	2014	2015	2016	2017	2018	2019	2020	2021	2022		
% seagrass	92.38	96.99	98.75	98.38	94.93	98.09	96.91	97.13	96.18		
% no seagrass	7.62	3.01	1.25	1.62	5.07	1.91	3.09	2.28	3.82		
Transect A3	2014	2015	2016	2017	2018	2019	2020	2021	2022		
% seagrass	100.0	86.40	94.85	96.69	98.01	99.26	99.12	91.03	99.19		
% no seagrass	0.00	13.60	5.15	3.31	1.99	0.74	0.88	8.97	0.81		
Transect A4	2014	2015	2016	2017	2018	2019	2020	2021	2022		
% seagrass	94.51	93.97	99.12	100.0	89.78	48.98	99.41	100.0	98.31		
% no seagrass	5.49	6.03	0.88	0.00	10.22	51.02	0.59	0.00	1.69		

Transect A5	2014	2015	2016	2017	2018	2019	2020	2021	2022		
% seagrass	96.37	95.59	99.71	100.0	97.35	84.50	96.76	97.13	97.96		
% no seagrass	3.63	4.41	0.29	0.00	2.65	15.50	3.24	2.87	2.04		
Transect A6	2014	2015	2016	2017	2018	2019	2020	2021	2022		
% seagrass	99.56	98.01	96.97	97.65	93.53	90.88	94.26	96.62	96.84		
% no seagrass	0.44	1.99	3.03	2.35	6.47	9.12	5.74	3.38	3.16		

Crangan Bay 2008 to 2022

Transect C1	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	48.60	80.53	68.71	85.38	99.31	94.04	99.94	76.18	99.68	34.26	88.68	93.90
% no seagrass	51.40	19.47	31.29	14.62	0.69	5.96	0.06	23.82	0.32	65.74	11.32	3.90
Transect C2	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	93.09	98.03	67.79	95.21	97.24	100.0	98.09	99.40	96.69	81.62	96.76	97.72
% no seagrass	6.91	1.97	32.21	4.79	2.76	0.00	1.91	0.60	3.31	18.38	3.24	1.25
Transect C3	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	95.59	88.75	94.41	97.16	99.93	98.46	99.90	96.47	100.0	87.21	96.84	100.0
% no seagrass	4.41	11.25	5.59	2.84	0.07	1.54	0.10	3.53	0.00	12.79	3.16	0.00
Transect C4	2008	2010	2011	2012	2013	2015	2016	2017	2018	2019	2020	2021
% seagrass	87.25	86.56	58.09	90.40	100.0	99.49	99.96	96.47	96.76	74.56	94.93	99.85
% no seagrass	12.75	13.44	41.91	9.60	0.00	0.51	0.04	3.53	3.24	25.44	5.07	0.15

Transect C1	2022						
% seagrass	89.04						
% no seagrass	10.96						
Transect C2	2022						
% seagrass	98.60						
% no seagrass	1.40						
Transect C3	2022						
% seagrass	97.81						
% no seagrass	2.19						
Transect C4	2022						
% seagrass	97.15						
% no seagrass	2.85						

Sugar Bay Brightwaters 2018 to 2022

Transect S1	2018	2019	2020	2021	2022				
% seagrass	62.50	24.71	99.63	97.79	99.63				
% no seagrass	37.50	75.29	0.37	0.74	0.37				
Transect S2	2018	2019	2020	2021	2022				
% seagrass	96.62	85.83	97.50	96.54	93.90				
% no seagrass	3.38	14.17	2.50	3.46	6.10				

Transect S3	2018	2019	2020	2021	2022				
% seagrass	99.19	97.13	98.75	100.0	98.53				
% no seagrass	0.81	2.87	1.25	0.00	1.47				
Transect S4	2018	2019	2020	2021	2022				
% seagrass	99.97	98.82	99.56	100.0	99.41				
% no seagrass	0.03	1.18	0.44	0.00	0.59				
Transect S5	2018	2019	2020	2021	2022				
% seagrass	99.12	67.08	75.88	94.56	79.34				
% no seagrass	0.88	32.92	24.11	5.37	20.66				
Transect S6	2018	2019	2020	2021	2022				
% seagrass	100.0	99.78	100.0	98.57	99.41				
% no seagrass	0.00	0.22	0.00	1.32	0.59				

Table 9.2 shows the average composition, percent cover and condition of seagrass beds in the four regions of Lake Macquarie under investigation for the years 2011 to 2022. It shows that the growth form of *Zostera capricorni* in the Summerland Point, Frying Pan Bay and Sugar Bay region and the Crangan Bay region is predominantly short leaved. The growth form of *Z. capricorni* in Chain Valley Bay and Bardens Bay, however, is long leaved.

Table 9.2 Average composition, % cover and condition of seagrass beds in the four regions of Lake Macquarie under investigation for the years 2011 to 2022.

Year	Total SG	% long	% short	% long 1	% long 2	% short 1	% short 2	algae	bare gr.
Summerla	nd Point, Fry	ing Pan Bay	and Sugar E	Bay					
2011	61.74	9.88	51.86	9.98	0.00	51.86	0.00	0.27	38.13
2012	82.18	38.03	44.15	38.03	0.00	44.15	0.00	0.00	17.85
2013	90.92	25.19	65.88	25.03	0.32	64.92	0.80	0.82	8.26
2014	96.74	19.73	80.27	19.93	0.00	80.27	0.00	0.00	3.26
2015	95.06	17.31	69.33	17.31	0.00	77.75	0.00	0.00	4.93
2016	98.15	20.82	77.64	28.32	0.00	77.66	0.00	0.00	1.30
2017	97.92	17.05	80.63	14.61	2.50	65.14	15.63	0.24	1.35
2018	96.22	28.00	66.03	25.44	5.36	67.00	0.91	1.31	2.28
2019	77.37	32.99	40.16	36.46	0.00	44.00	0.00	2.11	20.51
2020	93.29	35.89	57.40	33.99	1.67	56.91	0.49	0.03	6.64
2021	97.76	48.55	48.14	17.35	26.98	11.33	33.43	0.52	2.00
2022	93.53	28.19	65.33	27.36	0.83	65.08	0.26	0.03	6.36
Chain Vall	ey Bay		•		•				
2011	85.44	41.75	43.68	40.28	1.47	43.68	0.00	0.99	13.32
2012	95.26	89.97	5.28	89.97	0.00	5.28	0.00	2.89	1.92
2013	95.63	62.25	35.84	55.83	1.06	35.84	0.00	0.25	4.00
2014	96.57	34.15	65.85	34.14	0.64	65.85	0.00	0.69	2.74
2015	94.70	70.26	18.80	58.28	11.97	24.45	0.00	1.02	5.06
2016	98.65	74.52	27.13	71.30	0.00	27.13	0.00	1.20	0.15
2017	97.63	52.60	42.79	36.35	18.19	49.82	0.11	0.60	1.62
2018	98.46	72.25	25.48	66.32	5.88	23.48	1.79	0.83	0.71
2019	93.15	84.48	8.64	84.48	0.00	15.66	0.00	0.39	6.72
2020	98.82	94.53	4.29	91.70	2.84	4.29	0.00	0.21	0.92
2021	99.65	95.35	4.30	2.84	74.63	0.21	2.51	0.00	0.26
2022	99.00	95.27	4.11	92.18	1.67	4.11	0.00	0.31	0.58

Crangan B	ay								
2011	72.52	28.47	44.05	28.47	0.00	43.31	0.74	0.87	26.98
2012	92.38	0.00	92.38	0.00	0.00	92.38	0.00	0.01	7.99
2013	98.82	13.79	85.52	10.84	2.96	85.52	0.00	0.02	1.02
2014	97.94	23.23	76.77	23.23	0.00	76.77	0.00	0.06	2.02
2015	98.00	23.53	74.47	23.53	0.00	74.47	0.00	0.00	2.01
2016	99.47	15.90	83.30	6.99	9.18	55.37	27.93	0.13	0.49
2017	92.48	16.73	75.75	15.99	3.20	74.71	1.05	0.02	7.57
2018	98.28	46.25	52.03	5.48	89.13	49.09	2.94	0.01	1.74
2019	69.39	39.56	29.95	39.56	0.00	29.95	0.00	0.00	30.40
2020	94.30	25.40	68.90	25.40	0.70	59.12	7.06	0.57	4.01
2021	97.87	67.28	30.59	16.54	50.74	20.66	9.93	0.00	1.32
2022	95.65	19.50	74.35	15.46	5.85	61.07	13.28	0.09	2.50
Bardens B	ay								
2014	96.87	54.20	45.80	54.20	0.00	45.80	0.00	1.20	2.03
2015	94.84	68.18	26.67	68.18	0.00	26.67	0.00	0.00	2.92
2016	96.40	63.48	33.01	63.98	0.00	33.01	0.00	0.00	3.61
2017	98.78	76.02	22.75	51.51	24.51	20.59	3.78	0.03	1.23
2018	94.96	55.58	39.39	38.78	16.80	37.67	2.45	2.19	2.68
2019	84.48	73.08	6.40	73.03	11.40	11.40	0.00	0.00	15.52
2020	95.89	81.08	16.04	63.26	1.69	14.60	0.22	0.00	4.11
2021	96.63	96.63	0.00	12.41	78.48	0.00	0.00	3.79	3.24
2022	96.31	81.41	16.07	79.72	1.69	14.90	0.00	0.01	3.57

Table 9.2 also shows in greater detail the increase in percent cover of seagrasses, with bare ground decreasing from 38.13 percent in 2011 to 6.36 percent in 2022 in the Summerland Point, Frying Pan Bay and Sugar Bay region. In the Chain Valley Bay region, bare ground decreased from 13.32 percent in 2011 to 0.58 percent in 2022. In the Crangan Bay region, bare ground decreased from 26.98 percent in 2011 to 2.50 percent in 2022. Seagrass cover in Bardens Bay has mostly been around 95 percent since 2014.

Plate 9.1 shows sand deposited on seagrasses along Summerland Point after strong onshore winds in June 2011. This event demonstrated how climatic conditions can affect seagrass coverage. It also shows how the movement of sand from deeper waters due to strong winds can increase water depth in some areas whilst decreasing water depth closer to shore as sediment is deposited. Lake Macquarie experienced strong onshore winds prior to the June 2022 survey.



Plate 9.1 Zostera capricorni covered by sand along Summerland Point after strong southwesterly winds in 2011.

10. Extent of Coal Mining

Figure 10.1 shows the extent of mining up to 30 June 2022. Mining of the Fassifern seam is currently underway in the Brightwaters and Summerland Point regions. Mining ceased in the Chain Valley Bay region on 24 December 2017.



Figure 10.1 Extent of Fassifern Seam Workings from 1 July 2021 to 30 June 2022 (pink)

11. Seagrass Management Plan

The mine, in conjunction with the relevant stake holders, has developed a Seagrass Management Plan. While the colliery does not undertake secondary extraction which would cause subsidence, the purpose of the plan is to monitor any changes and identify if subsidence is the cause.

Elements of the plan require:

- That the July 2008 survey is to act as a baseline of seagrass distribution, density and condition. Since this time new seagrass transects have been added to the sampling schedule (now 50 transects in 2018-2022).
- Annual re-surveys of the permanent transect lines will be carried out.
- If, during the annual re-surveys, either:
 - Subsidence along the seagrass permanent transects greater than 150mm is detected, or
 - There are reductions in seagrass cover of 20% or more (compared to 2008 values),

then Mine Management will notify the relevant stakeholders of the event and convene a meeting to discuss the implications.

12. Discussion

In June 2022 the seagrasses in the study area were mostly not fouled with epiphytic algae or only lightly fouled. Factors affecting the levels of fouling included nutrient levels in the water and water temperature. Seagrass cover along the transects ranged from 79% to 100% of the substratum. Since 2011 seagrass cover has increased progressively. This annual increase in seagrass cover was treated with some suspicion until it was realized that almost all of the beaches in the study area were used by commercial fishermen as net landing grounds. Nets up to 3 km in length were drawn across the lake and hauled up on beaches to extract and sort the various fish species. This fishing effort caused minor damage to seagrass beds over the 150 years of commercial fishing in Lake Macquarie. Netting was stopped eventually and the minor damage to seagrass beds began to recover. This recovery process took place over the period of this study and is almost complete in most areas.

The results from the June 2022 seagrass monitoring programme show compliance to the Schedule 4 Environmental Conditions - underground mining of SSD5465 - Modification 4 in the Performance Measures table with respect to the Subsidence Impact Performance Measure for Natural Environment Biodiversity - Seagrass which display nil to minor environmental consequences due to underground mining.

The below summary of findings outline the historical basis for this compliance statement and the compliance is detailed in the table below.

Condition from SSD5465 - Mod 4	Compliance Status and Comments
Schedule 4 Environmental Conditions - underground mining	Compliant - See section 16 - Conclusions
Performance Measures - Natural Environment Biodiversity -	
Benthic Communities.	
Subsidence Impact Performance Measure - Minor environmental consequences, including minor changes composition and/or distribution.	
Measurements undertaken by generally accepted methods.	Compliant - See section 4 and 5
Measurements Methods fully described.	Compliant - See section 4 and 5

13. References

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Appendix 1 – Results of Analysis of Quadrat photographs comprising each Transect (Results for June 2022)

Chain Valley Bay

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1 1	100 100	0	0	0	0 0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	98	2	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	98	2	0	1	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	98	2	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

Long=1 Fouling Zostera Cystophyllum % algae Pinna % I	Long=1	Fouling	Zostera	Cystophyllum	% algae	Pinna	% Bare
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		%				
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
	_				•	
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1 1	90	0	0	0	10
2	1	95 100	0	0	0	5 0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	98	2	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	1	0
1	1	100	0	0	0	0
1	1	95	5	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	98	2	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	98	2	0	0	0
1	1	100	0	0	1	0
1	1	100	0	0	0	0
1 1	1 1	100 100	0	0	0	0 0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
Τ.	1	100	O	0	J	U

1	100	0	0	0	0
1	100	0	0	0	0
1	95	5	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	95	5	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
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1	100	0	0	0	0
1	100	0	0	0	0
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1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 100 1 95 1 100 1	1 100 0 1 95 5 1 100 0	1 100 0 0 1 95 5 0 1 100 0 0 <td>1 100 0 0 0 1 95 5 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1<</td>	1 100 0 0 0 1 95 5 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1<

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
					_	_
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
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1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	5	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1 1	1 1	100 100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	5	0	0	0
1	1	100	0	0	0	0
1	1		0	0	0	0
1	1	100 100	0	0	0	0
1	1		0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100 100	0	0	0	0
1	1	90	0	10	1	0
1	1	100	0	0	0	0
1	1		0	0	0	0
1	1	100 100	0	0	0	0
1	1		0	0	0	0
1	1	100	0	0	0	0
1	1	100		0	0	0
1	1	100	0		0	0
	1	100	0	0	1	
1	1	90	0			10
1		100	0	0	0	0
1	1 1	100	0	0	0	0
1		100	0	0	0	0
1	1	100	0	0	0	0
1 1	1	100	0	0	0	0
	1	80 100	0	20	0	0
1	1	100	0	0	0	0
1	1 1	90 95	0	10 5	0	0
1 1	1	95 90	0	10	0	0 0
1	1		0	0	0	0
1	1	100 100	0	0	0	0
1	1	100	0	0	0	0
	1				0	
1 1	1	100	0	0 10	0	0
		90	0			0
1	1 1	100	0	0	0	0
1		100	0	0		0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	5	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	98	2	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	98	2	0	1	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	2	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	1	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	98	2	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	1	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1 1 100 0 0 0 0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	60	0	30	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	60	0	30	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	5	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	60	0	40	0	0
1	1	70	0	30	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	60	0	30	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	80	0	20	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	50	0	0	0	50
1	1	100	0	0	0	0
1	1	50	0	0	0	50
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
2	1	90	0	10	0	0
2	1	100	0	0	0	0
2	1	70	0	30	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	98	2	0	0	0
1	1	100	0	0	1	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	5	0	0	0
1	1	100	0	0	0	0
1	1	98	2	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
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1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
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1	1	100	0	0	0	0
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1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
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1	1	100	1	0	0	0
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1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

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1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
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1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1		100	0	0		0
	1	100	0	0	0	0
1 1	1 1	100	0	0	0	0
		100	0			0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Transect E14

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

4	4	400	•	•	•	•
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
	*		-	-	-	-

1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	90	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0

1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	90	0	0	0	10
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0

Transect L1

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	80	0	0	0	20
1	1	70	0	0	0	30
1	1	80	0	0	0	20
1	1	80	0	0	0	20
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	80	0	0	0	20
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	95	5	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	5	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

				_	_	_
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	5	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Bardens Bay

Transect A1

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	1	95	0	0	1	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	90	5	0	0	5
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	85	0	0	1	15
2	1	90	0	0	0	10
2	1	85	0	0	0	15
2	1	90	0	0	0	10
2	1	80	10	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	80	5	0	0	15
2	1	90	0	0	0	10
2	1	90	0	0	0	10

2	1	80	0	0	0	20
2	1	60	0	0	0	40
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	5	0	0	0
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	85	0	0	0	15
2	1	90	0	0	1	10
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	85	0	0	1	15
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10

Transect A2

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0 0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	95	5	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	5	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	90	0	0	0	10
1	1	80	0	0	0	20
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1 1	1 1	100 100	0	0	0	0 0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	75	0	0	0	25
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	75	0	0	0	25
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
-	_	100	U	J	3	J

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	85	0	0	0	15
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	80	0	0	0	20
1	50	0	0	0	50
1	100	0	0	0	0
1	100	0	0	0	0
1	75	0	0	0	25
2	100	0	0	0	0
2	100	0	0	0	0
	1 1 1 1 1 1 1 1 1 1 2	1 100 1 100 1 100 1 100 1 100 1 80 1 50 1 100 1 100 1 75 2 100	1 100 0 1 100 0 1 100 0 1 100 0 1 80 0 1 50 0 1 100 0 1 100 0 1 75 0 2 100 0	1 100 0 0 1 100 0 0 1 100 0 0 1 100 0 0 1 80 0 0 1 50 0 0 1 100 0 0 1 100 0 0 1 75 0 0 2 100 0 0	1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 80 0 0 0 1 50 0 0 0 1 100 0 0 0 1 100 0 0 0 1 75 0 0 0 2 100 0 0 0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
		0.5				_
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	98	0	0	0	2
1	1	100	0	0	1	0
1	1	98	0	0	0	2
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	1	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	75	0	0	0	25
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	60	0	0	0	40
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	85	0	0	0	15
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
	1	100	0	0	0	0
1 1	1 1	100 100	0	0	0	0
1	1	100	0	0	0	0 0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	2	0	8
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	85	0	0	0	15
1	1	85	0	0	0	15
1	1	50	0	0	0	50
1	1	80	0	0	0	20

1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	2	0	0
1	2	100	0	0	0	0
1	2	90	0	0	0	10
1	2	100	0	0	0	0

Crangan Bay

Transect C1

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	4	00	0	0	0	10
2 2	1	90	0	0	0	10
2	1 1	90 90	0	0	0	10 10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	80	20	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	85	0	0	0	15
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	70	25	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	1	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	80	0	0	0	20
2	1	60	30	10	0	0
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	40	50	0	0	0
2	1	5	40	0	0	0
2	1	50	0	0	0	50
2	1	90	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	70	30	0	0	0
2	1	90	0	10	0	0
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	80	20	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	0
2	1	90	0	0	0	0
2	1	70	0	0	0	20
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	80	0	0	0	10
2	1	80	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	1	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	5	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	1	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
2	1	90	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
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1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	100	0	0	0	0
1	95	0	0	0	5
1	90	0	0	0	10
1	90	0	0	0	10
1	95	0	0	0	5
1	90	0	0	0	10
1	100	0	0	0	0
1	100	0	0	0	0
1	95	0	0	0	5
1	95	0	0	0	5
1	100	0	0	0	0
1	100	0	0	0	0
1	95	0	0	0	5
2	100	0	0	0	0
2	90	0	0	0	10
2	100	0	0	0	0
2	100	0	0	0	0
2	100	0	0	0	0
2	100	0	0	0	0
2	100	0	0	0	0
	1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2	1 100 1 100 1 100 1 100 1 100 1 100 1 95 1 90 1 95 1 90 1 100 1 100 1 100 1 95 1 95 1 100 2 100 2 100 2 100 2 100	1 100 0 1 100 0 1 100 0 1 100 0 1 100 0 1 95 0 1 90 0 1 90 0 1 95 0 1 100 0 1 100 0 1 100 0 1 100 0 1 100 0 2 100 0 2 100 0 2 100 0 2 100 0 2 100 0 2 100 0 2 100 0 2 100 0 2 100 0 2 100 0 2 100 0 2 100 0 2 100 0	1 100 0 0 1 100 0 0 1 100 0 0 1 100 0 0 1 100 0 0 1 90 0 0 1 90 0 0 1 95 0 0 1 100 0 0 1 100 0 0 1 100 0 0 1 100 0 0 1 100 0 0 1 100 0 0 2 100 0 0 2 100 0 0 2 100 0 0 2 100 0 0 2 100 0 0 2 100 0 0 2 100 0 0 2 100 0 0 2 100 0 0	1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 90 0 0 0 1 90 0 0 0 1 95 0 0 0 1 90 0 0 0 1 90 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 1 100 0 0 0 2 100 0 0 0 2 100 0 0 0 2 100 0 0 0 2 100 0 0 0 2 100 0 0 0 2

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	1	0
1	1	100	0	0	0	0
1	1	80	20	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	95	5	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	1	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	5	0	1	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	1	0
2	1	98	0	0	0	2
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	98	0	0	0	2
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

2	1	80	20	0	0	0
2	1	100	0	0	0	0
2	1	80	20	0	0	0
2	1	70	10	0	0	20
2	1	100	0	0	0	0
2	2	100	0	0	0	0
2	2	100	0	0	0	0
2	2	100	0	0	0	0
2	2	100	0	0	0	0
2	2	100	0	0	0	0
2	2	100	0	0	0	0
2	2	95	0	0	0	5
2	2	100	0	0	0	0
2	2	100	0	0	0	0
2	2	95	0	0	0	5
2	2	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	95	0	0	0	5
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	10	0	0	0
1	1	90	0	0	0	10
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	2	90	0	0	0	10

	_			_	_	_
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	1	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	1	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	2	100	0	0	0	0
2	2	100	0	0	0	0
2	2	80	20	0	0	0
2	2	100	0	0	0	0
2	2	98	0	2	0	0
2	2	100	0	0	2	0
2	2	100	0	0	0	0
2	2	100	0	0	1	0
2	2	100	0	0	0	0
2	2	90	10	0	0	0
2	2	95	0	0	0	5
2	2	95	0	0	0	5

2	2	95	0	0	1	5
2	2	95	0	0	0	5
2	2	100	0	0	0	0
2	2	98	0	2	0	0
2	2	90	0	0	0	10
2	2	95	0	0	0	5
2	2	100	0	0	0	0

Summerland Point, Frying Pan Bay, Sugar Bay

Transect T1

1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0 0 0 0 1 1 100 0<	е
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1 1 100 0 0 0 0 0 0 1 1 100 0 0 0 0 5 5 1 1 100 0 </td <td>0</td>	0
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1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0	0
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1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0	0
1 1 100 0 0 0 1 1 100 0 0 0 1 1 100 0 0 0	0
1 1 100 0 0 0 1 1 100 0 0 0	0
1 1 100 0 0 0	0
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$1 \qquad 1 \qquad 100 \qquad 0 \qquad 0 \qquad 0$	0
	0
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	0
	0
1 1 100 0 0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	80	0	0	0	20
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
1	2	100	0	0	0	0
2	1	100	0	0	0	0
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	60	0	0	0	40
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	1	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	80	0	0	3	20
2	1	100	0	0	0	0
2	1	100	0	0	0	0
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Transect T2

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
4	4	00	0	0	0	10
1 1	1 1	90 90	0	0	0	10
1	1	100	0	0	0	10 0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2 2	1 1	90 100	0	0	0	10 0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	95	0	0	0	5
1	1	95	0	0	0	5

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	70	0	0	0	30
2	1	70	0	0	0	30
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0

2	1	100	0	0	0	0
2	1	60	0	0	0	40
2	1	40	0	0	0	60
2	1	90	0	0	0	10
2	1	70	0	0	0	30
2	1	60	0	0	0	40
2	1	60	0	0	0	40
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	2	100	0	0	0	0
2	2	100	0	0	0	0
2	2	95	0	0	0	5

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	1	70	0	0	0	30
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

		400		•	•	
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	60	0	0	0	30
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	70	0	0	0	30
2	1	70	0	0	0	30
2	1	70	0	0	0	30
2	1	70	0	0	0	30
2	1	60	0	0	0	40
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	60	0	0	0	20
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	60	0	0	0	40
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	90	0	0	0	10

2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	80	0	0	0	20
2	1	60	0	0	0	40
2	1	70	0	0	0	30
2	1	100	0	0	0	0
2	1	40	0	0	0	60
2	1	50	0	0	0	50
2	1	60	0	0	0	40
2	1	70	0	0	0	30
2	1	70	0	0	0	30
2	1	70	0	0	0	30
2	1	100	0	0	0	0
2	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	60	0	0	0	40
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	60	0	0	0	40
2	1	70	0	0	0	30
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	90	0	0	0	10

2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1		0	0	0	
		80	0			20 40
2	1	60 70		0	0	
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	70 70	0	0	0	30
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	60	0	0	0	40
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	70	0	0	0	30
2	1	60	0	0	0	40
2	1	50	0	0	0	50
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20

2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1 1	1 1	100 100	0	0	0	0 0
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	70	0	0	0	30
1	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	80	1	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	70	0	0	0	30
2	1	90	0	0	0	10
2	1	40	0	0	0	60
2	1	60	0	0	0	40
2	1	50	0	0	0	50
2	1	70	0	0	0	30
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20

2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	70	0	0	0	30
2	1	60	0	0	0	40
2	1	90	0	0	0	10
2	1	70	0	0	0	30
2	1	60	0	0	0	40
2	1	60	0	0	0	40
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	60	0	0	0	40
2	1	50	0	0	0	50
2	1	60	0	0	0	40
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20

Transect T7

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	1	0
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	100	0	0	0	0 0
2 2	1 1	100 100	0	0	0 0	0
2	1	70	0	0	0	30
2	1	90	0	0	0	10
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	60	0	0	0	40
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

2	1	60	0	0	0	40
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	90	0	0	1	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	60	0	0	0	40
2	1	60	0	0	0	40
2	1	60	0	0	0	40
2	1	10	0	0	0	90
2	1	20	0	0	0	80
2	1	40	0	0	0	60
2	1	50	0	0	0	50
2	1	40	0	0	0	60
2	1	50	0	0	0	50
2	1	60	0	0	0	40
2	1	10	0	0	0	90
2	1	20	0	0	0	80
2	1	20	0	0	0	80

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	1	70	0	0	0	30
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20

2	4	00	0	0	0	20
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	80	0	0	1	20
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	70	0	0	0	30
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	80	0	0	0	20
2	1	80 100	0	0	0	20
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90 100	0	0 0	0	10 0
	1		0 0		0	
2	1 1	100 90	0	0 0	0 0	0
						10
2	1	90	0	0 0	0 0	10
2	1 1	100 95	0 0	0	0	0 5
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	
2	1	100	0	0	0	10 0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	20
_	1	50	J	J	J	20

2	1	60	0	0	0	40
2	1	70	0	0	0	30
2	1	60	0	0	0	40
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	2	80	0	0	0	20
2	2	80	0	0	0	20

Transect E8

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

	_				•	_
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	90	0	0	0	10
1	1	90	0	0	0	10
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0

2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

Transect E9

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	5	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	5	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
		400			•	
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2 2	1	100	0	0	0	0
2	1 1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100 100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0 0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	10	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	1	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	10	0	0	0
2	1	100	0	0	0	0

Transect C6

Long=1 Fouling Zostera Cystophyllum % algae Pinna % Bare

		%				
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	5	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	5	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1 1	1 1	100 100	0	0	0	0
1	1	100	0	0	0	0 0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	1	0
2	1	100	0	0	0	0

2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5

	4	400		•	•	•
2	1	100	0	0	0	0
2	1	95	5	0	0	0
2	1	100	0	0	0	0
2	1	95	5	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0 0	0	0	0
2 2	1 1	100 100	0	0 0	0 0	0 0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	95	0	0	0	0
2	1	100	0	0	0	0

2	1	100	0	0	1	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	1	95	0	0	0	5
2	1	80	10	0	0	10
2	1	90	0	0	0	10
2	1	80	20	0	0	0
2	1	80	10	0	0	10
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	10	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

2	1	95	0	0	0	5
2	1	95 95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	80	0	0	0	20
2	1	70	0	0	0	30
2	1	70 70	0	0	0	30
2	1	50	0	0	0	50
2	1	50	0	0	0	50
2	1	60	0	0	0	40
2	1	60	0	0	0	40
2	1	65	0	0	0	35
2	1	75	0	0	0	25
2	1	70	0	0	0	30
2	1	75 75	0	0	0	25
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	80	0	0	0	20
2	1	80	0	0	0	15
2	1	85	0	0	0	15
2	1	85	0	0	0	15
2	1	75	0	0	0	25
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	1	95	0	0	0	5
2	1	98	0	0	0	2
2	1	95	5	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	98	0	0	0	2
2	1	100	0	0	0	0
2	1	98	0	0	0	2
2	1	98	0	0	0	2
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0

2		400	•	•	•	•
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
			-	-	-	-

2 1 90 0 0 10

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	1	5
2	1	80	0	0	0	20
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1 1	100 95	0	0	0	0 5
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	1	10

2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	70	20	0	0	10
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	80	0	0	0	20
2	1	85	0	0	0	15
2	1	85	0	0	0	15

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	1	80	0	0	0	20

2	4	00	•	0	0	4.0
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95 05	0	0	0	5
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	85	10	0	0	5
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	95 00	0	0	0	5
2	1	90	10	0	0	0
2	1	95 00	0	0	0	5
2	1	90	0	0	0	10
2	1 1	90 85	0	0 0	0 0	10
	1		0 0			15
2	1	100 90	0	0 0	0 0	0
						10
2	1	80 100	0	0 0	0 0	20
2	1 1	70	0 0	0	0	0
2	1	65	0	0	0	30 35
2	1	90	0	0	0	33 10
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	75	0	0	0	25
2	1		0	0	0	
2	1	85 75	0	0	0	15 25
2	1	85	0	0	0	15
2	1	85	0	0	0	15
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	85	0	0	0	15
_	1	0.5	U	O	J	13

2	1	95	0	0	0	5
2	1	75	0	0	0	25
2	1	85	0	0	0	15
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	85	0	0	0	15
2	1	85	0	0	1	15
2	1	80	15	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	85	0	0	0	15
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0

2	4	0.5	•	0	0	-
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95 100	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90 or	0	0	0	10
2	1	85 85	0	0	0	15 15
2	1	85 65	0	0	0	15 25
2	1	65 75	0	0	0	35 25
2	1 1	75 75	0 0	0 0	0 0	25 25
	1	75 or	0			
2	1	85 95	0	0 0	0 0	15 5
			0			
2	1 1	100 100	0	0 0	0 0	0
2	1	95	0	0	0	0 5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
_	1	100	J	U	U	U

2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5
2	1	95	0	0	0	5

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
2	1	75	0	0	0	25
2	1	70	0	0	0	30
2	1	85	10	0	0	5
2	1	75	0	0	0	25
2	1	85	0	0	0	15
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	85	0	0	0	15
2	1	75	0	0	0	25
2	1	85	0	0	0	15
2	1	85	0	0	0	15
2	1	85	0	0	0	15
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	75	0	0	0	25
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	85	0	0	0	15

_			_	_	_	
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	85	0	0	0	15
2	1	85	0	0	0	15
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	85	0	0	0	15
2	1	75	0	0	0	25
2	1	80	0	0	0	20
2	1	65	0	0	0	35
2	1	85	0	0	0	15
2	1	80	0	0	0	20
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	65	0	0	0	35
2	1	50	0	0	0	50
2	1	85	0	0	0	15
2	1	85	0	0	0	15
2	1	85	0	0	0	15
2	1	90	0	0	0	10
2	1	80	0	0	0	20
2	1	85	0	0	0	15
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	85	0	0	0	15
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	95	0	0	0	5
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	100	0	0	0	0
2	1	90	0	0	0	10
2	1	95	0	0	0	5
2	1	95	0	0	0	5
	_		•	•	•	_

2	1	95	0	0	0	5
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	90	0	0	0	10
2	1	95	0	0	0	15
2	1	100	0	0	0	0
2	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	10	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	10	0	0
1	1	95	0	0	0	5
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0

Long=1	Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2	1,2,3	cover	% cover	filamentous	Number	Ground
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	75	0	0	0	25
1	1	80	0	0	0	20
1	1	80	0	0	0	20
1	1	90	0	0	0	10
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	50	0	0	0	50
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	95	0	0	0	5
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0

1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	90	0	0	0	10
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	80	0	0	0	20
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	1	100	0	0	0	0
1	2	100	0	0	0	0
1	2	90	0	0	0	10
1	2	50	0	0	0	50
1	2	60	0	0	0	40
1	2	85	0	0	0	15
1	2	100	0	0	0	0

Long=1		Fouling	Zostera %	Cystophyllum	% algae	Pinna	% Bare
Short=2		1,2,3	cover	% cover	filamentous	Number	Ground
	1	1	100	0	0	0	0
	1	1	100	0	0	0	0
	1	1	100	0	0	0	0
	1	1	100	0	0	0	0
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Appendix 4: Biodiversity Monitoring Report

Review Date	Next Review Date	Revision No	Document Owner	Page	
		1	Environmental Compliance Coordinator	Page 104 of 114	
DOCUMENT UNCONTROLLED WHEN PRINTED					



CVC Biodiversity Monitoring 2022 Chain Valley Colliery

Prepared for Delta Coal

February 2023

CVC Biodiversity Monitoring 2022

Chain Valley Colliery

Delta Coal

E221082 RP1

February 2023

Version	Date	Prepared by	Approved by	Comments
1	03 February 2023	Bianca Seal	Eugene Dodd	Final

Approved by

Eugene Dodd

Senior Ecologist 03 February 2023

Level 3 175 Scott Street Newcastle NSW 2300

Madd

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1 Introduction

1.1 Rehabilitation monitoring plan requirements

Chain Valley Colliery (CVC) and Mannering Colliery (MC) are underground coal mines located at the southern extent of Lake Macquarie, approximately 60 km south of Newcastle. Both sites are operated by Great Southern Energy Pty T/a Delta Coal (Delta Coal) and produce thermal coal for the domestic and export markets.

CVC and MC operate in accordance with Development Consent SSD-5465 and Project Approval MP06_0311 respectively. SSD-5465 required the preparation of Chain Valley Colliery Biodiversity Management Plan (BMP, EMGA 2012). The original BMP prepared in 2013 has since had multiple revisions. The monitoring surveys conducted within this monitoring period and referenced throughout the report are in accordance with the revised 2019 BMP (EMM 2019).

The BMP (EMM 2019) includes an annual terrestrial biodiversity monitoring program comprising of:

- condition and composition of an area of Swamp Oak Forest;
- condition of vegetation adjacent to the ventilation shafts and fans;
- mapping the location and distribution of weeds; and
- abundance and distribution of feral animal use.

This report aims to detail the annual monitoring results which will be reviewed and assessed against trigger values and condition criteria identified in the BMP (EMM 2019).

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2 Methods

2.1 Condition and composition of Swamp Oak Forest

The condition and composition of an area of Swamp Oak Forest adjacent to the sediment ponds in the pit top area (Figure 2.1) and downstream of the D10 discharge was monitored in line with the method set out in in the BMP (EMGA 2016), including:

- completion of two biobanking plots as per Section 11.2 of the BMP (EMM 2019) and the proforma in Appendix 1 of the 2014 BMP (EMGA 2014); and
- a comparison of the collected plot data against the previous years' data, specifically to monitor dieback of Broad-leaved Paperbark (*Melaleuca quinquenervia*) observed in Plot 1 during the 2017 monitoring (EMM 2017), as well as to determine the total weighted scores for both plots to assess any other change in condition and against the trigger value identified within the BMP (EMM 2019).

2.2 Condition of vegetation adjacent to the ventilation shafts and fans

Condition monitoring of vegetation surrounding the ventilation shaft area includes (Figure 2.2):

- observation of two Rough-barked Apple (Angophora floribunda) trees directly adjacent to the ventilation shaft, as shown in Figure 9 of the BMP (EMGA 2016), or assessment of condition and health due to their proximity to the ventilation shaft;
- the completion of four photo points, as per Figure 9 of the BMP (EMGA 2016) and assessment of any change in vegetation condition from 2017; and
- the recording of dominant species (canopy, mid-storey, understorey and ground layers) around the periphery of each side of the ventilation shaft area.

2.3 Location and distribution of weeds

Weed monitoring targets existing locations and significant new weed occurrences in the eastern management zone (within the Swamp Oak Forest) as well as at the ventilation shaft area.

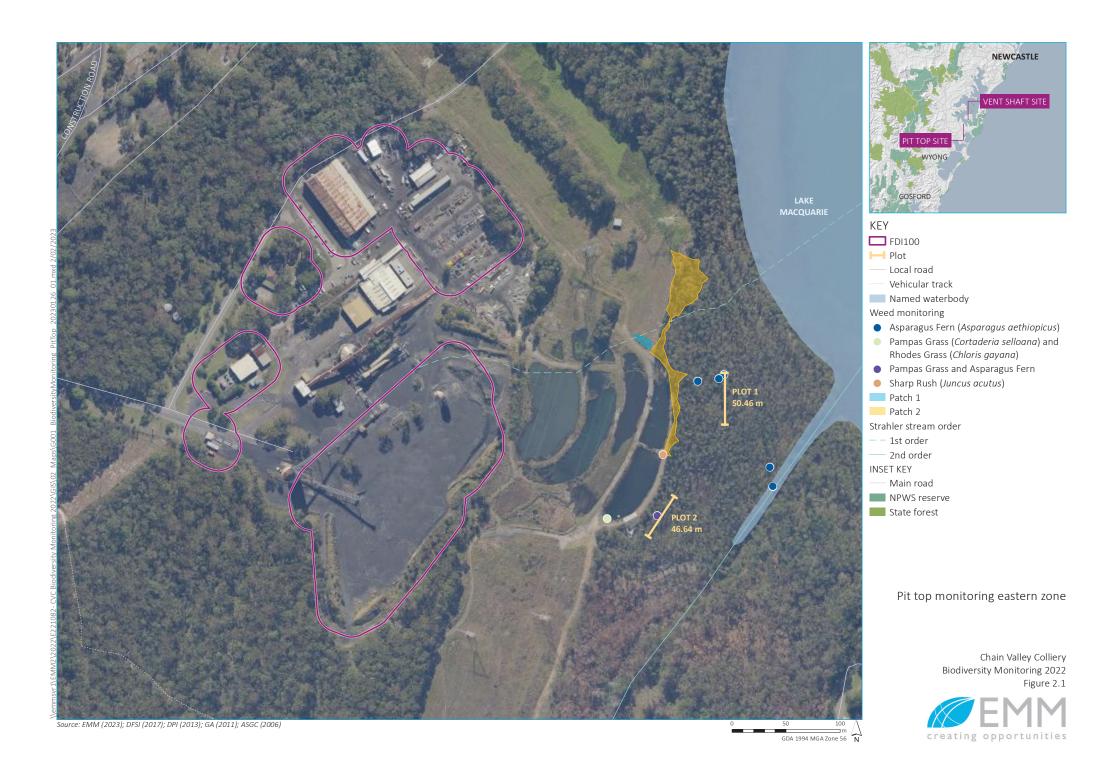
2.4 Abundance and distribution of feral animal use

The monitoring of feral animals is undertaken in conjunction with the weed monitoring and as per the proforma in Appendix 1 of the BMP (EMGA 2014) and includes recording of activity of feral species by searching for tracks, diggings, burrows and sighting of individuals.

2.5 Limitations

The surveys completed within this report were conducted on 6 January 2023. However, it should be noted these surveys were completed for the 2022 monitoring period. For the 2021 monitoring period, the survey was conducted in early January 2022 and therefore seasonal timing is similar to that of previous monitoring events.

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☐ FDI100

■ Photo point

--- Vehicular track

Named waterbody

Weed monitoring

- Fishbone Fern (Nephrolepsis cordifolia)
- Lantana (Lantana camara)
- Lantana and Senna pendula
- Senna pendula
- Senna pendula,
 Lantana (Lantana camara) and
 Bitou Bush (Chrysanthemoides monilifera subsp. rotundata)
- Spanish Reed (Arundo donax), Lantana (Lantana camara) and Senna pendula
- Whiskey Grass (Andropogon virginicus) and Senna pendula

Strahler stream order

– – 1st order

2nd order

Ventilation shaft monitoring

Chain Valley Colliery Biodiversity monitoring 2022 Figure 2.2



3 Results

3.1 Condition and composition of Swamp Oak Forest

The detailed monitoring results are provided in Appendix A, with the location of monitoring plots provided in Appendix B, and detailed descriptions of the findings for each plot provided below. The weighted score for the combination of the two plots is 67.8%, which is a slight decrease to the score of 2021 (68.1%). No remedial actions are required as the score is above the minimum trigger of 60% (EMM 2019).

3.1.1 Plot 1

The condition and composition of the vegetation within Plot 1 was comparable with the monitoring results from the previous year (EMM 2022). The Swamp Oak has had a decrease in overstorey coverage from 21% to 18%. The native species richness remains unchanged at 9 species. One new species was observed (Creeping Brookweed (Samolus repens)), whilst a previously recorded species was absent (Samphire (Sarcocornia quinqueflora)). No new regeneration (less than 1 year old) was observed during the survey. The regenerating species observed within the 2021 monitoring period appeared to have increased in size. Two weed species, Asparagus Fern (Asparagus aethiopicus) and Pampas Grass (Cortaderia selloana) were identified within the plot. Asparagus Fern has previously been recorded (EMM 2022) and does not appear to be increasing in cover or abundance. The one individual Pampas Grass has not been recorded in the plot previously and appears to occur adjacent to the plot and associated access road to the west. The cover percentage of exotics within the plot remains consistent from the previous year. The community appears to have reach an equilibrium with the Swamp Oak Forest persisting in the same condition.

3.1.2 Plot 2

The condition and composition of the vegetation within Plot 2 was broadly comparable with the 2021 and 2020 monitoring (EMM 2022; 2021). The Swamp Oak has had a slight increase in coverage from 23% to 24.5%. No new species regeneration (less than 1 year old) was observed during the survey. The regenerating species observed within the 2021 monitoring period appeared to have increased in size and subsequently overstorey cover. There is a decrease in the native plant species richness of 7, where three previously recorded native species are absent (Samphire, Tall Saw-sedge (*Gahnia clarkei*) and Rusty Sedge (*Fimbristylis ferruginea*)). Despite the decrease in native species richness, ground cover remains unchanged at 98%. The presence of Asparagus Fern within Plot 2 reflects previous observations in 2021 (EMM 2022). Weeds were frequently recorded outside of the plot. These will require ongoing management, to prevent them increasing in prevalence at the expense of native species.

3.2 Condition of vegetation adjacent to the ventilation shafts and fans

A photolog of the photo monitoring points and tree monitoring points are provided in Appendix B, with a summary of observations provided in Table 3.1.

Vegetation around the ventilation shaft compound was cleared for an asset protection zone (APZ) prior to the 2017 monitoring. This did not affect any of the tree monitoring points, however, it has affected the photo point monitoring, with obvious clearance of shrubs and regenerating small trees close compound.

When clearance for the APZ is taken into account, vegetation condition was broadly similar to previous years. Tree point 2 appeared to have dieback, with a decrease in canopy cover compared to previous monitoring years. No evidence was observed as to the cause of the dieback. The dieback was not concentrated on any one side of the crown, rather being consistent throughout. Surrounding vegetation did not appear to be affected by dieback. Climatic conditions have been favourable for plant growth (BOM 2023). Dieback observed during 2019 (EMM 2020) was following two years of less than average rainfall.

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The mid-storey appears to be primarily unchanged, with the exception of some weed encroachment (Lantana (Lantana camara) and Senna pendula) on the edges. Ground cover appeared to be regenerating well, with increased density of native species (Gahnia clarkei) during this monitoring period survey compared to the previous year (EMM 2022), despite increased weed encroachment primarily by exotic grasses.

Table 3.1 Monitoring point observations

Monitoring point	2022 monitoring observation
1	Vegetation appears healthy with persistent growth of canopy and midstorey species. No significant change observed
2	Some dieback is occurring to the canopy (see Tree 2 below). Encroachment of Lantana has increased from 2021 (EMM 2022).
3	No observable change has occurred to canopy and midstorey vegetation. Patches of dense Rhodes Grass occur on the edges of the adjacent treed area.
4	Vegetation appears healthy with no observable change in canopy or midstorey growth. Ground cover density appears to have increased from 2021 (EMM 2022), particularly Gahnia clarkei adjacent to the APZ.
Tree 1	Tree appears healthy with established growth observed, dense foliage within the crown and no dieback observed.
Tree 2	Tree appears to have some dieback. Crown coverage appears to have decreased since the 2021 monitoring survey (EMM 2022). The tree appears to have a percentage foliage cover similar to that of 2019 (EMM 2020).

3.3 Location and distribution of weeds

Weed prevalence has been documented in Appendix C, with a list of recommended control measures provided for each area. Locations of the weeds are provided in Appendix C.

3.4 Abundance and distribution of feral animal use

In the 2020 monitoring, four feral animal species were recorded using the presence of scats as indicators. Seven scats from the European Fox (*Vulpes vulpes*) and one scat from the Domestic Dog (*Canis lupus*) were recorded (Appendix D). The 2022 monitoring period recorded one scat from the European Fox (Appendix D), which is consistent with the 2021 monitoring period results (EMM 2022).

4 **Summary**

The 2022 biodiversity monitoring period established that the vegetation and habitat values within the pit top area was broadly similar to the 2021 monitoring. No remedial actions are required as the condition score remained above the trigger threshold as per the BMP (EMM 2019).

Observations and photo monitoring at the vent shaft area demonstrated sustained growth of native vegetation, whilst some weed species appear to be increasing in cover and abundance. The cause of potential tree dieback at tree point 2 at the vent shaft area is unknown, as weather conditions remain favourable for growth. There is no direct evidence that the vent shaft is causing the dieback due to the consistent dieback throughout the crown, and may be a systemic issue, perhaps disease. It is recommended that the tree is reviewed at the next monitoring event (2023).

Whilst evidence of weed control was observed in some areas, ongoing control is recommended to suppress those weeds still present and to prevent reestablishment in treated areas.

5 References

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EMM 2021, *Biodiversity monitoring 2020 Chain Valley Colliery*, prepared for Delta Coal by EMM Consulting Pty Ltd.

EMM 2022, *Biodiversity Monitoring 2021 Chain Valley Colliery*, prepared for Delta Coal by EMM Consulting Pty Ltd.

Appendix A

Swamp Oak monitoring data



Plot 1

Swamp Oak Floodplain Forest

Photo no: Plot 1

Date: 6/01/2023

Data collectors: Bianca Seal

Plot/transect: 1

Coordinates start transect	
Easting:	365039.06
Northing:	6329514.86

Coordinates finish transect	
Easting:	365013.57
Northing:	6329475.8

Native overstorey cover %	
(every 5m)	
1	10
2	15
3	15
4	30
5	20
6	10
7	10
8	20
9	30
10	20
AVG	18

Species	Common Name	Native
Asparagus aethiopicus	Ground asparagus	N
Ваитеа јипсеа	Twig-rush	Υ
Casuarina glauca	Swamp Oak	Υ
Gahnia clarkei	Tall Saw-sedge	Υ
Juncus krausii	Sea Rush	Υ
Selliera radicans	Swamp Weed	Υ
Sporobolus virginicus	Marine Couch	Υ
Melaleuca quinquinervia	Broad-leaved Paperbark	Υ
Fimbristylis ferruginea	Rusty Sedge	Υ
Cortaderia selloana	Pampas Grass	N
Samolus repens	Creeping Brookweed	Υ

Native plant species (#) (plot):	9

Regeneration (%) (plot):	0
	No regeneration younger than 1 year

Trees with Hollows (#) (plot):	1
	Stag with 5 cm hollows in branches

Total le	ngth of fallen logs (m) (plot	6

Layer	Cover in 20x20m plot (%)	
Native midstorey	0	
Native ground (grasses)	5	
Native ground (shrubs)	0	
Native ground (other)	95	
Exotics	1	

Weeds

Two occurrences of exotic species. 1 Pampas Grass and 1 Asparagus Fern. Does not appear to have increased since 2021 monitoring event.

Dieback of canopy

Lots of juveniles present averaging 4 metres in height. Leaf growth appears sparse.

Water

Site is extremely waterlogged. 40cm mud in some places (fine sediment). Plot crosses creekline

Comments

Good condition. A few standing dead trees. No new trees fallen (absence of green foliage).

Photo no: Plot 2

Date: 6/01/2023

Data collectors: Bianca Seal

Plot/transect: 2

Coordinates start transect
Easting: 365085.13
Northing: 6329629.28

Coordinates finish transect
Easting: 365085.18
Northing: 6329578.82

Native overstorey cover %		
(every 5m)		
1	30	
2	30	
3	20	
4	35	
5	15	
6	15	
7	20	
8	30	
9	20	
10	30	
AVG	24.5	

Species	Common Name	Native
Asparagus aethiopicus	Ground asparagus	N
Ваитеа јипсеа	Twig-rush	Υ
Casuarina glauca	Swamp Oak	Υ
Juncus krausii	Sea Rush	Υ
Selliera radicans	Swamp Weed	Υ
Sporobolus virginicus	Marine Couch	Υ
Melaleuca quinquinervia	Broad-leaved Paperbark	Υ
Samolus repens	Creeping Brookweed	Υ

Native plant species (#) (plot):	7

Regeneration (%) (plot):	1

Trees with Hollows (#) (plot):	0

Total length of fallen logs (m) (plot):	8

Layer	Cover in 20x20m plot (%)
Native midstorey	0
Native ground (grasses)	3
Native ground (shrubs)	0
Native ground (other)	98
Exotics	1

Weeds

Very few weeds within plot. One occurrence of Asparagus Fern, dense groundcover of natives preventing weed growth.

Dieback of canopy

No apparent dieback of canopy. Some stems appear older- no recent dieback (green foliage on fallen logs/stems).

Water

Soils waterlogged throughout majority of area.
Occassional areas of shallow pooled water

Comments

No new regeneration (less than 1 year old). Juvenile Swamp Oak present. No scats or animals observed.

Site attribute	Benchmark	Plot 1 data	Plot 1 score	Plot 2 data	Plot 2 score	Average	Weighting %		Weighted score %
A	>6	9	4	7	4	4	25	25	25.0
В	5 to 18	18	3	24.5	3	3	10	7.5	7.5
С	36 to 48	0	1	0	1	1	10	2.5	2.5
D	3 to 21	5	4	3	4	4	2.5	2.5	2.5
E	0 to 0	0	4	0	4	4	2.5	2.5	2.5
F	1 to 13	95	1	98	1	1	2.5	0.625	0.6
G		1	4	1	4	4	5	5	5.0
Н	> 0	1	4	0	1	2.5	20	12.5	12.5
ı		0	1	1	2	1.5	12.5	4.6875	4.7
J	> 20	6	2	8	2	2	10	5	5.0
Total						27	100		67.8

7.8 trigger is <60%

Site attribute		Site attribute	Weighting			
		1	2	3	4	for site
Α	Native plant species	(0-<50% of	50-<100%	≥	25%
	richness		benchmark	of	benchmark	
				benchmark		
В	Native over-storey cover	0-10% or	10-<50% or	50-<100%	Within	10%
		>200% of	>150-200%	or >100-	benchmark	
		benchmark	of	150% of		
			benchmark	benchmark		
С	Native mid-storey cover	0-10% or	0-<50% or	50-<100%	Within	10%
		>200% of	>150-200%	or >100-	benchmark	
		benchmark	of	150% of		
			benchmark	benchmark		
D	Native ground-cover	0-10% or	0-<50% or	50-<100%	Within	2.50%
(!	(grasses)	>200% of	>150-200%	or >100-	benchmark	
	,	benchmark	of	150% of		
			benchmark	benchmark		
E	Native groundcover	0-10% or	0-<50% or	50-<100%	Within	2.50%
	(shrubs)	>200% of	>150-200%	or >100-	benchmark	
	,	benchmark	of	150% of		
			benchmark	benchmark		
F	Native groundcover	0-10% or	0-<50% or	50-<100%	Within	2.50%
	(other)	>200% of	>150-200%	or >100-	benchmark	
	,	benchmark	of	150% of		
			benchmark	benchmark		
G	Exotic plant cover (all	>66%	>33-66%	>5-33%	0-5%	5%
	strata)					
Н	Number of trees with	0 (unless	0-<50% of	50-<100%	≥	20%
	hollows	benchmark	benchmark	of	benchmark	
		includes 0)		benchmark		
		,				
1	Proportion of over-storey	(>0-<50%	50-<100%	100%	12.50%
	species occurring as			I		
	regeneration					
J	Total length of fallen logs	0-10% of	>10-<50%	50-<100%	≥	10%
	Jgr	benchmark	of	of	benchmark	
			benchmark			
Total we	eighted score				•	100%

Appendix B Vent shaft monitoring



B.1 Vent shaft photolog



Photograph B.1 Photo point 1



Photograph B.2 Photo point 2



Photograph B.3 Photo point 3



Photograph B.4 Photo point 4



Photograph B.5 Tree monitoring point 1



Photograph B.6 Tree monitoring point 2

Appendix C
Weed monitoring results



Weed Monitoring Proforma

Date:	6/01/2023
Management zone:	Pit top.
Data collectors:	Bianca Seal

Location ID (see Figure 3.1)	Weed species	Location (MGA 94)	# plants	Area (m2)	Distance to native vegetatation (m)	Recommended control measures
		Easting	Northing				
Waypoint 1;		365129.6;	6329523.1;				
Waypoint 2	Asparagus Fern (Asparagus aethiopicus)	365126.84	6329540.92	3 individuals per location	1	0	As per BMP
Waypoint 5;		365084.52;	6329626.39;				
Waypoint 6	Asparagus Fern (Asparagus aethiopicus)	365079.54	6329622.99	1 individual per location	0.5	0	As per BMP
Waypoint 7	Asparagus Fern (Asparagus aethiopicus)	365060.26	6329620.51	6	2	0	As per BMP
Waypoint 8	Sharp Rush <i>(Juncus acutus)</i>	365028.09	6329552.74	1	0.5	3	As per BMP
	Pampas Grass (Cortaderia selloana), Rhodes			2 Pampas Grass; 100 Rhodes			Meets edge of the access rack. As pe
Waypoint 9	Grass (Chloris gayana)	364976.4	6329493.37	Grass	1; 5	4	BMP
	Pampas Grass (Cortaderia selloana),						
Waypoint 13	Asparagus Fern (Asparagus aethiopicus)	365022.52	6329496.34	1 of each species	1	0	As per BMP
							Mechanical removal most effective.
Patch 1	Sharp Rush (Juncus acutus)	See Figure 2.1				0	Also see BMP
	Asparagus Fern (Asparagus aethiopicus)						
	prevelant, also Bitou Bush						
	(Chrysanthemoides monilifera subsp.						
	rotundata), Lantana (Lantana camara),						
	Crofton Weed (Ageratina adenophora),						
	Rhodes Grass (Chloris gayana) and Senna						
Patch 2	pendula	See Figure 2.1				0	As per BMP

Comments:

It appears that a patch of mature Sharp Rush, adjacent to the access track has not increased in size, however a few isolated individuals were observed adjacent to the dam. Mechanical removal is likely to be most effective for Sharp Rush. Note that the superficially similar, and native Sea Rush (*Juncus krausii*) is also present in the vicinity. There is also a large patch (Figure 2.1) where Asparagus Fern is widespread, along with several other weed species.

Weed Monitoring Proforma

Date:	6/1/23
Management zone:	Vent shaft - Sumerland point
Data collectors:	Bianca Seal

Location ID (see Figure 3.2)	Weed species	Location		# plants	Area (m2)	Distance to native	Recommended control measures
		Easting	Northing				
	Senna pendula, Lantana (Lantana camara)			Senna pendula- 9			
	regrowth, Bitou Bush (Chrysanthemoides			Lantana- 1			
Waypoint 14	monilifera subsp. rotundata)	366608.72	6331044.63	Bitou Bush- 2	2	0	As per BMP
				Lantana- 2			
Waypoint 15	Lantana, Senna pendula	366613.69	6331035.16	Senna pendula- 3	1	0	As per BMP
Waypoint 16	Senna pendula - mostly seedlings	366631.29	6331017.99	20	25	0	As per BMP, hand pull if small enough
,,	Whiskey grass (Andropogon virginicus) patch			Whiskey Grass- 1000			
Waypoint 17	with Senna pendula seedlings	366642.45	6331013.05	Senna pendula- 3	25	0	As per BMP, hand pull if small enough
				Bamboo- 22			
	Spanish Reed (Arundo donax), Lantana, Senna			Lantana- 6			
Waypoint 18	pendula	366673.78	6330966.23	Senna- 3	6	0	As per BMP
Waypoint 19	Lantana	366673.83	6330982.87	4	9	0	As per BMP
,,							
Waypoint 20	Senna pendula	366675.72	6331002.42	20	4	0	As per BMP
				Lantana- 1			
Waypoint 21	Lantana, Senna pendula	366677.68	6331042.69	Senna- 1	1	0	As per BMP
Waypoint 22	Lantana	366661.73	6331056.12	4	9	0	As per BMP
71				Lantana- 1			
Waypoint 23	Lantana, Senna pendula	366604.29	6331068.2	Senna- 3	4	0	As per BMP
	Fishbone fern (Nephrolepis cordifolia)- linear	366606.66;	6331085.53;				
Waypoints 24 to 26	patch along roadside	366595.66	6331119.64	2000	10	0	As per BMP
Waypoint 25	Senna pendula	366607.32	6331099.07	1	1	0	As per BMP
Waypoint 27	Lantana- juvenile	366604.23	6331113.66	2	1	0	As per BMP

Comments:

The majority of the weeds are easily accessable and small to medium in size. Most could be controlled with spot herbicide spray or cut and paint methods. Many of the Senna pendula patched have few large plant and a large number of seedlings which are easily hand pulled. Care should be taken not to impact the native Coffee Bush (Breynia oblongifolia) which has superficially similar leaves, especially as a seedling. It appears that some patches of Senna pendula have been treated before, with some plants showing decreased or prohibited growth.

Appendix D
Feral animal monitoring results



Feral Animal M	Ionitoring Proforma		
Date:	6/01/2023	Data collectors:	Bianca Seal
Management z	one: Eastern Zone		

Feral animal	Location (MGA 9	Location (MGA 94)		
species	Easting		Activity level	Recommended control measures
Fox (<i>Vulpes</i>	364987.64	6329489.2	1 scat observed	
vulpes)				
-				

Record types: O - observed, S - scats, T - tracks, D - diggings, B - burrows

Australia

SYDNEY

Ground floor 20 Chandos Street St Leonards NSW 2065 T 02 9493 9500

NEWCASTLE

Level 3 175 Scott Street Newcastle NSW 2300 T 02 4907 4800

BRISBANE

Level 1 87 Wickham Terrace Spring Hill QLD 4000 T 07 3648 1200

CANBERRA

Suite 2.04 Level 2 15 London Circuit Canberra City ACT 2601

ADELAIDE

Level 4 74 Pirie Street Adelaide SA 5000 T 08 8232 2253

MELBOURNE

Suite 8.03 Level 8 454 Collins Street Melbourne VIC 3000 T 03 9993 1900

PERTH

Suite 9.02 Level 9 109 St Georges Terrace Perth WA 6000 T 08 6430 4800

Canada

TORONTO

2345 Yonge Street Suite 300 Toronto ON M4P 2E5 T 647 467 1605

VANCOUVER

60 W 6th Ave Vancouver BC V5Y 1K1 T 604 999 8297





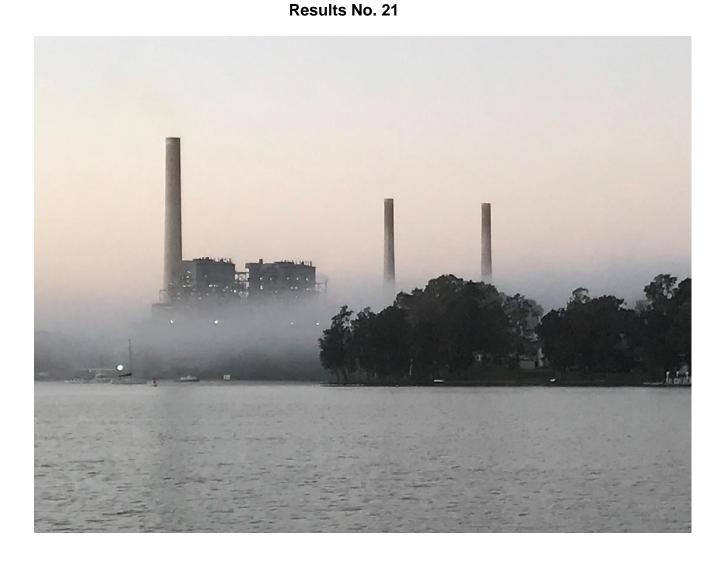


Appendix 5: Benthic Communities Monitoring Reports

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		1	Environmental Compliance Coordinator	Page 105 of 114		
DOCUMENT UNCONTROLLED WHEN PRINTED						

Delta Coal Mannering & CVC Collieries

Lake Macquarie Benthos Survey



By Dr Emma Laxton

March 2022

J.H. & E.S. Laxton - Environmental Consultants P/L 170 Warrimoo Avenue, St. Ives. NSW 2075 Australia Telephone: 0429 855 891 Email: emmalaxton07@gmail.com

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Summary of survey findings

In March 2022, 22 benthic stations were sampled. The following is a history of benthos sampling from 2014 to 2022:

By March 2014, mining beneath Lake Macquarie had proceeded so that two Reference stations
 (R) had been re-designated Impact Stations (IM), namely:

R3 became IM5

R4 became IM6.

- By September 2014, Station R5 had become the impact station IM7.
- In March 2016 two more stations were added to the sampling schedule. They were:

C5 GR 367701 6334310

R7 GR 366232 6333856.

In September 2016, difficult geology beneath Bardens Bay and along parts of Summerland Point led
Lake Coal to begin mining beneath Chain Valley Bay. To accommodate this change in mining
direction, three additional benthos sampling stations were added. They were C6, R8 and R9.

C6 GR 363988 6332492

R8 GR 364523 6332010

R9 GR 365258 6331210

- The total number of Stations sampled in September 2017 was 19.
- In March 2018, three new stations were added to the sampling programme. They were:

C7 GR 366276 6334947

R10 GR 365172 6334706

R11 GR 367072 6333639

- The mud basin off Summerland Point, in Chain Valley Bay and Bardens Bay, was found to be inhabited by 27 species of organisms greater than 1mm in size. This list was derived from the 21 samplings undertaken between February 2012 and March 2022. Polychaete worms and bivalve molluscs were the most frequently encountered animals.
- Bottom sediment in the study area was composed of fine black mud with varying proportions of black sand and shell fragments.

Water levels in Lake Macquarie can vary by as much as 1.3m over the course of a year due to combinations of the following phenomena:

- Diurnal tidal changes (around 0.05m)
- Changes in atmospheric pressure (up to 0.4m)
- Wave set up at the entrance to Lake Macquarie
- Inflow of water from the catchment during major rainfall events.

Light attenuation through the water column of Lake Macquarie, measured off Wyee Point, between 1983 and 1985, showed that only 14% of the photosynthetically active radiation (PAR) reached the lakebed at 2m depth (the growth limit of seagrasses and macroscopic algae in the Delta Coal study area). At 6m depth, between 2% and 4% of the surface PAR reached the lakebed, not enough light to support the growth of seagrasses or benthic algae.

The 21 samplings of the benthos undertaken at six monthly intervals between February 2012 and March 2022 revealed the following:

- The same suite of organisms dominated each of the 22 sample stations. These were polychaete worms and bivalves.
- Stations were distinguished by the relative abundance of the dominant species.
- Water depth was not in any way important in determining the species composition at a station.
- Physical variables such as salinity, conductivity and turbidity of the bottom water had little influence on the species composition of the benthos. Dissolved oxygen concentration, however, can have a major effect on abundance. Major extinction events have occurred in the mud basin of Lake Macquarie. The evidence for this lies in the presence of large numbers of intact but dead bivalve shells entombed in the mud. The cause of extinction events appears to be prolonged dissolved oxygen depletion of bottom water. Prolonged dissolved oxygen depletion of the bottom water was measured during the water quality study conducted by Laxton and Laxton (1983 to 1997). Low concentrations of dissolved oxygen in the bottom water were also recorded during the March 2020 sampling period. Stations with low abundance of organisms correlated with low concentrations of dissolved oxygen in the bottom waters.
- At the time of sampling, water depth does not determine species composition at a station.
- In the March 2022 survey species diversity or composition was consistent with previous years. A
 total of 1196 organisms greater than 1mm in size were found, comprising 10 species. This
 compared with the results from March 2017, March 2018, March 2019, March 2020 and March

2021 where 1031, 1160, 832, 1032 and 797 organisms respectively were recorded representing approximately twelve species.

 As in previous years, polychaete worms and bivalve molluscs were the most frequently encountered animals in the March 2022 survey. Stations were distinguished by the relative abundance of the dominant species.

These results appear to support the notion that increasing the water depth by the predicted 0.8m subsidence has, to date, had little to no discernible effect on the composition and abundance of organisms making up the benthos of the mud basin.

Rainfall effects the salinity of Lake Macquarie. Annual rainfall in the Cooranbong (Lake Macquarie AWS) region was 839.8 mm in 2017; 859.8 mm in 2018; 763.4 mm in 2019; and 1496.4 mm in 2020 (BOM Station Number 061412). This lack of rainfall in the Lake Macquarie catchment had the effect of raising the concentration of salinity in the water column of Lake Macquarie. In March 2019, salinity was over 39 parts per thousand and almost uniform from surface to bottom.

The Lake Macquarie region received relatively heavy rainfall in August (111.2 mm) and September (64.8 mm) 2019; and January (79.6 mm), February (335.4 mm), March (173.0 mm), July (184.0 mm), October (150.8 mm) and December (220.6 mm) 2020. The catchment also received rainfall in January (104.8 mm) and February (155.8 mm) 2021 (BOM Station Number 061412). This rainfall lowered the salinity of water in the lake to around 36 parts per thousand in 2019, 33 parts per thousand in March 2020, and 32 parts per thousand in August 2020. Monthly rainfall for the Cooranbong region in January and February 2022 was 152.2 mm and 247.6 mm respectively. At the time of sampling, a further 268.8 mm had fallen in the catchment. Mean salinity of Lake Macquarie bottom waters is currently 32.89 parts per thousand.

Rainfall also influences water clarity. During periods of low rainfall, the water profile of the lake becomes very clear. Long periods of high water clarity effected the benthos of the study area. First, the small seagrass, *Halophila sp.* became established as a dense bed in 6m of water at Station R10 (Brightwaters Bay) in September 2018. *Halophila sp* was not recorded at Station R10 in March 2019 but in September 2019 a healthy plant of *Zostera capricorni* was found at this station. Second, red and brown algae were found on mussels at depths between 4.5 and 6 m of water in September 2018 at stations C4 and IM2, and on mussels at stations R3 and IM2 in March 2021. Recent heavy rainfall, however, has increased the turbidity and greatly reduced water clarity in the lake. The water is brown in colour. A combination of freshwater, lower dissolved oxygen and possibly an increase in sediment is likely responsible for the smaller than usual number of living mussels collected during the March 2022 survey.

In general, water temperature, conductivity, salinity, and pH were found to be uniform from surface to bottom. During the March 2021 sampling period, for instance, water temperature throughout the water column ranged from 24.18°C to 27.04°C; conductivity ranged from 51.68 ms/cm to 52.04 ms/cm; salinity

ranged from 33.96 parts per thousand to 34.23 parts per thousand; and pH ranged from 7.90 to 8.06.

In September 2019 some changes to the composition of the upper 100mm of the bottom sediments were detected. At Stations C1-C4 and C6-C7 no sand was present, just fine black silt. This indicated that these sediments had been reworked since March 2019. Sediments at Stations R5, R6 R8 and R9 also appeared to have been reworked. In March 2020, changes were again detected. Sediments at stations C5 and C7 comprised mostly of course black sand. In August 2020, sediment was mostly fine grey/black silt. The sediment collected during the March 2022 survey was largely fine grey silty mud with some shell fragments.

Note: AWS - Automatic Weather Station

Introduction

In 2012 Lake Coal P/L was seeking a variation to its mining agreement because of proposed changes to its mining methods. They were planning on increasing miniwall panel widths to 85m wide, 97m total extraction, which will result in some additional subsidence above that currently approved. As such, a modification and supporting EA was prepared. The predicted subsidence agreed to by the NSW Government was around 0.406m. The method now proposed will increase subsidence to around 0.468m.

NSW Department of Planning and Infrastructure raised concerns that this increase in depth of water over the existing benthic community of the mud basin of Lake Macquarie may alter the species composition and relative abundances of organisms within that community.

To address these concerns, Lake Coal decided to conduct a benthic survey of the mud basin community to attempt to answer the following questions.

- What is the structure of the benthic community of the mud basin off Summerland Point and in Chain Valley Bay?
- What changes to the benthic community, if any, have taken place in areas of the lake mud basin that have been subjected to subsidence from previous mining activity?
- What changes to the benthic community, if any, may be expected in the mud basin community from the proposed variation to the mining method?

This study had a seasonal component and the benthos could change from year to year without the influence of any subsidence due to mining.

Ms Jemma Sargent of JSA Environmental prepared a formal document entitled:

Benthic Communities Management Plan. Chain Valley Colliery Domains 1 & 2 Continuation. Project (10 0161). 25 June 2012.

The extraction plan required under Condition 6 of Schedule 3 within Project approval (10_0161) requires that a Benthic Communities Management Plan (BCMP) be developed. This BCMP was prepared to provide for the management of the potential impacts and/or environmental consequences of the proposed second workings on benthic communities and includes:

- surveys of the lakebed to enable contours to be produced and changes in depth following subsidence to be accurately measured
- benthic species surveys within the area subject to second workings, as well as control sites outside the area subject to second workings (at similar depths) to establish baseline data on species

- numbers and composition within the communities
- a program of ongoing seasonal monitoring of benthic species in both control and impact sites
- development of a model to predict the likely impact of increased depth and associated subsidence impacts and effects, including but not limited to light reduction and sediment disturbance, on benthic species number and benthic communities composition, incorporating the survey data collected.

Three types of station were sampled. They were:

- Control stations C, areas of lakebed sufficiently remote from previous or proposed mining.
- Reference stations R, areas of lakebed above subsidence areas of previous mining.
- Impact stations IM, areas of lakebed where subsidence is expected from future mining.

Two depth zones within the mud basin were sampled, -4.5m AHD and -5.5 to -6.0m AHD. The locations of the sampling stations were specified by Mr Chris Ellis and Mr Wade Covey, using the results of a bathymetric survey of the lake and the known locations of past and proposed mining.

In November 2014, project consent 10_0161 was surrendered. It was replaced by consent SSD-5465 as modified. The remodeled subsidence values were 0.62m for the single seam extraction area (everywhere that is currently being mined) and up to 0.886m for areas where multiseam mining will occur (near Site R2).

This report (March 2022) presents the results of the just completed 21st sampling of the now 22 (previously 19, 16, 14 and 12) stations off Summerland Point, in Chain Valley Bay, Bardens Bay and Sugar Bay. These results will be compared with those obtained from the previous twenty surveys (February 2012 to September 2021). The benthic survey was conducted between the 5th and 18th March 2022. Water quality variables were measured on 5th and 18th March 2022. The work in March 2022 was supervised by Mr Lachlan McWha of Delta Coal.

Location of Sampling Stations

Figure 1 shows the location of sampling stations, depth contours of the lake, and the locations of existing and proposed underground mine workings prepared by Mr Chris Armit and the LDO team in February 2017 and updated in October 2019. **Table 1** provides the exact location of each sampling station by latitude and longitude and by eastings and northings using WGS84 datum. **Figure 2** shows the extent of mining from March 2021 to March 2022.

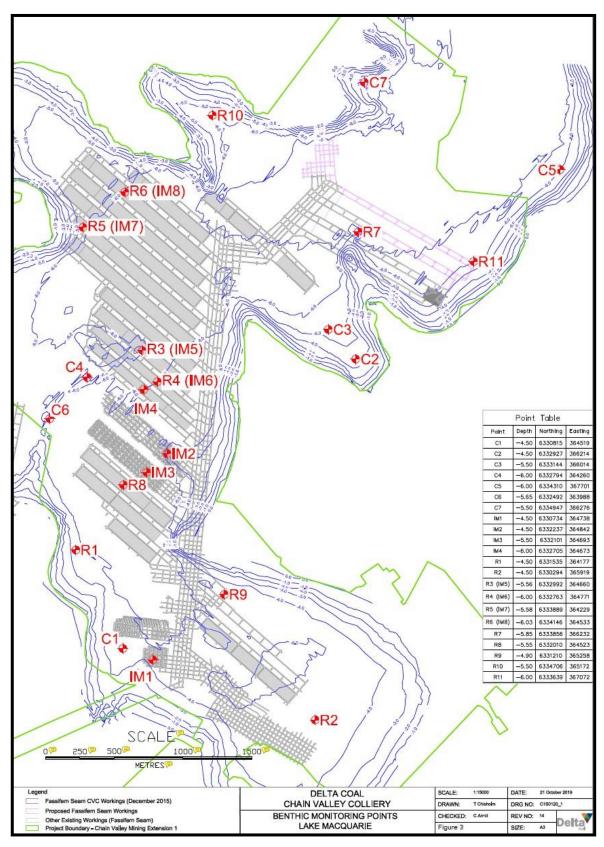


Figure 1. Location of Benthos Sampling Stations (March 2022).

 Table 1. Co-ordinates of Benthos Sampling Stations prepared by the LDO team.

Station	Sample depth (m) AHD	Latitude	Longitude	MG-56 Easting	MG56 Northing
C1	-4.50	S33° 09' 10.69"	E151° 32' 50.11"	364519	6330815
C2	-4.50	S33° 08' 02.89"	E151° 33' 56.65"	366214	6332927
C3	-5.50	S33° 07' 55.78"	E151º 33' 49.05"	366014	6333144
C4	-6.00	S33° 08' 06.35"	E151º 32' 41.17"	364260	6332794
C5	-6.00			367701	6334310
C6	-5.50			363988	6332492
C7	-5.50			366276	6334947
IM1	-4.50	S33° 09' 13.44"	E151° 32' 58.51"	364738	6330734
IM2	-4.50	S33º 08' 24.67"	E151º 33' 03.34"	364842	6332237
IM3	-5.50	S33° 08' 29.02"	E151º 32' 57.52"	364693	6332101
IM4	-6.00	S33º 08' 09.42"	E151° 32' 57.04"	364873	6332705
R1	-4.50	S33º 08' 47.18"	E151º 32' 37.31"	364177	6331535
R2	-4.50	S33° 09' 28.23"	E151º 33' 43.87"	365919	6330294
R3 (IM5)	-5.50	S33° 08' 00.10"	E151º 32' 56.72"	364660	6332992
R4 (IM6)	-6.00	S33° 08' 07.58"	E151° 33' 00.88"	364771	6332763
R5(IM7)	-5.50	S33° 07' 30.78"	E151° 32' 40.55"	364229	6333889
R6 (IM8)	-6.00	S33° 07' 22.56"	E151° 32' 52.42"	364533	6334146
R7	-6.00			366232	6333856
R8	-5.50			364523	6332010
R9	-4.50			365258	6331210
R10	-5.50			365172	6334706
R11	-6.00			367072	6333639

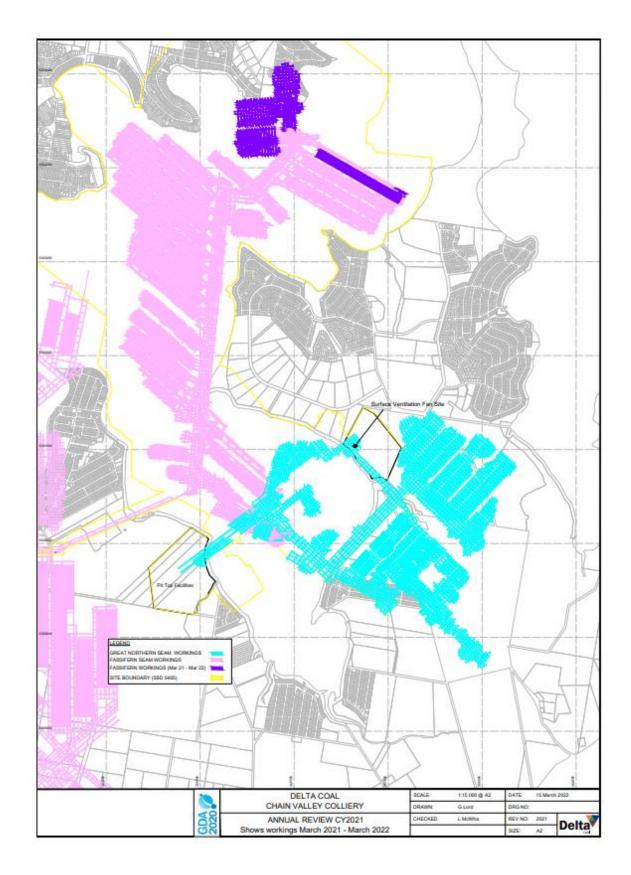


Figure 2. Extent of Fassifern Seam Workings from March 2021 – March 2022 (purple)

Selection and Evaluation of the Sampling Method

Methods for sampling benthos of sedimentary bottoms of oceans, coastal waters and saline and freshwater lakes must fulfill the following criteria:

- The area of bottom collected by the sampling device must be appropriate to the types and sizes of organisms inhabiting the substratum.
- The depth that the sampler penetrates the sediment must be sufficient to capture infauna or identifiable parts of more deeply buried species.
- Sufficient samples must be taken within the benthic environment to be certain that more than 95% of the component species of the ecosystem are collected.
- Sufficient samples must be taken to permit the population densities of component species to be calculated.

In 1971, Dr John Laxton was appointed by Dr Frank Talbot, Director of the Australian Museum, to lead a team of scientists to undertake the Shelf Benthic Survey. The purpose of the Shelf Benthic Survey was to provide baseline biological data on the benthos, fish and birds of the Continental Shelf adjacent to Sydney. Baseline oceanographic and biological data for coastal waters adjacent to Sydney were required to evaluate the effects of the proposed deep water ocean outfalls planed by the Metropolitan Water Sewerage and Drainage Board to replace the existing shoreline sewage outfalls. Both rocky bottoms and sedimentary bottoms were present in the study area and water depths ranged from the intertidal zone out to 200m.

At first, a Shipek grab was employed to collect samples of sediment. The Shipek grab used a spring loaded hemi-cylindrical bucket that rotated through 180° to collect a half cylinder of sediment nominally 200 x 200 mm in area and cut to a maximum depth of 100mm. On gravel bottoms, the Shipek grab worked consistently to collect 200 x 200 x 100mm samples. On sandy bottoms the grab, when triggered, penetrated the bottom to varying depths, collecting half cylinders of sediment that could range in depth from the full 100mm to as little as 25mm. This meant that the area of the seabed sampled varied greatly between samples taken at the same station and the depth of some samples was so shallow that many species of infauna were not collected. On muddy bottoms the heavy Shipek grab could plunge into the soft mud and emerge untriggered.

The Shipek grab was safe to use from a pitching and rolling vessel but as a scientific sampling device, it had serious deficiencies.

The Shelf Benthic Survey then obtained a Smith-MacIntyre (S-M) grab for evaluation. The Smith-MacIntyre grab used two spring operated clam-shells which swung inwards towards the midline to gather 200 x 200 x 100mm samples of sediment. This grab also had similar limitations to the Shipek grab when used to sample various sediment types. The worst feature of the S-M grab was that the two springs had to be tensioned by

a lever separately and then a keeper was placed in position to stop it triggering while on deck or while being lowered to the seabed. To position the keeper, the operator had to reach in between the two cocked spring loaded clam-shells. These clam-shell jaws were sharp and the action was violent enough to remove a hand. The Captain of the vessel banned its use on the project and undoubtedly saved someone's hand.

Following completion of the Shelf Benthic Survey, John Laxton joined an engineering firm that was commissioned to design wastewater outfalls for Gosford City, Wyong Shire and the Hunter Area. Baseline data on water quality and biology were again required and the seabed in the discharge and mixing zones was either rocky or sedimentary. As the maximum water depth in sedimentary areas was 30m, diver operated sample collection devices could be used to sample sedimentary bottoms. It was decided to build a diver operated benthic sampler that would overcome the difficulties and deficiencies of the available grab samplers. It should collect a 200 x 200 x 100mm section of sediment consistently and be easy to operate in conditions of zero underwater visibility.

To collect a 200 x 200 x 100mm sample of sediment consistently an aluminium box was designed that could be slid sideways into the sediment, whether gravel, sand or mud, and be filled completely before it was lifted clear of the bottom and the door closed and locked to retain the sediment. The top of the box included a panel of 1.0mm stainless steel mesh. Thus each box contained its own sieve to permit particles less than 1mm in size to be removed from the box leaving only large particles and organisms.

Tests of this box revealed that in all sediments (gravel, sand and mud) between 3 and 5 replicate samples were required to capture 95% of the species present. Once the maximum number of replicates required had been determined, five sieve boxes were manufactured along with a carry case to contain the boxes on the journey between the surface and the bottom and back. These devices permitted samples of consistent area and depth to be collected. Five replicates were always collected regardless of the sediment type or the environment being studied so that individual species/area curves were not required for each new area being investigated.

Five sieve boxes sample an area of 0.20 m². This sampling device has been used in all J.H. & E.S. Laxton - Environmental Consultants P/L benthos studies since 1980.

In an attempt to make the Summerland Point/Chain Valley Bay study results comparable with other studies, the BCMP required two cores of 100mm diameter and 200mm depth to be taken along with the 5 sieve box samples. These two cores covered an area of 0.015 m². There was no requirement in the BCMP to determine how many cores of these dimensions were needed to capture 95% of the benthic species inhabiting the lakebed. However, it is unlikely that sampling 0.015 m² of bottom sediment will provide a more realistic picture of the structure of the benthic community than sampling 0.20 m² of bottom sediment.

Sampling Procedure

Between September 2012 and September 2021, five replicate samples of basin mud were collected at each station using 200 x 200 x 100mm sieve boxes (1mm mesh). Two 100 x 200mm core samples were also collected at each station on each date sampled.

Twenty-two stations were sampled in March 2022. At each station the following procedure was carried out:

- A GPS unit was used to locate the sampling station. The boat was positioned upwind of the station and was then allowed to drift back to the exact location. When the wind strength was 0- 5km/h, the boat stayed on position. When the wind strength increased from 5 to 25km/h, the boat yawed on its anchor warp, causing the distance from the boat to the station to vary greatly and the sampling difficulty to increase. This was mitigated by working in calm conditions only.
- A line with five sieve boxes, two 100 x 200mm core samplers and a mesh bag containing a 250mL jar for whole sediment was cast overboard as the boat drifted into position.
- The diver descended to the lakebed to fill the 250mL jar, the two core samplers and five sieve boxes with sediment.
- The samplers were then hauled to the surface, and the contents of each sampler placed in a clean, labeled zip-lock plastic bag.
- Processing of samples occurred in the laboratory.
- Water quality of bottom waters was measured using a calibrated Yeo-Kal 618 Water Quality Analyser. Water temperature, conductivity, salinity, pH, dissolved oxygen, turbidity and depth were measured. Each line of data was stored in the memory of the machine.

In the laboratory the marine benthic samples were treated in the following way:

- Each sample was tipped into a 1 mm mesh sieve and washed free of mud.
- The washed material from each sample was then placed into an enamel dish and sorted for animals.
- Organisms and parts of organisms were removed, counted, identified and the results entered into a spread sheet. This process was repeated until the debris of the entire sample had been examined.
- Sorted organisms were preserved in formaldehyde solution.
- All shell remaining in the sample was kept for later examination.

The 250mL samples of whole sediment were treated in the following way:

• Each sample was tipped into a 1L clear glass measuring cylinder and the volume made up to 600mL with freshwater.

- The cylinders were stoppered and shaken vigorously to suspend the sediment in the freshwater.
- The cylinders were then placed on the laboratory bench to allow the fractions of the sediment to settle.
- Once settled the volumes of each fraction (shell and coarse sand, fine sand, mud and fine silt) were calculated and recorded. Results were displayed relative to the final volume of sediment collected.

Factors Affecting the Depth of Water in Lake Macquarie

The bathymetric chart of Lake Macquarie shows water depths relative to AHD. The actual depth of water above the lakebed varied greatly (**Figure 3**).

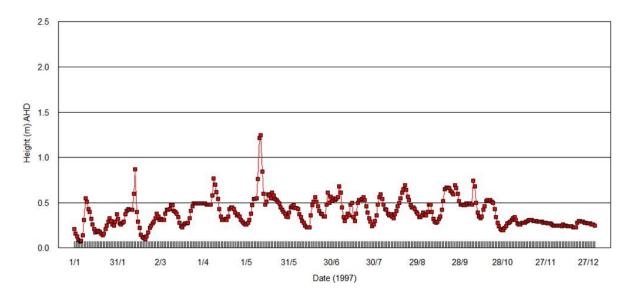


Figure 3. Water level changes in a coastal lagoon with an entrance open to coastal waters.

The actual water depth above the lakebed varied between 0 and 1.3m above AHD over a year. Water depths in coastal saline lakes with an open entrance to coastal waters vary due to combinations of the following factors:

- The body of Lake Macquarie is subject to tidal influence. The height of the tidal prism at Swansea Head may reach almost 2m (during spring tides) but by the time the body of the lake is reached, the tidal prism has been reduced to around 0.05m.
- The height of coastal waters and coastal lakes are influenced by changes in atmospheric pressure.
 The Tasman Sea acts as a huge barometer. When the atmospheric pressure is high the sea surface is depressed. This causes water to drain from Lake Macquarie causing the depth of water in the

body of the lake to decrease. When the atmospheric pressure over the Tasman Sea is low, the surface of the sea bulges upwards. This raising of sea level causes water to flow into Lake Macquarie, increasing the water depth.

- Low pressure systems in the Tasman Sea almost always generate strong winds and coastal rainfall.
 The strong winds cause large swells to form that impact the coast. Wave setup at the entrance to Lake Macquarie causes the water level in the lake to rise as large volumes of seawater enter the system.
- Rainfall during a period of low atmospheric pressure causes runoff into catchment rivers and streams to increase. When this extra water reaches the body of Lake Macquarie, the water level rises in proportion to the runoff volume. This water is prevented from exiting the lake by wave setup at the entrance and the state of the tide. Under these circumstances, the level of the lake can rise to heights of a meter or more above AHD (Figure 3).

Water Quality of Lake Macquarie (April 1983 – March 1997)

In 1983 the Hunter District Water Board (later Hunter Water Corporation) commissioned J.H. & E.S. Laxton – Environmental Consultants P/L to carry out a water quality study of Lake Macquarie in conjunction with their plans to sewer the western shore of the lake. The study commenced in April 1983 with monthly sampling of the lake and ended in March 1997. The water quality results for the body of Lake Macquarie (as opposed to the creeks) are summarized and presented in **Table 2**.

Table 2. Water Quality of the body of Lake Macquarie (1983-1997)

Variable		Mean	Maximum	Minimum
Water Temperature (oC)	Surface	20.56	33.77	10.95
	Bottom	20.06	29.17	11.45
Water Salinity (ppt)	Surface	32.61	37.96	1.00
	Bottom	33.92	37.95	21.06
pH	Surface	8.28	9.28	7.19
	Bottom	8.26	8.90	7.55
Dissolved Oxygen (% saturation)	Surface	101.6	177.7	71.9
	Bottom	89.5	147.0	0.9
Turbidity (NTU)	Surface	3.0	32.8	0.0

	Bottom	5.1	77.7	0.0
Transmision of light through water (%)	Surface	94.2	99.9	7.3
	Bottom	88.1	99.4	2.0
Total Suspended Solids (mg/L)	Surface	4.8	123.5	0.5
Chlorophyll-a (µg/L)	Surface	2.953	112.900	0.000
Ammonia-nitrogen (mg-N/L)	Surface	0.071	1.500	0.006
	Bottom	0.075	0.813	0.010
Organic-nitrogen (mg-N/L)	Surface	0.355	9.691	0.000
	Bottom	0.361	3.357	0.002
Oxidized-nitrogen (mg-N/L)	Surface	0.10	0.459	0.000
	Bottom	0.008	0.142	0.000
Total-nitrogen (mg-N/L)	Surface	0.436	9.749	0.033
	Bottom	0.445	3.918	0.027
Orthophosphate phosphorus (mg-P/L)	Surface	0.0191	0.4148	0.0006
	Bottom	0.0188	0.1386	0.0003
Total phosphorus (mg-P/L)	Surface	0.0450	0.8922	0.0025
	Bottom	0.0489	0.3534	0.0022
Faecal coliform bacteria (no./100mL)				

Blue shading in Table 2 indicates variables of interest to this study of the benthos of Lake Macquarie.

Light attenuation in Lake Macquarie (1983 – 1997)

Observations made over many years (Laxton, 2007) show that photosynthetic benthic organisms (seagrasses and algae) are confined to the shallow water areas around the perimeter of Lake Macquarie. In Chain Valley Bay, Bardens Bay and off Summerland Point, seagrasses and benthic algae grow between 0 and -1.89m below AHD (except in September 2018 when *Halophila* and some algae were found in 4.5 to 6m of water at some stations due to low rainfall and clear water).

The water quality study of Lake Macquarie, carried out between 1983 and 1997, measured Photosynthetically Active Radiation (PAR) changes with depth monthly at twelve stations throughout the lake during the years 1983 to 1985. Data for Station 1 off Wyee Point are presented in **Figure 4** and **Figure 5**.

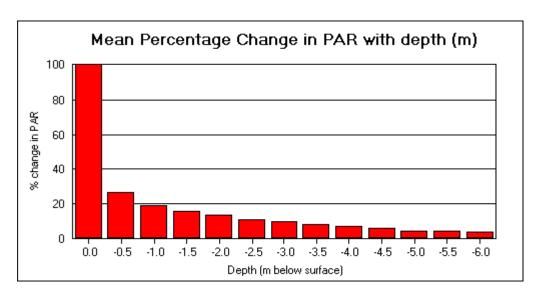


Figure 4. Mean percentage changes in PAR with depth at Station 1 - Wyee Point over 12 months.

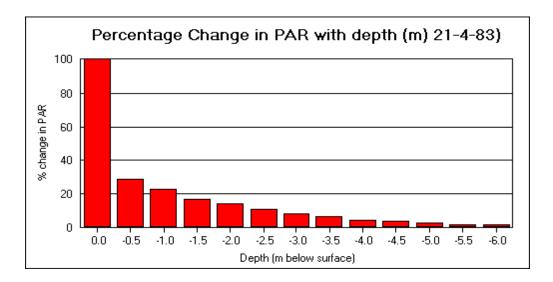


Figure 5. Actual percentage changes in PAR at Station 1 - Wyee Point on the morning of 21-4-83.

It was found that only 14% of the light present at the surface reached a depth of 2.0m below the surface. By 6m below the surface only between 2% and 4% of PAR remained. Seagrasses and algae just manage to survive at 14% of the surface radiation but have no chance of survival at 6m below the surface. The mud basin of Lake Macquarie was devoid of macroscopic benthic algae and seagrasses except at some stations in September 2018.

Results

Benthos of the Study Area – February 2012 to March 2022

The following organisms were found in the sediment samples collected off Summerland Point and in Chain Valley Bay between February 2012 and March 2022:

Designated name	Family or Species	Comments
Anemone	Coelenterata	Found associated with mussel shells.
Planaria (Flat worm)	Platyhelminthes	2 specimens found in 2017.
Polychaete thin	Sthenelais pettiboneae	Most common polychaete present.
Polychaete (thick)	Cirratulidae	Present in small numbers.
Polychaete (mud tube)	Not yet identified	Present in small numbers.
Polychaete	Terebellidae	Present at Stations C1, C6, R1 and IM2.
Pectinaria sp. Polychaete	Terebellidae	First found in March 2019
Gastropod	Nassarius jonasii	Present in small numbers.
Gastropod	Lepsiella (Bedeva) hanleyi	Present in small numbers.
Gastropod	Bullimorph slug	One specimen found in August 2014.
Bivalve	Corbula truncata	Common as live animals and dead shells.
Bivalve	Soletellina alba	Common
Bivalve	Paphia undulata	Uncommon as live animals. Common as dead
		shells.
Bivalve	Cyamiomactra mactroides	Uncommon. (Brown or pink bivalve)
Bivalve	Anadara trapezia	Uncommon.
Bivalve	Dosinia sculpta	Many juveniles found in sandy sediment in
		September 2019.
Bivalve	Trichomya hirsuta	Common as dead shells. Found in large
		clumps at C2, C6, R3, R7, IM2 and IM3.
Bivalve	Saccostrea glomerata	Found on mussels at C4 and C6 in 2021.
Ophuroid	Brittle star	Uncommon. Found amongst mussel clumps
		and on mud.
Echinoid	Sea urchin	Uncommon. Found at C5 and C7 in 2021.
Sponge	White calcareous sponge	Specimen found associated with mussels.
	Pink sponge	Small species found on mud surface.
	Red sponge	Several specimens found in 2019.
Crabs	Small	Uncommon.
Prawn	Small	One specimen taken in March 2013 at R3 and
		one specimen in September 2013 at C4.

Shrimp	Small	Found at IM2 in March 2014.
Fish	Small (35mm)	One specimen taken at C3 (September
		2012), at R1 (September 2013) and at IM4 in
		March 2017. 1 specimen in C6 in 2019.

Plates 1a to **1f** provide information about the benthic organisms present in the basin mud of Lake Macquarie, NSW.

Plate 1a. Annelid species found in the benthos of Lake Macquarie (February 2012 – March 2022).



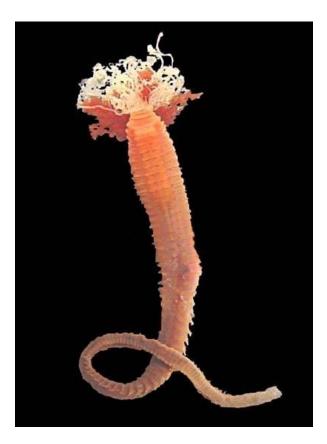
Phylum: Annelida **Class:** Polychaeta

Subclass: Errantia

Order: Phyllodocida
Family: Sigalionidae
Genus: Sthenelais

Species: Sthenelais pettiboneae

Remarks: Found in marine environments.



Phylum: AnnelidaClass: PolychaetaSubclass: CanalipalpataOrder: TerebellidaFamily: Cirratulidae

Remarks: Cirratulids vary in size from 1-20 cm long. They are mostly burrowers in soft sediments but some live in rock crevices. The head is conical or wedge-shaped and has no antennae. The body is generally cylindrical, tapering at both ends. Cirratulids are characterised by many simple elongate filaments along the body. The genera are poorly defined.

Plate 1b. Gastropod species found in the benthos of Lake Macquarie (February 2012 – March 2022).



Phylum: Mollusca
Class: Gastropoda
Superfamily: Buccinoidea
Family: Nassariidae
Genus: Nassarius

Species: Nassarius jonasii

Remarks: Endemic to Australia; Noosa Heads, Qld, to SA. Inhabit sand and mud flats in estuaries and lagoons, intertidal down to 100 m. Most *Nassarius* species are very active scavengers. They often burrow into marine substrates and then wait with only their siphon protruding, until they smell nearby food.



Phylum: MolluscaClass: GastropodaOrder: Neogastropoda

Family: Muricidae

Genus: Lepsiella (Bedeva)
Species: Lepsiella hanleyi

Remarks: Common name mussel drill. Shell up to 32 mm, with angulated whorls, a high spire and moderately long anterior canal and with both spiral threads and axial ribs. Endemic to Australia. Found in temperate and southern parts of tropical Australia. Lives mainly on sheltered shores, including estuaries and often in association with mangroves. Feeds by drilling holes in bivalves. Lays lens-shaped capsules and development is direct.

Plate 1c. Bivalve species found in the benthos of Lake Macquarie (February 2012 – March 2022).



Phylum: MolluscaClass: BivalviaOrder: MyoidaFamily: Corbulidae

Genus: Corbula

Species: Corbula truncata

Remarks: Marine bivalve mollusc.



Phylum: Mollusca
Class: Bivalvia
Order: Veneroida
Family: Psammobiidae
Genus: Soletellina
Species: Soletellina alba

Remarks: Posterior and anterior margins almost parallel. Shell thin and normally bluish, rarely white. Lives intertidally and subtidally in sand and mud, especially in sheltered environments. Occurs all around Australia; not recorded elsewhere.



Phylum: MolluscaClass: BivalviaOrder: VeneroidaFamily: VeneridaeGenus: Paphia

Species: Paphia undulata

Remarks: Saltwater clam, marine bivalve mollusc. Inhabits inshore shallow sandy seabeds.



Phylum: MolluscaClass: BivalviaOrder: VeneroidaFamily: VeneridaeGenus: Dosinia

Species: Dosinia sculpta

Remarks: *Dosinia* is a genus of saltwater clams, marine bivalve molluscs in the family Veneridae, (subfamily Dosiniinae). The shell of *Dosinia* species is disc-like in shape, usually white, and therefore is reminiscent of the shells of Lucinid bivalves.

Typically found in the intertidal zone at the water's edge at a mean distance from sea level of -15 meters (-50 feet).



Phylum: MolluscaClass: BivalviaOrder: VeneroidaFamily: CyamiidaeGenus: Cyamiomactra

Species: Cyamiomactra mactroides



Phylum: Mollusca
Class: Bivalvia
Order: Arcoida
Family: Arcidae
Genus: Anadara

Species: Anadara trapezia

Remarks: Sydney cockle, or ark cockle is an estuarine filter-feeding bivalve. Its calcareous, heavily-ribbed, shell can grow to approximately 7 to 8 cm across. Its current range is along the east coast of Australia, from Queensland to Victoria. It has been used as an indicator species to study levels of the metals selenium, copper and cadmium.



Phylum: MolluscaClass: BivalviaOrder: MytiloidaFamily: MytilidaeGenus: Trichomya

Species: Trichomya hirsuta

Remarks: The hairy mussel is a major part of the megafauna of Lake Macquarie. It is tolerant of low oxygen levels in the water and its temperature tolerance range has been researched in connection with using the waters of the lake for cooling power stations.

Hairy mussels have been used as bioindicators to monitor concentrations of heavy metals (namely Pb, Cd, Cu, Zn, Co, Ni, and Ag) in marine environments.

Plate 1d. Brittle stars found amongst the mussel beds of Lake Macquarie, NSW.



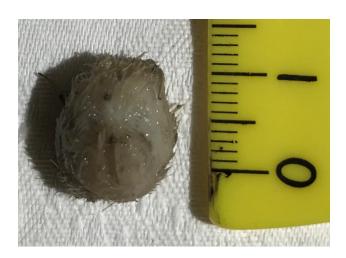
Phylum:EchinodermataClass:OphiuroideaOrder:Ophiurida

Family: Ophionereididae **Genus:** *Ophionereis*

Species: Ophionereis schayeri

Remarks: Largest and most common brittle star found in Sydney waters. Brittle stars have five long, slender arms which radiate out from a central disc. The mouth is located in the centre of the underside of the disc. There is no anus. Offshore, brittle stars form dense aggregations. In intertidal zones, they are typically found as single individuals in crevices, under stones and amongst seaweed. They feed by raising their arms above the substrate; extending tube-feet; and removing particles from the water. They pass food along the arms to the mouth. They also scavenge on decaying matter. They inhabit the hairy mussel beds of Lake Macquarie.

Plate 1e Sand dollar sea urchins found in Lake Macquarie, NSW



Phylum: EchinodermataClass: EchinoideaOrder: Clypeasteroida

Remarks: Sand dollars are small in size. They possess a rigid skeleton called a test. The test consists of calcium carbonate plates arranged in a fivefold symmetric pattern.

Plate 1f Crab species found in Lake Macquarie, NSW



Phylum: ArthropodaClass: MalacostracaOrder: Decapoda

Molluscs found as dead shells

Benthic organism samples collected between February 2012 and March 2022 included a large component of shell. **Plates 2a** and **2b** show the mass of shell obtained from the sixty 200x200x100mm samples of sediment taken in February 2012. **Plate 2c** and **Plate 2d** show the mass of shell collected in September 2012 and **Plates 2e** and **2f** show the mass of shells collected in March 2013.



Plate 2a. Large shell removed from samples during sorting process - February 2012 survey.



Plate 2b. Small shells removed from samples during sorting process - February 2012 survey.



Plate 2c. Large shells removed from samples - September 2012 survey.



Plate 2d. Small shells removed from samples during sorting in September 2012.



Plate 2e. Large shells removed from samples during sorting in March 2013.



Plate 2f. Small shells removed from samples during sorting in March 2013.

Similar masses of shell were found in the samples of the September 2013 to March 2022 surveys. These masses of shell were photographed for the record but were not included in this report.

The following molluscs were found in the large volume of shell collected during the sampling periods between February 2012 and March 2022:

1. Paphia undulata

2. Anomia sp.

3. Dosinia sculpta

4. Trichomya hirsuta

5. Katelysia rhytiphora

6. Pecten sp.

7. Chlamys sp.

8. Saccostrea glomerata

9. Corbula truncata

10. Batillaria (Velacumantis) australis

11. Conuber sp.

12. Anadara trapezia

Plates 3a and **3b** provide information about bivalve mollusc and gastropod species found as dead shells in the basin mud of Lake Macquarie, New South Wales during the periods of sampling.

Plate 3a. Mollusc species found as dead shells in the benthos of Lake Macquarie, NSW.



Phylum: Mollusca Class: Bivalvia Order: Ostreoida Family: Anomiidae Genus: *Anomia*

Remarks: Genus of saltwater clam, marine bivalve mollusc. Known as "jingle shells". Common in both tropical and temperate oceans and live primarily attached to rock or other shells via a calcified byssus that extends through the lower valve. *Anomia* shells tend to take on the surface shape of what they are attached to; thus if an *Anomia* is attached to a scallop shell, the shell of the *Anomia* will also show ribbing.



Phylum: Mollusca Class: Bivalvia Order: Veneroida Family: Veneridae Genus: Katelysia

Species: Katelysia rhytiphora

Remarks: Commonly known as mud cockles, this group of commercially important bivalves often represents a major faunal component of shallow estuarine and marine embayments. *K. rhytiphora* is broadly distributed around Australia's temperate coastline from Augusta, Western Australia to Port Jackson, NSW.



Phylum: Mollusca
Class: Bivalvia
Order: Ostreoida
Family: Pectinidae
Genus: Pecten

Remarks: Genus of large saltwater clams or scallops. Marine bivalve mollusc.



Phylum: Mollusca Class: Bivalvia Order: Ostreoida Family: Pectinidae Genus: *Chlamys*

Remarks: Genus of saltwater clams or scallops. Marine bivalve mollusc.



Phylum: Mollusca Class: Bivalvia Order: Ostreoida Family: Pectinidae Genus: Saccostrea

Species: Saccostrea glomerata

Remarks: Sydney rock oysters are endemic to Australia and New Zealand. In Australia it is found in bays, inlets and sheltered estuaries from Wingan Inlet in eastern Victoria, along the east coast of NSW and up to Hervey Bay QLD, around northern Australia and down the west coast to Shark Bay in WA. Sydney rock oysters are capable of tolerating a wide range of salinities (halotolerant). They are usually found in the intertidal zone to 3 metres (9.8 ft) below the low water mark.

Plate 3b. Gastropod species found as dead shells in the benthos of Lake Macquarie, NSW.



Phylum: Mollusca Class: Gastropoda Family: Naticidae Genus: Conuber

Species: Conuber sordidum

Remarks: Species of predatory sea snail. A marine gastropod mollusc known commonly as the moon snail. Lives on intertidal muddy sand flats near mangroves or sea weed.



Phylum: Mollusca Class: Gastropoda Family: Batillariidae

Genus: Batillaria (Velacumantis)

Species: Batillaria australis

Remarks: The Australian Mud Whelk is a marine gastropod found on mud flats in estuaries, river mouths and mangrove swamps. The snail has a high resistance to predation and environmental tolerance, which may partially explain its success as an invasive species. This species is one of the hosts for the flatworm parasite *Austrobilharzia*. Larvae of the flatworm are discharged from the snail into the surrounding water. They normally burrow into the legs of wading birds and complete their life cycle, but may burrow though the skin of humans, causing "bathers itch".

Benthic organisms in the Study Area - March 2022

The organisms found living in the sediments of the mud basin off Summerland Point and in Chain Valley Bay and Bardens Bay were entered into an Excel worksheet. **Table 3** shows the organisms found in each replicate at each station sampled in March 2022.

Table 3. Organisms found at Sampling Stations from 5th to 18th March 2022.

Control Station C	:1	Depth -4.5	0m AHD	5	6 364519	6330815		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Ophuroid	Barnacle	Fish	Crab
	0	0	2	0	0	1	2	0	0	0	0	0	0	0	0
C1.1 C1.2	1	1	0	0	0	1	15	0	0	0	0	0	0	0	0
C1.3	4	0	3	0	0	3	8	0	0	0	0	0	0	0	0
C1.4	0	0	4	0	0	2	5	0	0	0	0	0	0	0	0
C1.5	1	0	2	0	0	0	15	0	0	0	0	0	0	0	0
Mean/station (boxes) no./m2 (box)	1.2 30	0.2 5	2.2 55	0.0 0	0.0	1.4 35	9.0 225	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		3	55	Ü	O	33	225	Ū	O	O				O	
No. species (box)	5										Total Org	anisms a	t Station		70
Control Station C	2	Depth -4.5	0m AHD	5	6 366214	6332927		Sampled	5 - 18 Ma	arch 2022					
		Polychaete				Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Ophuroid	Barnacle	Fish	Planaria
Replicates	thin	mud	thick	Nassarius	Bedeva	Corbula	Soletellina	Paphia	Anadara	Cyamiomactra	Trichomya				
C2.1	0	1	0	0	0	20	4	0	0	0	0	0	0	0	0
C2.2	0	1	0	0	0	0	5	0	0	0	0	0	0	0	0
C2.3	0	0	0	0	0	6	12	0	0	1	0	0	0	0	0
C2.4	1 0	2 1	1 5	0 0	0 0	0 3	14 4	0	0 0	0 0	0	0 0	0 0	0	0 0
C2.5	U	1	5	U	U	3	4	U	U	U	U	U	U	U	U
Mean/station (boxes) no./m2 (box)	0.2 5	1.0 25	1.2 30	0.0 0	0.0	5.8 145	7.8 195	0.0	0.0	0.2 5	0.0	0.0	0.0	0.0	0.0 0
110./1112 (00%)		25	30	Ü	O	143	155	Ū	O	3				O	
No. species (box)	6										Total Org	anisms a	t Station		81
Control Station C	:3	Depth -5.5	0m AHD	5	6 366014	6333144		Sampled	5 - 18 Ma	arch 2022					
		Dopar o.o	0111711112		0 000014	0000111		Campica	O TO IVIC	20011 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Dosinia	Ophuroid	Planaria	Sponge
C3.1	0	1	0	0	0	2	7	0	0	0	0	0	0	0	0
C3.2	0	1	3	0	0	0	29	0	0	0	0	0	0	0	0
C3.3	0	1	2	0	0	2	15	0	0	0	0	0	0	0	0
C3.4	0	0	0	0	0	2	14	0	0	0	0	0	0	0	0
C3.5	0	1	0	0	0	2	11	0	0	0	0	0	0	0	0
Mean/station (boxes)	0.0	0.8	1.0	0.0	0.0	1.6	15.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
no./m2 (box)	0	20	25	0	0	40	380	0	0	0	0	0	0	0	0
No. species (box)	4										Total Org	anisms a	t Station		93
Control Station C	:4	Depth -5.5	0m AHD	5	6 364260	6332794		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Dosinia	Oyster Saccostrea	Ophuroid	Fish
·								•			-				
C4.1	2		•	0		0		0				0			
C4.2	1	1		0	0	0	0	0			0	0	0	0	0
C4.3	0	0		0	0	0	0	1			0	0		0	
C4.4	0			0	0	0	6 4	0			0	0		0	
C4.5	2		'	U	U	U	4	U	U	U	U	U	U	U	U
Mean/station (boxes) no./m2 (box)	1.0 25	0.8 20	0.6 15	0.0 0	0.0	0.0	2.2 55	0.2 5	0.0	0.0	0.0	0.0	0.0 0	0.0	0.0 0
No. species (box)	5										Total Org	anisms a	t Station		54
Control Station C	5	Depth -5.5	0m AHD	5	6 367701	6334510		Sampled	5th to ??	March 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Dosinia	Ophuroid	Echinoid	Fish
C5.1	1	6	1	0	0	0	1	0	0	0	0	1	5	0	0
C5.2	0	1	2	0	0	0	1	0	0	0	0	0	8	0	0
C5.3	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0
C5.4	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
C5.5	0	4	1	0	0	0	0	0	0	0	0	0	3	0	0
Mean/station (boxes)	0.2	2.8	0.8	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.2	3.4	0.0	0.0
no./m2 (box)	5	70	20	0	0	0	10	0	0	0	0	5	85	0	0
No. species (box)	6										Total Org	anisms a	t Station		39 36

	C6	Depth -5.5	0m AHD	5	6 363988	6332492		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Dosinia	Oyster Saccostrea	Ophuroid	Barnad
C6.1	0	0	0	0	0	0	7	1	0	0	0	0	0	0	0
C6.2	0	1	0	0	0	3	7	0	0	Ō	0	0	0	0	0
C6.3	0	0	1	0	0	3	10	0	0	0	0	0	0	0	0
C6.4	0	0	0	0	0	4	8	0	0	0	0	0	0	0	0
C6.5	2	0	1	Ö	Ö	3	2	1	Ö	0	0	0	0	Ö	0
Mean/station (boxes)	0.4	0.2	0.4	0.0	0.0	2.6	6.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
no./m2 (box)	10	5	10	0	0	65	170	10	0	0	0	0.0	0.0	0	0
No. species (box)	7										Total Orga	anisms a	t Station		5
Control Station C	27	Depth -5.5	0m AHD	5	6 364736	6334947		Sampled	5 - 18 Ma	arch 2022					
D " .		Polychaete		Gastropod	Gastropod	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Ophuroid	Echinoid	Barnac
Replicates	thin	mud	thick	Nassarius	Bedeva	Corbula	Soletellina	Paphia		Cyamiomactra	Trichomya	Dosinia	0	0	0
C7.1	3 4	4 4	0	0 0	0 0	0 0	0 0	0	0	0	0	0	0	0 0	0
C7.2			1	0	0		0	0		0	0			0	
C7.3	3	2	-			0			0			1	0		0
C7.4	2	2	0	0	0	0	0	0	0	0	0	1	0	0	0
C7.5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean/station (boxes) no./m2 (box)	3.0 75	3.0 75	0.2 5	0.0 0	0.0 0	0.0	0.0 0	0.0	0.0	0.0	0.0	0.4 10	0.0	0.0 0	0.0
No. species (box)	4										Total Orga	anisms a	t Station		3
Station R1		Depth -4.5	0m AHD	5	6 364177	6331535		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Ophuroid	Barnacle	Fish	Crab
R1.1	0	2	2	0	0	1	8	0	0	0	0	0	0	0	0
R1.2	0	1	2	0	0	2	2	0	0	0	0	0	0	0	0
R1.3	2	2	0	0	0	0	4	0	0	0	0	0	0	0	0
R1.4	2	2	6	0	0	0	9	1	0	0	0	0	0	0	0
R1.5	1	3	0	0	0	1	8	0	0	0	0	0	0	0	0
Mean/station (boxes) no./m2 (box)	1.0 25	2.0 50	2.0 50	0.0	0.0	0.8 20	6.2 155	0.2 5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
No. species (box)	6										Total Orga	anisms a	t Station		6
Station R2		Depth -4.5	0m AHD	5	6 365919	6330294		Sampled	5 - 18 Ma	arch 2022					
		Polychaete	-	Gastropod		Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Ophuroid	Barnacle	Fish
Replicates	thin	mud	thick	Nassarius	Bedeva	Corbula	Soletellina	Paphia -		Cyamiomactra	Trichomya	Dosinia		_	
	0	0	8	0	0	5	10	0	0	0	0	0	0	0	0
R2.1						_	_				0	0	0	0	0
R2.2	0	0	0	0	0	2	2	0	0	0					
	0 1		0 0		0 0	2 2	2 10	0 0	0	0	0	0	0	0	0
R2.2		0	0	0									0 0	0 0	0
R2.2 R2.3	1	0	0 0	0 0	0	2	10	0	0	0	0	0			
R2.2 R2.3 R2.4 R2.5 Mean/station (boxes)	1 1	0 0 0	0 0 3	0 0 0	0 0	2 4	10 14	0 0	0	0 0	0 0	0 0	0	0	0
R2.2 R2.3 R2.4	1 1 0	0 0 0 0	0 0 3 2	0 0 0 0	0 0 0	2 4 3	10 14 17 10.6	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0 0.0 0	0 0 0.0 0	0 0	0 0.0
R2.2 R2.3 R2.4 R2.5 Mean/station (boxes) no./m2 (box) No. species (box)	1 1 0 0.4 10 4	0 0 0 0	0 0 3 2 2.6 65	0 0 0 0	0 0 0 0.0 0	2 4 3 3.2 80	10 14 17 10.6	0 0 0 0.0 0	0 0 0 0.0 0	0 0 0 0.0 0	0 0 0 0.0 0	0 0 0 0.0 0	0 0 0.0 0	0 0	0 0 0.0 0
R2.2 R2.3 R2.4 R2.5 Mean/station (boxes) no./m2 (box)	1 1 0 0.4 10 4	0 0 0 0 0.0 0	0 0 3 2 2.6 65	0 0 0 0 0.0 0	0 0 0 0.0 0	2 4 3 3.2 80	10 14 17 10.6 265	0 0 0 0.0 0	0 0 0 0.0 0	0 0 0 0.0 0	0 0 0 0.0 0	0 0 0 0.0 0 anisms a	0 0 0.0 0	0 0 0.0 0	0.000
R2.2 R2.3 R2.4 R2.5 Mean/station (boxes) no./m2 (box) No. species (box)	1 1 0 0.4 10 4	0 0 0 0	0 0 3 2 2.6 65	0 0 0 0	0 0 0 0.0 0	2 4 3 3.2 80	10 14 17 10.6	0 0 0 0.0 0	0 0 0 0.0 0	0 0 0 0.0 0	0 0 0 0.0 0	0 0 0 0.0 0	0 0 0.0 0	0 0	0 0 0.0 0
R2.2 R2.3 R2.4 R2.5 Mean/station (boxes) no./m2 (box) No. species (box) Station R3 (now I Replicates R3.1	1 1 0 0.4 10 4 MM5)	0 0 0 0 0.0 0 Depth -5.5	0 0 3 2 2.6 65 0m AHD Polychaete thick	0 0 0 0 0.0 0	0 0 0 0.0 0 0 6 364660 Gastropod Bedeva 0	2 4 3 3.2 80 6332992 Bivalve Corbula	10 14 17 10.6 265 Bivalve Soletellina	0 0 0 0.0 0 Sampled Bivalve Paphia	0 0 0 0.0 0 5 - 18 Ma Bivalve Anadara	0 0 0 0.0 0	0 0 0 0.0 0 Total Orga	0 0 0 0.0 0 anisms a	0 0 0.0 0 t Station	0 0 0.0 0	0 0 0.0 0 8 Crab
R2.2 R2.3 R2.4 R2.5 Mean/station (boxes) no./m2 (box) No. species (box) Station R3 (now l	1 1 0 0.4 10 4 (M5)	0 0 0 0 0.0 0	0 0 3 2 2.6 65 0m AHD	0 0 0 0 0.0 0	0 0 0 0.0 0 6 364660 Gastropod Bedeva	2 4 3 3.2 80 6332992 Bivalve Corbula	10 14 17 10.6 265 Bivalve Soletellina	0 0 0 0.0 0 Sampled	0 0 0 0.0 0 5 - 18 Ma Bivalve	0 0 0 0.0 0	0 0 0 0.0 0 Total Orga Bivalve Trichomya 6 2	0 0 0 0.0 0 anisms a	0 0 0.0 0 t Station	0 0 0.0 0	0 0 0.0 0
R2.2 R2.3 R2.4 R2.5 Mean/station (boxes) no./m2 (box) No. species (box) Station R3 (now I Replicates R3.1	1 1 0 0.4 10 4 MM5)	0 0 0 0 0.0 0 Depth -5.5	0 0 3 2 2.6 65 0m AHD Polychaete thick	0 0 0 0 0.0 0 0 5 Gastropod Nassarius 0 0	0 0 0 0.0 0 0 6 364660 Gastropod Bedeva 0	2 4 3 3.2 80 6332992 Bivalve Corbula	10 14 17 10.6 265 Bivalve Soletellina	0 0 0 0.0 0 Sampled Bivalve Paphia	0 0 0 0.0 0 5 - 18 Ma Bivalve Anadara	0 0 0 0.0 0	0 0 0 0.0 0 Total Orga	0 0 0 0.0 0 anisms a	0 0 0.0 0 t Station	0 0 0.0 0	0 0 0.0 0 \$
R2.2 R2.3 R2.4 R2.5 Mean/station (boxes) no./m2 (box) No. species (box) Station R3 (now I Replicates R3.1 R3.2 R3.3	1 1 0 0.4 10 4 10 5) Polychaete thin 3 1	0 0 0 0 0.0 0 0 Depth -5.5 Polychaete mud	0 0 3 2 2.6 65 Om AHD Polychaete thick 1 0	0 0 0 0 0.0 0	0 0 0 0.0 0 0 6 364660 Gastropod Bedeva	2 4 3 3.2 80 6332992 Bivalve Corbula	10 14 17 10.6 265 Bivalve Soletellina	0 0 0 0.0 0 Sampled Bivalve Paphia	0 0 0 0.0 0 5 - 18 Ma Bivalve Anadara 0	0 0 0 0.0 0	0 0 0 0.0 0 Total Orga Bivalve Trichomya 6 2	0 0 0 0.0 0 anisms a	0 0 0.0 0 t Station	0 0 0.0 0	0 0 0 0 0 8
R2.2 R2.3 R2.4 R2.5 Mean/station (boxes) no./m2 (box) No. species (box) Station R3 (now I Replicates R3.1 R3.2 R3.3 R3.4	1 1 0 0.4 10 4 IM5) Polychaete thin 3 1 0	0 0 0 0 0.0 0 0 Depth -5.5 Polychaete mud 3 11 4	0 0 3 2 2.6 655 0m AHD Polychaete thick 1 0 0	0 0 0 0 0.0 0 0 5 Gastropod Nassarius 0 0	0 0 0 0.0 0 0 6 364660 Gastropod Bedeva 0 0	2 4 3 3.2 80 6332992 Bivalve Corbula 1 0 0	10 14 17 10.6 265 Bivalve Soletellina 1 0 0	0 0 0 0.0 0 Sampled Bivalve Paphia 1 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0.0 0 Total Orga Bivalve Trichomya 6 2 0	0 0 0 0.0 0 anisms a Bivalve Dosinia 0 0	0 0 0.0 0 t Station	0 0 0.0 0	0 0 0.0 0 0 Crall
R2.2 R2.3 R2.4 R2.5 Mean/station (boxes) no./m2 (box) No. species (box) Station R3 (now language) Replicates R3.1 R3.2 R3.3 R3.4 R3.5 Mean/station (boxes)	1 1 0 0.4 10 4 IM5) Polychaete thin 3 1 0 3 0 1.4	0 0 0 0 0.0 0 0 Depth -5.5 Polychaete mud 3 11 4 5 2	0 0 3 2 2.6 65 0m AHD Polychaete thick 1 0 0 0 0 0.2	0 0 0 0 0.0 0 0 0 Gastropod Nassarius 0 0 0	0 0 0 0.0 0 0 6 364660 Gastropod Bedeva 0 0 0 0	2 4 3 3.2 80 6332992 Bivalve Corbula 1 0 0 2 0	10 14 17 10.6 265 Bivalve Soletellina 1 0 0 1 0	0 0 0 0.0 0 0 Sampled Bivalve Paphia 1 0 0 0 1	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0.0 0 0 arch 2022 Bivalve Cyamiomactra 0 0 0 1	0 0 0 0.0 0 Total Orga Bivalve <i>Trichomya</i> 6 2 0 8 2	0 0 0 0.0 0 anisms a Bivalve Dosinia 0 0 0	0 0 0.0 0 t Station Ophuroid 0 0 1 0 0	0 0 0.0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
R2.2 R2.3 R2.4 R2.5 Mean/station (boxes) no./m2 (box) No. species (box) Station R3 (now label) Replicates R3.1 R3.2	1 1 0 0.4 10 4 MM5) Polychaete thin 3 1 0 3 0	0 0 0 0 0.0 0 0 Depth -5.5 Polychaete mud 3 111 4 5 2	0 0 3 2 2.6 65 Om AHD Polychaete thick 1 0 0 0 0	0 0 0 0 0.0 0 0 5 Gastropod Nassarius 0 0 0	0 0 0 0.0 0 0 6 364660 Gastropod Bedeva 0 0 0	2 4 3 3.2 80 6332992 Bivalve Corbula 1 0 0 2	10 14 17 10.6 265 Bivalve Soletellina 1 0 0	0 0 0 0.0 0 0 Sampled Bivalve Paphia 1 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0 0 0 0.0 0 0 arch 2022 Bivalve Cyamiomactra 0 0 0	0 0 0 0.0 0 Total Orga Bivalve <i>Trichomya</i> 6 2 0 8 2	0 0 0 0.0 0 anisms a Bivalve Dosinia 0 0 0 0	0 0 0.0 0 t Station Ophuroid 0 0 1 0 0	0 0 0.0 0 0	0 0 0.0 0 8

Station R4 (now	IM6)	Depth -6.0	0m AHD	5	6 364771	6332763		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Ophuroid	Barnacle	Fish	Crab
R4.1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0
R4.2	0	4	0	0	0	0	5	1	0	1	0	0	0	0	0
R4.3	1	1	0	0	0	2	0	1	0	0	0	0	0	0	0
R4.4	1 0	1 3	0 3	0 0	0 0	1 0	5 2	0	0 0	0 0	0	0 0	0 0	0 0	0 0
R4.5	U	3	3	U	U	U	2	U	U	U	U	U	U	U	U
Mean/station (boxes) no./m2 (box)	0.4 10	1.8 45	0.8 20	0.0	0.0	0.8 20	2.6 65	0.4 10	0.0	0.2 5	0.0	0.0	0.0	0.0 0	0.0
No. species (box)	7										Total Org	anisms a	t Station		35
Station R5 (now	IM7)	Depth -6.0	0m AHD	5	66 364229	6333889		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Ophuroid	Barnacle	Fish	Crab
R5.1	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0
R5.2	0	0	2	0	0	1	4	0	0	0	0	0	0	0	0
R5.3	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
R5.4	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0
R5.5	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0
Mean/station (boxes) no./m2 (box)	0.4 10	0.0	0.8 20	0.0 0	0.0	0.8 20	1.6 40	0.0	0.0	0.0	0.0	0.0	0.0	0.0 0	0.0
No. species (box)	4										Total Org	anisms a	t Station		18
,															
Station R6 (now	IM8)	Depth -6.0	0m AHD	5	6 364533	6334146		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Ophuroid	Barnacle	Fish	Crab
R6.1	0	1	0	0	0	0	3	0	0	0	0	0	0	0	0
R6.2	0	1	1	0	0	0	2	0	Ö	Ö	0	Ö	Õ	0	0
R6.3	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0
R6.4	0	2	0	0	0	1	2	0	0	0	0	0	0	0	0
R6.5	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Mean/station (boxes) no./m2 (box)	0.0	0.8 20	0.4 10	0.0 0	0.0	0.6 15	1.8 45	0.0	0.0	0.0	0.0	0.0	0.0 0	0.0 0	0.0
No. species (box)	4										Total Org	anisms a	t Station		18
Station R7		Depth -6.0	0m AHD	5	6 366232	6333856		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Ophuroid	Barnacle	Fish	Prawn
R7.1	0	7	7	0	0	0	3	2	0	1	6	0	0	0	0
R7.2	2	4	2	0	0	0	2	1	0	0	3	0	0	0	0
R7.3	2	3	0	0	0	0	2	0	0	0	15	0	0	0	0
R7.4	0 2	0	1 1	0 0	0	0	0	0	0	0 1	9	0	0	0	1 0
R7.5	2	3	'	U	0	0	0	0	0	'	0	0	0	0	U
Mean/station (boxes) no./m2 (box)	1.2 30	3.4 85	2.2 55	0.0 0	0.0	0.0	1.4 35	0.6 15	0.0	0.4 10	6.6 165	0.0	0.0 0	0.0 0	0.2 5
No. species (box)	8										Total Org	anisms a	t Station		80
Station R8		Depth -6.0	0m AHD	5	6 364323	63322010		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Dosinia	Ophuroid	Barnacle	Fish
R8.1	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0
R8.2	0	0	0	0	0	5	4	0	0	0	0	0	0	0	0
R8.3	0	0	1	0	0	8	5	0	0	0	0	0	0	0	0
R8.4	0 0	0	0	0 0	0	0 2	6 7	0 0	0	0 0	0	0 0	0 0	0	0
R8.5	U	U	U	U	0	2	1	U	0	U	0	U	U	U	0
Mean/station (boxes) no./m2 (box)	0.0	0.0	0.2 5	0.0	0.0	4.0 100	5.2 130	0.0	0.0	0.0	0.0	0.0	0.0	0.0 0	0.0
No. species (box)	3										Total Org	anisms a	t Station		38

Station R9		Depth -6.0	0m AHD	5	66 366232	6331210		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Dosinia	Ophuroid	Barnacle	Fish
R9.1 R9.2 R9.3 R9.4 R9.5	2 1 1 0 10	0 0 0 0	0 1 0 2 0	0 0 0 0	0 0 0 0	3 0 1 0	11 6 9 2 23	0 1 0 0 1	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
Mean/station (boxes) no./m2 (box)	2.8 70	0.0	0.6 15	0.0	0.0	0.8 20	10.2 255	0.4 10	0.0	0.0	0.0 0	0.0	0.0 0	0.0	0.0
No. species (box)	5										Total Org	anisms a	t Station		74
Station R10		Depth -6.0	0m AHD	5	66 365172	6334708		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Dosinia	Ophuroid	Barnacle	Fish
R10.1 R10.2 R10.3 R10.4 R10.5 Mean/station (boxes) no./m2 (box)	0 0 0 0 1 0.2 5	1 0 0 0 0 0	0 2 0 0 1 0.6 15	0 0 0 0 0	0 0 0 0 0	0 1 0 0 0 0	0 1 1 0 2 0.8 20	0 0 0 0 0	0 0 0 0 0	0 0 0 0 1	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
No. species (box)	6										Total Org	anisms a	t Station		11
Station R11		Depth -6.0	0m AHD	5	66 367072	6333638		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Dosinia	Ophuroid	Barnacle	Fish
R11.1 R11.2 R11.3 R11.4 R11.5	0 0 0 1 3	4 1 1 4 3	1 1 0 2 0	0 0 0 0	0 0 0 0	1 0 0 1 0	0 0 1 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	1 0 0 0 0	0 0 0 0	0 0 0 0
Mean/station (boxes) no./m2 (box)	0.8 20	2.6 65	0.8 20	0.0	0.0 0	0.4 10	0.4 10	0.0	0.0	0.0	0.0 0	0.0	0.2 5	0.0	0.0
No. species (box)	6										Total Org	anisms a	t Station		26
Station IM1		Depth -4.5	0m AHD	5	66 364738	6330734		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Dosinia	Ophuroid	Barnacle	Sponge
IM1.1 IM1.2 IM1.3 IM1.4 IM1.5	4 0 2 4 0	1 4 2 1 4	0 1 0 0 1	0 0 0 0	0 0 0 0	0 0 1 0	5 1 0 1 1	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
Mean/station (boxes) no./m2 (box)	2.0 50	2.4 60	0.4 10	0.0	0.0	0.2 5	1.6 40	0.0 0	0.0	0.0	0.0 0	0.0	0.0	0.0	0.0
No. species (box)	5										Total Org	anisms a	t Station		33
Station IM2		Depth -4.5	0m AHD	5	66 364842	6332237		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Sponge	Prawn
IM2.1 IM2.2 IM2.3 IM2.4 IM2.5	7 1 3 3 5	0 3 0 5 4	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0	1 0 0 0 1	0 0 0 1 0	0 0 0 0	0 0 0 0	10 3 2 0 2	0 0 0 0	0 0 0 0	0 0 0 0	0 0 0 0
Mean/station (boxes) no./m2 (box)	3.8 95	2.4 60	0.0	0.0	0.0	0.0	0.4 10	0.2 5	0.0	0.0	3.4 85	0.0	0.0	0.0	0.2 5
No. species (box)	6										Total Org	anisms a	t Station		⁵² 39

Station IM3		Depth -5.5	0m AHD	5	6 364693	6332101		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Ophuroid	Barnacle	Fish	Crab
IM3.1	0	0	0	0	0	3	11	0	0	0	0	0	0	0	0
IM3.2	1	1	0	0	0	1	11	0	0	0	0	0	0	0	0
IM3.3	1	0	0	0	0	1	6	0	0	0	0	0	0	0	0
IM3.4	2	0	1	0	0	2	5	0	0	0	0	0	0	0	0
IM3.5	0	1	0	0	0	0	9	0	0	0	0	0	0	0	0
Mean/station (boxes)	0.8	0.4	0.2	0.0	0.0	1.4	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
no./m2 (box)	20	10	5	0	0	35	210	0	0	0	0	0	0	0	0
No. species (box)	5										Total Org	anisms a	t Station		56
Station IM4		Depth -6.0	0m AHD	5	66 364673	6332705		Sampled	5 - 18 Ma	arch 2022					
Replicates	Polychaete thin	Polychaete mud	Polychaete thick	Gastropod Nassarius	Gastropod Bedeva	Bivalve Corbula	Bivalve Soletellina	Bivalve Dosinia	Bivalve Anadara	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Paphia	Ophuroid	Barnacle	Fish
IM4.1	0	0	1	0	0	1	3	0	0	0	0	0	0	0	0
IM4.2	0	0	1	0	0	2	6	0	0	0	0	1	0	0	0
IM4.3	0	4	4	0	0	1	2	0	0	0	0	0	0	0	0
IM4.4	3	2	0	0	0	0	2	0	0	0	0	0	0	0	0
IM4.5	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean/station (boxes)	1.0	1.8	1.2	0.0	0.0	0.8	2.6	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
no./m2 (box)	25	45	30	0	0	20	65	0	0	0	0	5	0	0	0
No. species (box)	6										Total Org	anisms a	t Station		38
												Total org	ganisms		1196

A total of 1196 benthic marine organisms greater than 1 mm in size were captured in the study area of Lake Macquarie during the March 2022 survey of 22 stations (**Table 3**). Ten species of benthic marine organisms were found in the samples. The fauna included three species of polychaete worm (**Plate 1a**); six species of bivalve (**Plate 1c**); and one species of brittle star (**Plate 1d**).

In March 2022, the greatest numbers of organisms were collected at stations C3 (93 organisms), R2 (84 organisms), C2 (81 organisms), R7 (80 organisms), and C1 (70 organisms). The stations with the least numbers of organisms were R10 (11 organisms), R5 now IM7 (18 total), R6 now IM8 (18 total), R11 (26 total), IM1 (33 total), C7 (33 total), and R4 now IM6 (35 total) (**Table 3**).

Polychaete worms were common in the benthos, with means ranging from 0.2 to 3.8 organisms in each sample (**Table 5**). Soletellina alba and Corbula truncata were the most commonly occurring bivales in the benthic muds during the March 2022 survey (**Plate 1c**, **Table 3**). Small numbers of the bivalves Paphia undulata and Dosinia sculpta were also collected at several stations. The mussel Trichomya hirsuta was found alive at station R3 (now IM5), R7 and IM2 only (**Table 3**). The low water clarity, inflow of freshwater, and lower concentrations of dissolved oxygen are the likely causes of mussel mortality in the lake.

Table 4 shows the number of species found at each station between February 2012 and March 2022. It shows diversity has not changed significantly compared to previous years, and that diversity between Control, Reference and Impact stations do not vary greatly.

 Table 4.
 Number of species found at each Station from February 2012 to March 2022

Station	C1	C2	C 3	C4	C5	C6	C 7	R1	R2	R3	R4
Feb 2012	10	5	5	7				8	8	5	5
Sept 2012	3	6	4	4				6	3	4	5
March 2013	4	5	7	7				6	5	6	5
Sept 2013	6	6	3	7				5	6	5	4
March 2014	4	3	5	5				6	4	5	3
Sept 2014	3	4	4	8				6	5	6	6
March 2015	3	3	5	3				5	3	6	5
Sept 2015	5	4	4	3				5	3	4	6
March 2016	6	4	5	5	5			6	5	6	4
Sept 2016	7	3	6	5	4	8		8	4	5	6
March 2017	2	4	5	3	5	5		4	5	4	5
Sept 2017	4	4	4	4	4	5		4	3	6	5
March 2018	4	4	8	4	4	3	5	7	8	5	4
Sept 2018	3	4	4	6	5	5	5	4	4	5	5
March 2019	6	3	4	4	6	5	3	4	5	7	3
Sept 2019	5	6	5	5	4	5	6	4	3	7	4
March 2020	5	6	6	4	7	3	6	6	6	7	4
August 2020	6	5	4	4	3	5	5	4	5	7	4
March 2021	5	6	3	4	5	2	2	5	4	7	4
Sept 2021	4	4	7	6	7	7	6	5	4	8	3
March 2022	5	6	4	7	6	7	4	6	4	9	7
Station	R5	R6	R7	R8	R9	R10	R11	IM1	IM2	IM3	IM4
Feb 2012	R5	R6	R7	R8	R9	R10	R11	IM1 7	IM2 4	IM3	IM4 5
	R5	R6	R7	R8	R9	R10	R11				
Feb 2012	R5	R6	R7	R8	R9	R10	R11	7	4	4	5
Feb 2012 Sept 2012	R5	R6	R7	R8	R9	R10	R11	7	4	4	5 5
Feb 2012 Sept 2012 March 2013	R5	3	R7	R8	R9	R10	R11	7 4 7 4 5	4 4 5	4 3 5	5 5 5
Feb 2012 Sept 2012 March 2013 Sept 2013			R7	R8	R9	R10	R11	7 4 7 4	4 4 5 3	4 3 5 4	5 5 5 5
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015	4 3 3	3	R7	R8	R9	R10	R11	7 4 7 4 5 5	4 4 5 3 9	4 3 5 4 4	5 5 5 5 5
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015	4 3	3 3 3 4		R8	R9	R10	R11	7 4 7 4 5 5 5 5	4 4 5 3 9 6 4 5	4 3 5 4 4 3 4	5 5 5 5 5
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015 March 2016	4 3 3 5 4	3 3 3 4 4	8			R10	R11	7 4 7 4 5 5 5 5	4 4 5 3 9 6 4 5 6	4 3 5 4 4 3 4 4 3	5 5 5 5 5 6 5 4 4
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015 March 2016 Sept 2016	4 3 3 5 4 6	3 3 3 4 4 7	8 7	5	8	R10	R11	7 4 7 4 5 5 5 5 6 6	4 4 5 3 9 6 4 5 6 4	4 3 5 4 4 3 4 4 3 6	5 5 5 5 6 5 4 4 3
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015 March 2016 Sept 2016 March 2017	4 3 3 5 4 6 4	3 3 4 4 7 4	8 7 4	5 3	8 5	R10	R11	7 4 7 4 5 5 5 5 6 6	4 4 5 3 9 6 4 5 6 4	4 3 5 4 4 3 4 4 3 6 3	5 5 5 5 5 6 5 4 4 3 4
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015 March 2016 Sept 2016 March 2017 Sept 2017	4 3 3 5 4 6 4	3 3 4 4 7 4	8 7 4	5 3 5	8 5 4			7 4 7 4 5 5 5 5 6 6 3 5	4 4 5 3 9 6 4 5 6 4 4 5	4 3 5 4 4 3 4 4 3 6 3 5	5 5 5 5 6 5 4 4 3 4 5
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015 March 2016 Sept 2016 March 2017 Sept 2017	4 3 3 5 4 6 4 4 6	3 3 3 4 4 7 4 4 4 3	8 7 4 4	5 3 5 3	8 5 4	4	4	7 4 7 4 5 5 5 5 6 6 3 5 5	4 4 5 3 9 6 4 5 6 4 4 5 7	4 3 5 4 4 3 4 4 3 6 3 5 3	5 5 5 5 6 5 4 4 3 4 5 4
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015 March 2016 Sept 2016 March 2017 Sept 2017 March 2018 Sept 2018	4 3 3 5 4 6 4 4 6 5	3 3 3 4 4 7 4 4 3 4	8 7 4 4 4 6	5 3 5 3 4	8 5 4 4 5	4 4	4 4	7 4 7 4 5 5 5 5 6 6 3 5 4	4 4 5 3 9 6 4 5 6 4 5 7 8	4 3 5 4 4 3 4 4 3 6 3 5 3 4	5 5 5 5 6 5 4 4 3 4 5 4
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015 March 2016 Sept 2016 March 2017 Sept 2017 March 2018 Sept 2018 March 2019	4 3 3 5 4 6 4 4 6 5 5	3 3 4 4 7 4 4 3 4	8 7 4 4 4 6 4	5 3 5 3 4 4	8 5 4 4 5	4 4 6	4 4 6	7 4 7 4 5 5 5 5 6 6 3 5 5 4 5	4 4 5 3 9 6 4 5 6 4 4 5 7 8 5	4 3 5 4 4 3 4 4 3 6 3 5 3 4 4 2	5 5 5 5 6 5 4 4 3 4 5 4 4 4 4
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015 March 2016 Sept 2016 March 2017 Sept 2017 March 2018 Sept 2018 March 2019 Sept 2019	4 3 3 5 4 6 4 4 6 5 5 4	3 3 3 4 4 7 4 4 3 4 4 4	8 7 4 4 6 4 5	5 3 5 3 4 4	8 5 4 4 5 4	4 4 6 4	4 4 6 3	7 4 7 4 5 5 5 6 6 3 5 5 4 5 6	4 4 5 3 9 6 4 5 6 4 4 5 7 8 5 5	4 3 5 4 4 3 4 4 3 6 3 5 3 4 4 2 7	5 5 5 5 5 6 5 4 4 3 4 5 4 4 5
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015 March 2016 Sept 2016 March 2017 Sept 2017 March 2018 Sept 2018 March 2019 Sept 2019 March 2020	4 3 3 5 4 6 4 4 6 5 5 4 4	3 3 3 4 4 7 4 4 3 4 4 4 4 4	8 7 4 4 6 4 5 8	5 3 5 3 4 4 4 3	8 5 4 5 4 4 4	4 4 6 4 4	4 4 6 3 4	7 4 7 4 5 5 5 6 6 3 5 5 4 5 6 7	4 4 5 3 9 6 4 5 6 4 4 5 7 8 5 7	4 3 5 4 4 3 4 4 3 6 3 5 3 4 4 2 7 4	5 5 5 5 6 5 4 4 3 4 5 4 4 4 5 4
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015 March 2016 Sept 2016 March 2017 Sept 2017 March 2018 Sept 2018 March 2019 Sept 2019 March 2020 August 2020	4 3 3 5 4 6 4 4 6 5 5 4 4 7	3 3 3 4 4 7 4 4 3 4 4 4 4 5	8 7 4 4 6 4 5 8	5 3 5 3 4 4 4 4 3 4	8 5 4 4 5 4 4 5	4 4 6 4 4 5	4 4 6 3 4 4	7 4 7 4 5 5 5 6 6 3 5 5 4 5 6 7 5	4 4 5 3 9 6 4 5 6 4 5 7 8 5 7 6	4 3 5 4 4 3 4 4 3 6 3 5 3 4 2 7 4 4	5 5 5 5 5 6 5 4 4 3 4 5 4 4 4 5 4 6
Feb 2012 Sept 2012 March 2013 Sept 2013 March 2014 Sept 2014 March 2015 Sept 2015 March 2016 Sept 2016 March 2017 Sept 2017 March 2018 Sept 2018 March 2019 Sept 2019 March 2020	4 3 3 5 4 6 4 4 6 5 5 4 4	3 3 3 4 4 7 4 4 3 4 4 4 4 4	8 7 4 4 6 4 5 8	5 3 5 3 4 4 4 3	8 5 4 5 4 4 4	4 4 6 4 4	4 4 6 3 4	7 4 7 4 5 5 5 6 6 3 5 5 4 5 6 7	4 4 5 3 9 6 4 5 6 4 4 5 7 8 5 7	4 3 5 4 4 3 4 4 3 6 3 5 3 4 4 2 7 4	5 5 5 5 6 5 4 4 3 4 5 4 4 4 5 4

Table 5 shows the mean number of marine benthic organisms for each station and species sampled in March 2022. The table includes depths relative to AHD for each station.

Table 5 Mean number of marine benthic organisms at Control (C), Reference (R) and Impact Stations (IM)

	Depth (m)	Polychaete	•	Polychaete	Gastropod	Gastropod	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Ophuroid	Fish	Crab
		thin	mud	thick	Nassarius	Bedeva	Corbula	Soletellina	Paphia	Anadara	Cyamiomactra	Trichomya	Dosinia			
C1	-4.5	1.2	0.2	2.2	0.0	0.0	1.4	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C2	-4.5	0.2	1.0	1.2	0.0	0.0	5.8	7.8	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
C3	-5.5	0.0	8.0	1.0	0.0	0.0	1.6	15.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C4	-6.0	1.0	8.0	0.6	0.0	0.0	0.0	2.2	0.2	0.0	0.0	0.0	8.0	0.0	0.0	0.0
C5	-6.0	0.2	2.8	8.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	3.4	0.0	0.0
C6	-5.5	0.4	0.2	0.4	0.0	0.0	2.6	6.8	0.4	0.0	0.0	0.0	0.2	0.0	0.2	0.0
C7	-5.5	3.0	3.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0
R1	-4.5	1.0	2.0	2.0	0.0	0.0	8.0	6.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R2	-4.5	0.4	0.0	2.6	0.0	0.0	3.2	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R3 (IM5)	-5.5	1.4	5.0	0.2	0.0	0.0	0.6	0.4	0.4	0.0	0.2	3.6	0.0	0.2	0.0	0.0
R4 (IM6)	-6.0	0.4	1.8	8.0	0.0	0.0	8.0	2.6	0.4	0.0	0.2	0.0	0.0	0.0	0.0	0.0
R5 (IM7)	-5.5	0.4	0.0	8.0	0.0	0.0	8.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R6	-6.0	0.0	8.0	0.4	0.0	0.0	0.6	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R7	-6.0	1.2	3.4	2.2	0.0	0.0	0.0	1.4	0.6	0.0	0.4	6.6	0.0	0.0	0.2	0.0
R8	-5.5	0.0	0.0	0.2	0.0	0.0	4.0	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R9	-4.5	2.8	0.0	0.6	0.0	0.0	8.0	10.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R10	-5.5	0.2	0.2	0.6	0.0	0.0	0.2	8.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
R11	-6.0	8.0	2.6	8.0	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IM1	-4.5	2.0	2.4	0.4	0.0	0.0	0.2	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IM2	-4.5	3.8	2.4	0.0	0.0	0.0	0.0	0.4	0.2	0.0	0.0	3.4	0.0	0.0	0.0	0.0
IM3	-5.5	8.0	0.4	0.2	0.0	0.0	1.4	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IM4	-6.0	1.0	1.8	1.2	0.0	0.0	8.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

March 2022

Analysis of Data

Statistics

Principal component (PC) biplots or multivariate scatterplots produced by the R-statistical program were used to explore the relationship between benthos study sites, animal species found in the sediment, and water quality variables at the lake bed. Points in the matrix were obtained by standardizing the data by subtracting the variable (column) mean from the species (cell) mean and dividing the subsequent value by the variable or column mean (Gabriel, 1971; Gabriel and Odoroff, 1990).

Biplots

A biplot is a particular kind of scatterplot used for displaying multivariate data which results from mapping a matrix of field observations, **X**, into a 2-dimensional graphical display. The name derives from the fact that this is a *joint* display of the rows and columns of **X**. Sample units (rows) are shown by points and variables (columns) by arrows. Biplots have several appealing properties. Firstly, they are capable of presenting graphically large amounts of information on composition, structure and relationships with surpassing ease and efficiency. It enables a truly global look at the data.

Interpretation of Biplots

Sample Points

- The proximity of any pair of sample points is directly proportional to their resemblance with respect to all the variables studied, the closer the points the greater the resemblance;
- Points close to the origin tend to be representative of the sample as a whole, that is, they tend to be average samples,
- Points far from the origin are atypical in that they possess usually large or small values of one or more variables.

Variable Arrows

- The origin of the configuration of arrows marks the mean value of each variable, an important reference point.
- Arrows can be extended through the origin (by eye) in either direction to any desired extent.
- With increasing distance from the origin along an arrow in the direction of an arrow, the value of the variable increases steadily above its mean; similarly, with increasing distance from the origin along an arrow extended by eye in the opposite direction, the value of a variable falls increasingly below its mean.
- Arrow length is directly proportional to the correlation coefficient, r, between the two variables. The smaller the angle the stronger the correlation. Variables x and y with arrows subtending an angle of:

1.	0° are perfectly correlated	$r_{xy}=1$
2.	90° are strictly uncorrelated	$r_{xy}=0$
3.	0° ≤ Angle < 90°	$0 \le r_{xy} < 1$
4.	90° ≥ Angle ≤180°	$0 < r_{xy} < -1$

From 3 it follows that variables whose arrows subtend angles less than 90° are positively correlated, and from 4, that variables whose arrows subtend angles greater than 90° are negatively correlated; in particular, where the angle is 180° , $r_{xy} = -1$.

In general, long arrows can be regarded as more useful in interpretation than short arrows. They have greater influence in differentiating sites.

Relationship between benthic organisms and stations

Figure 6 shows a biplot representing the relationship between marine benthic organisms and stations for the March 2022 survey.

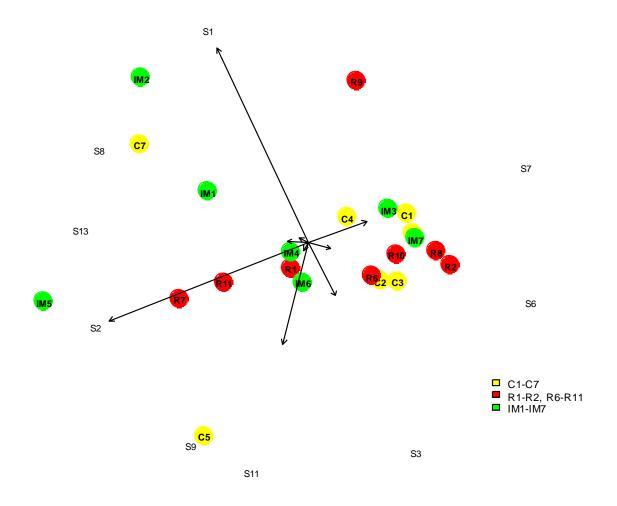


Figure 6. Relationship between benthic organisms and sampling stations – Lake Macquarie benthos survey March 2022 (PC biplot goodness-of-fit: 73.72%)

Station		Organism
C1 – Control Station C1	R8 – Reference Station R8	S1 Sthenelais pettiboneae
C2 – Control Station C2	R9 – Reference Station R9	S2 Polychaete mud
C3 – Control Station C3	R10 – Reference Station R10	S3 Polychaete thick
C4 – Control Station C4	R11 – Reference Station R11	S6 Corbula truncata
C5 – Control Station C5	IM1 – Impact Station IM1	S7 Soletellina alba
C6 – Control Station C6	IM2 – Impact Station IM2	S8 Paphia undulata
C7 – Control Station C7	IM3 – Impact Station IM3	S9 Cyamiomactra mactriodes
R1 – Reference Station R1	IM4 – Impact Station IM4	S11 Ophionereis schayeri
R2 – Reference Station R2	IM5 – Impact Station IM5	S13 Trichomya hirsuta (mussels)
R6 – Reference Station R6	IM6 – Impact Station IM6	
R7 – Reference Station R7	IM7 – Impact Station IM7	

Six species differentiated sampling stations during the March 2022 sampling period (Figure 6):

- The Polychaete *Sthenelais petitiboneae* (S1) characterised the Control Station C7; the Impact Stations IM1 and IM2; and the Reference Station R9.
- The Polychaete mud worm designated S2 characterised stations IM4, IM5, R7 and R11.
- The bivalve Soletellina alba (S7) defined the Control Stations C1, C2, C3, C4; the Reference Stations R2, R8, R9, R10; and the Impact Stations IM3 and IM7.
- The bivalve Corbula truncata (S6) defined Stations C2, C3, R2 and R8.
- The bivalve *Trichomya hirsuta* differentiated the Reference Station R7 and the Impact Stations IM5.
- The Control Station C5 was characterized by the brittle star Ophionereis schayeri.

Sediment Analysis

The sediment in the mud basin of Lake Macquarie off Summerland Point, in Chain Valley Bay and Bardens Bay was largely composed of fine grey/ black silty mud that was mildly plastic in nature (able to be molded into a coherent shape) or was very fine and fluid. Shell fragments were present in the sediment at most stations. The sediment at C5 consisted of fine to medium grey/black sand.

A description of the sediment samples collected in March 2022 is shown in Table 6.

 Table 6.
 Description of Sediment collected from Sampling Stations in March 2022.

Station	Description	Volume (mL)
C1	Fine grey silty mud with some shell	250
C2	Fine grey silty mud	250
C3	Fine grey silty mud	250
C4	Fine grey silty mud	250
C5	Grey sand and silt	250
C6	Fine grey silty mud with some shell	250
C7	Fine grey silty mud with grey sand and some shell	250
R1	Fine grey silty mud with some grey sand	250
R2	Fine grey silty mud with shell fragments	250
R3 (IM5)	Fine grey silty mud with some shell fragments	250
R4 (IM6)	Fine grey silty mud with some shell fragments	250
R5 (IM7)	Fine grey silty mud with some shell fragments	250
R6	Fine grey silty mud with some shell fragments	250
R7	Fine grey silty mud	250
R8	Fine grey silty mud with some shell fragments	250
R9	Fine grey silty mud with some shell fragments	250
R10	Fine grey silty mud with some shell fragments	250
R11	Fine grey silty	250
IM1	Fine grey silty mud with some shell fragments	250
IM2	Fine grey silty mud with some shell fragments	250
IM3	Fine grey silty mud with some large shell fragments	250
IM4	Fine grey silty mud with some shell fragments	250

Table 7 shows the percentage of silt in the sediment at each station from February 2012 to March 2022.

Table 7. Percent mud in sediment from each station – February 2012 to March 2022

	Sep-16	Mar-17	Sep-17	Mar-18	Sep-18	Mar-19	Sep-19	Mar-20	Aug-20	Mar-21	Sep-21	Mar-22
	% Mud											
C1	90	68	94	80	80	80	100	94	90	75	95	95
C2	80	92	80	80	64	70	100	86	95	94	95	100
C3	90	80	100	92	80	100	100	96	100	82	100	99
C4	75	98	100	80	40	80	100	92	100	60	95	100
C5	90	92	80	92	64	60	80	29	80	35	70	75
C6	80	92	100	84	60	70	100	100	95	75	98	95
C7				80	60	80	100	29	90	61	80	90
R1	70	96	100	80	80	80	96	96	70	55	100	95
R2	90	80	92	80	84	84	80	80	80	60	90	90
R3 (IM5)	90	96	100	80	96	92	80	92	95	60	52	95
R4 (IM6)	90	96	100	78	92	80	84	98	75	79	95	95
R5 (IM7)	90	88	100	70	80	80	100	94	100	95	95	95
R6	98	98	80	80	78	96	100	92	85	95	85	95
R7	90	94	92	50	80	98	84	92	95	94	90	100
R8	80	98	100	80	82	92	100	92	90	95	95	99
R9				80	84	70	100	80	95	60	90	90
R10				80	96	80	84	80	80	75	85	95
R11				80	30	50	92	100	90	75	98	100
IM1	90	76	96	80	60	80	80	70	95	90	70	80
IM2	98	98	98	92	70	60	80	80	80	95	95	94
IM3	99	96	100	92	96	80	92	90	95	95	98	95
IM4	99	84	92	100	80	80	92	92	90	95	98	90

Water Quality Profiles - March 2022

At each station, water quality was determined using a calibrated Yeo-Kal 618RU Analyser. Units of measurement were Temperature (TEMP) - degrees Celsius; Conductivity (COND) - mS/cm; Salinity (SAL) - parts per thousand; pH; Dissolved Oxygen - % saturation and mg/L; and Turbidity (TURB) - NTU (**Table 8**).

Up until recently, little significant rain has fallen in the catchments of Lake Macquarie. Annual rainfall in the Cooranbong (Lake Macquarie AWS) region was 839.8 mm in 2017; 859.8 mm in 2018 and 763.4 mm in 2019 (BOM Station Number 061412). The lack of rainfall caused the salinity of the water column to become very high (over 39 parts per thousand by March 2019) and almost uniform from surface to bottom. The Lake Macquarie region has since received relatively heavy rainfall in August (111.2 mm) 2019; February (335.4 mm), March (173.0 mm), July (184.0 mm), October (150.8 mm) and December (220.6 mm) 2020 (BOM Station Number 061412); and January (104.8 mm), February (155.8 mm) and March (421.6 mm) 2021. This

rainfall lowered the salinity of water in the lake to around 36 parts per thousand in 2019, 33 parts per thousand in March 2020, and 32 parts per thousand in August 2020. Monthly rainfall for the Cooranbong region in January and February 2022 was 152.2 mm and 247.6 mm respectively. At the time of sampling, a further 268.8 mm had fallen in the catchment. Mean salinity of Lake Macquarie bottom waters is currently 32.89 parts per thousand (**Table 8**).

The physical characteristics of the bottom waters of Lake Macquarie in March 2022 were as follows:

- Water Temperature ranged from 24.73°C to 27.26°C. Mean water temperature was 25.41°C.
- Conductivity ranged from 43.99 mS/cm to 52.76 mS/cm. Mean conductivity was 50.05 mS/cm.
- Salinity ranged from 28.63 ppt to 34.77 ppt. Mean salinity was 32.89 ppt.
- Turbidity ranged from 8.9 NTU to 15.9 NTU. Mean turbidity was 11.46 NTU.
- pH ranged from 7.44 and 7.99. Mean pH was 7.83.
- Dissolved oxygen (% saturation) ranged from 4.2% to 114.1%. Mean dissolved oxygen was 67.8% saturation.
- Dissolved oxygen (mg/L) ranged from 0.28 mg/L to 7.76 mg/L. Mean dissolved oxygen was 4.60 mg/L (Appendix 1).

The physical characteristics of the bottom water are shown in **Table 8**.

Table 8Physical characteristics of the bottom water – March 2022

Station	Temperature	Conductivity	Salinity	Dissolved Oxygen	Dissolved Oxygen	рН	Turbidity	Depth
	°C	mS/cm	ppt	% sat	mg/L		NTU	m
C1	27.26	44.36			7.70	7.98	9.2	3.22
C2	25.58	51.30	33.68	84.1	5.67	7.97	11.7	4.41
C3	25.48	51.34	33.73	86.0	5.81	7.99	12.1	4.91
C4	24.73	51.89	34.1	4.2	0.28	7.44	8.9	6.13
C5	24.88	52.65	34.67	65.4	4.47	7.93	13.1	6.09
C6	25.28	52.17	34.35	72.0	4.84	7.93	12.8	4.82
C7	25.34	46.75	30.39	62.2	4.30	7.76	11.1	3.62
R1	25.84	51.11	33.54	87.0	5.86	7.94	10.9	3.05
R2	24.98	43.99	31.79	43.6	3.12	7.54	11.9	4.37
R3 (IM5)	25.19	52.49	34.57	63.7	4.32	7.9	9.2	6.80
R4 (IM6)	25.07	52.68	34.7	57.9	3.93	7.88	10.2	6.91
R5 (IM7)	25.53	47.43	30.74	53.7	3.69	7.64	12.7	4.14
R6	25.02	49.80	32.58	29.1	1.71	7.51	12.9	5.54
R7	24.9	52.76	34.77	61.9	4.19	7.9	12.5	7.17
R8	25.34	52.53	34.59	58.6	3.94	7.87	15.9	5.72
R9	25.92	44.79	28.92	105.5	7.28	7.99	9.3	2.30
R10	25.02	49.55	31.59	50.7	3.48	7.63	10.3	4.38
R11	24.91	52.44	34.52	73.3	4.98	7.97	12.4	6.30
IM1	26.9	44.72	28.78	114.1	7.76	7.98	9.1	3.81
IM2	25.68	51.25	33.65	84.2	5.71	7.97	10.9	3.86
IM3	25.17	52.58	34.63	55.6	3.75	7.85	9.7	6.17
IM4	25.09	52.50	34.57	64.9	4.40	7.79	15.3	5.95
Mean	25.41	50.05	32.89	67.8	4.60	7.83	11.46	4.99
Min	24.73	43.99	28.63	4.2	0.28	7.44	8.9	2.30
Max	27.26	52.76	34.77	114.1	7.76	7.99	15.9	7.17

Conclusions

The results from the March 2022 benthic communities monitoring results show compliance to the Schedule 4 Environmental Conditions - underground mining of SSD5465 - Modification 2 in the Performance Measures table with respect to the Subsidence Impact Performance Measure for Benthic communities which display nil to minor environmental consequences due to underground mining.

The below summary of findings outlines the historical basis for this compliance statement and the compliance is detailed in the table below.

Conditions from SSD-5465 - Mod 3	Compliance Status and Comments
Schedule 4 Environmental Conditions – underground mining Performance Measures – Natural Environment Biodiversity – Benthic Communities Subsidence Impact Performance Measure – Minor environmental consequences, including minor changes composition and/or distribution.	Compliant – See section 16 - Conclusions
Measurements undertaken by generally accepted methods. Measures Methods fully described.	Compliant – See section 4 and 5 Compliant – See section 4 and 5

In March 2022, 22 benthic stations were sampled in the study area. A total of 1196 organisms greater than 1mm in size were found, comprising 10 species. This compares with the results from March 2017, March 2018, March 2019, March 2020 and March 2021 where 1031, 1160, 832, 1032 and 797 organisms respectively were recorded representing approximately twelve species. As in previous years, polychaete worms and bivalve molluscs were the most frequently encountered animals. Stations were distinguished by the relative abundance of the dominant species. Water depth was not in any way important in determining the species composition at a station.

Physical variables such as salinity, conductivity and turbidity of the bottom water had little influence on the species composition of the benthos. Dissolved oxygen concentration, however, can have a major effect on abundance. Major extinction events have occurred in the mud basin of Lake Macquarie. The evidence for this lies in the presence of large numbers of intact but dead bivalve shells entombed in the mud. The cause of extinction events appears to be prolonged dissolved oxygen depletion of bottom water. Prolonged dissolved oxygen depletion of the bottom water was measured during the water quality study conducted by Laxton and Laxton (1983 to 1997) and low dissolved oxygen levels were measured during the March 2020 benthic survey. In March 2022, dissolved oxygen levels of Lake Macquarie ranged from 4.2% saturation to 114.1% saturation. Surface waters had higher concentrations of dissolved oxygen than the bottom waters.

Bottom sediment in the study area was composed of fine black mud with varying proportions of black sand and shell fragments. In March 2020 some changes to the composition of the upper 100mm of the bottom sediments were detected. At Stations C5 and C7 the sediment comprised mostly sand where previously it was fine black silt. In March 2022, sediment comprised mostly of fine grey/black silty mud with some shell.

These results appear to support the notion that increasing the water depth by the predicted 0.8m

subsidence has, to date, had little to no discernible effect on the composition and abundance of organisms making up the benthos of the mud basin.

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Delta Coal Mannering & CVC Collieries

Lake Macquarie Benthos Survey
Results No. 22



By Dr Emma Laxton

September 2022

J.H. & E.S. Laxton - Environmental Consultants P/L Mobile: 0429 855 891 Email: emmalaxton07@gmail.com

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Summary

J.H. & E.S. Laxton – Environmental Consultants P/L was engaged by Mr. Lachlan McWha of Chain Valley Colliery to assess the potential effects of bord and pillar extraction mining beneath Lake Macquarie on benthic fauna.

The benthic survey was conducted on 7th and 12th September 2022 by Dr Emma Laxton of J.H. & E.S. Laxton – Environmental Consultants P/L. The survey involved the collection of benthos at 22 stations. The stations consisted of seven Control, eight Reference and seven Impact stations.

A total of 1981 benthic marine organisms greater than 1 mm in size were captured in the study area of Lake Macquarie during the survey. These organisms represented twelve species. The fauna included four species of polychaete worm; six species of bivalve; one species of brittle star; and one crab species. The greatest numbers of organisms were collected at station R10 (302 organisms), and the least numbers of organisms at station R7 (35 total).

The bivalve *Soletellina alba* was the most encountered organism and was collected in relatively large numbers throughout the study area. Polychaete worms were also common in the benthos.

Very few mussels were found alive during the survey. Mussel mortality may be due to the inflow of freshwater into the lake. Dissolved oxygen concentrations may not be a factor. Mine subsidence is also unlikely to be a cause of mussel deaths. The station with the greatest number of living mussels was R7 where samples were collected at around -5.85m AHD.

Species diversity at each station ranged from 3 to 8 species and was comparable with previous years. In September 2022, Control stations had a range of 5 to 7 species represented; Reference stations had a range of 4 to 7 species; and the Impact stations had a range of 3 to 8 species.

Seven species differentiated sampling stations during the September 2022 sampling period. These included the polychaete *Sthenelais petitiboneae* that characterized stations R9, R7 and C5, and the bivalve *Dosinia sculpta* that differentiated station R10.

There was variation between the sediments collected at each station within the study area. For most stations, the sediment collected off Summerland Point, Chain Valley Bay and Bardens Bay was largely composed of fine grey silt with small to large shell fragments. However, sediment collected at stations C7 and R10 also contained a large amount of coarse grey sand. The sediment sample collected at R7 was comprised of 98% shell

In September 2022, water quality profiles measured at each station recorded the effects of water depth on dissolved oxygen, salinity, conductivity and water temperature in Lake Macquarie. The concentration of dissolved oxygen, water temperature and pH decreased with depth. Conductivity was relatively uniform throughout the water column. Salinity increased slightly from surface to bottom.

Testing of the bottom water at each station found dissolved oxygen ranged from 93.8% to 109.2%. Mean dissolved oxygen of bottom waters was 101.1% saturation. Water temperature ranged from 17.09°C to 17.87°C, with a mean water temperature of 17.42°C. Conductivity ranged from 49.99 mS/cm to 51.84 mS/cm. Mean conductivity of bottom water was 51.04 mS/cm. Salinity ranged from 32.72 ppt to 34.07 ppt, with a mean salinity of 33.49 ppt. Turbidity ranged from 2.3 NTU to 39.3 NTU. Mean turbidity was 12.1 NTU. pH ranged from 8.09 to 9.16, mean pH was 8.31.

Rainfall in the months preceding the survey were 11mm, 402.8mm, and 37.8mm for June, July and August respectively (Cooranbong Lake Macquarie AWS No. 61412). By 12th September a further 69 mm had fallen in the catchment.

These results appear to support the notion that increasing the water depth by up to 0.78m (SSD-5465 subsidence limit in Lake Macquarie) has, to date, had little to no discernible effect on the composition and abundance of organisms making up the benthos of the mud basin.

1. Introduction

Lake Macquarie is the largest saline lake in New South Wales. It lies on the central coast between Sydney and Newcastle within the local government areas of Central Coast Council and Lake Macquarie Council. Lake Macquarie has a catchment of 700 square kilometers and a water surface area of 125 square kilometers (Bell & Edwards, 1980). The lake has a permanent entrance to coastal waters at Swansea.

The catchment of Lake Macquarie is largely rural with large areas of bushland and grazing land. The shoreline of Lake Macquarie is heavily urbanized, especially the eastern, western and northern shorelines. The region has a relatively long history of coal mining and power generation, with mining occurring since the late 1800s and the first power station at Lake Macquarie commencing operations in 1958.

Chain Valley Colliery is situated on the southern shores of Lake Macquarie near Mannering Park, NSW. The mine has been operating since 1963. Mining is continuing within the Chain Valley Coal Lease Area using the miniwall method. Prior to mining, there were three economically viable seams in the lease area, namely the Wallarah seam (not mined since 1997); the Great Northern seam, and the Fassifern seam. In 2018 Chain Valley Colliery went into voluntary receivership and was taken over by Great Southern Energy Pty Ltd (trading as Delta Coal) to provide coal for Vales Point Power Station.

Delta Coal is currently mining the Fassifern Seam beneath Lake Macquarie. As part of the protection of the lake foreshore, the mining leases require a protection zone. This zone, known as the High Water Mark (HWM) Subsidence Barrier, was calculated using a 35° angle of draw from the depth of mining. The zone is approximately 130 meters wide. J.H. & E.S. Laxton – Environmental Consultants P/L was engaged by Mr. Lachlan McWha, Environmental Compliance Coordinator for Chain Valley Colliery, to assess the potential effects of pillar extraction mining on benthic fauna in Lake Macquarie.

The monitoring programme consists of 22 stations, seven Control, eight Reference and seven Impact stations. Control stations are in areas of lakebed sufficiently remote from previous or proposed mining. Reference stations are located in areas of lakebed above subsidence areas of previous mining. Impact stations are in areas of lakebed where subsidence is expected from future mining. Two depth zones within the mud basin were sampled, -4.5m AHD and -5.5 to -6.0m AHD.

This report presents the results of the just completed 22nd sampling of stations situated off Summerland Point, in Chain Valley Bay, Bardens Bay and Sugar Bay. These results will be compared with those

obtained from the previous twenty-one surveys (February 2012 to March 2022). The September 2022 benthic survey was conducted between the 7th and 12th September. Water quality variables were measured on 12th September 2022.

2. Location of Sampling Stations

Figure 2.1 shows the location of sampling stations, depth contours of the lake, and the locations of existing and proposed underground mine workings. **Table 2.1** provides the exact location of each sampling station by latitude and longitude and by eastings and northings using WGS84 datum. The table also shows the depth of water at each station. **Figure 2.2** shows the extent of mining from March 2021 to March 2022, it is noted that all workings undertaken by Delta Coal from September 2021 have been classified as First Workings only.

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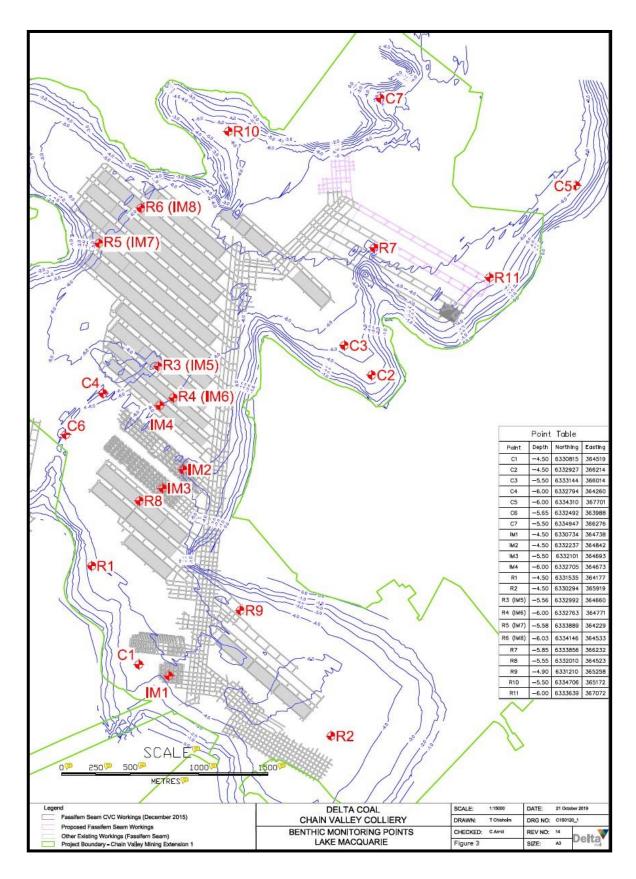


Figure 2.1 Location of benthic sampling stations

 Table 2.1
 Co-ordinates and water depth at each benthic sampling station

Station	Sample depth (m) AHD	Latitude	Longitude	MG-56 Easting	MG56 Northing
C1	-4.50	S33º 09' 10.69"	E151° 32' 50.11"	364519	6330815
C2	-4.50	S33° 08' 02.89"	E151° 33' 56.65"	366214	6332927
C3	-5.50	S33° 07' 55.78"	E151° 33' 49.05"	366014	6333144
C4	-6.00	S33° 08' 06.35"	E151° 32' 41.17"	364260	6332794
C5	-6.00			367701	6334310
C6	-5.50			363988	6332492
C7	-5.50			366276	6334947
IM1	-4.50	S33º 09' 13.44"	E151° 32' 58.51"	364738	6330734
IM2	-4.50	S33º 08' 24.67"	E151° 33' 03.34"	364842	6332237
IM3	-5.50	S33° 08' 29.02"	E151° 32' 57.52"	364693	6332101
IM4	-6.00	S33° 08' 09.42"	E151° 32' 57.04"	364873	6332705
R1	-4.50	S33º 08' 47.18"	E151º 32' 37.31"	364177	6331535
R2	-4.50	S33° 09' 28.23"	E151° 33' 43.87"	365919	6330294
R3 (IM5)	-5.50	S33° 08' 00.10"	E151° 32' 56.72"	364660	6332992
R4 (IM6)	-6.00	S33° 08' 07.58"	E151° 33' 00.88"	364771	6332763
R5(IM7)	-5.50	S33° 07′ 30.78″	E151° 32' 40.55"	364229	6333889
R6 (IM8)	-6.00	S33° 07' 22.56"	E151° 32' 52.42"	364533	6334146
R7	-6.00			366232	6333856
R8	-5.50			364523	6332010
R9	-4.50			365258	6331210
R10	-5.50			365172	6334706
R11	-6.00			367072	6333639

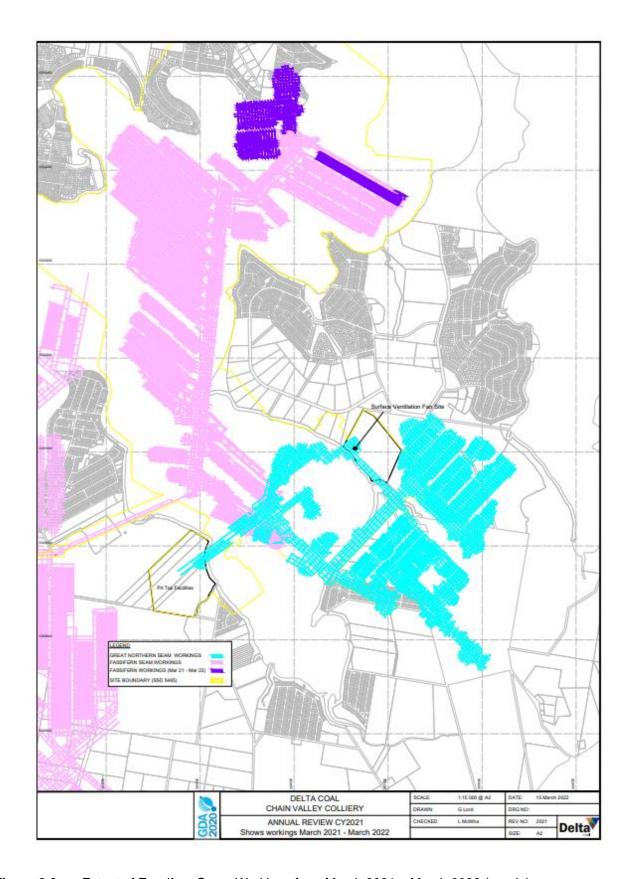


Figure 2.2 Extent of Fassifern Seam Workings from March 2021 – March 2022 (purple)

3. Sampling Procedure

Twenty-two stations were sampled in September 2022. At each station the following procedure was carried out:

- A GPS unit was used to locate the sampling station.
- A line with five sieve boxes (five replicates of 200 x 200 x 100 mm collection boxes with 1 mm mesh) and two core samplers (100 x 200 mm cylinders with 1 mm mesh) was cast overboard and secured as the boat drifted into position.
- The sieve boxes were filled using the forward momentum of the work boat.
- The samplers were then hauled to the surface, and the contents of each sampler placed in a clean, labeled zip-lock plastic bag.
- A 250mL jar was filled using the sediment collected from the core samplers.
- Processing of samples occurred in the laboratory.
- A water quality profile from surface to bottom was measured using a calibrated Yeo-Kal 618RU Water Quality Analyser. Water temperature, conductivity, salinity, pH, dissolved oxygen, turbidity and depth were measured. Each line of data was stored in the memory of the machine.

In the laboratory the marine benthic samples were treated in the following way:

- Each sample was tipped into a 1 mm mesh sieve and washed free of mud.
- The washed material from each sample was then placed into a tray and sorted for animals.
- Organisms and parts of organisms were removed, counted, identified and the results entered into a spread sheet. This process was repeated until the debris of the entire sample had been examined.
- Sorted organisms were preserved in formaldehyde solution.
- All shell remaining in the sample was kept for later examination.

The 250mL samples of whole sediment were treated in the following way:

- Each sample was tipped into a 1L measuring cylinder and the volume made up to 800mL with freshwater.
- The cylinders were stoppered and shaken vigorously to suspend the sediment in the

freshwater.

- The cylinders were then placed on the laboratory bench to allow the fractions of the sediment to settle.
- Fractions were decanted into separate measuring cylinders and allowed to settle.
- Once settled the volumes of each fraction (silt, sand, gravel and shell) were calculated and recorded. Results were displayed relative to the final volume of sediment collected.

4. Factors affecting the depth of water in Lake Macquarie

The bathymetric chart (**Figure 4.1**) of Lake Macquarie shows water depths relative to AHD throughout the year 1997. The actual depth of water above the lakebed varied greatly, between 0 and 1.3m above AHD.

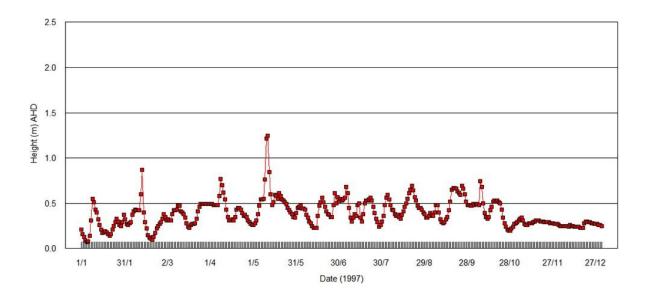


Figure 4.1 Water level changes in a coastal lagoon with an entrance open to coastal waters.

Water depths in coastal saline lakes with an open entrance to coastal waters vary due to combinations of the following factors:

 The body of Lake Macquarie is subject to tidal influence. The height of the tidal prism at Swansea Head may reach almost 2m (during spring tides) but by the time the body of the lake is reached, the tidal prism has been reduced to around 0.05m.

- The height of coastal waters and coastal lakes are influenced by changes in atmospheric pressure. The Tasman Sea acts as a huge barometer. When the atmospheric pressure is high the sea surface is depressed. This causes water to drain from Lake Macquarie causing the depth of water in the body of the lake to decrease. When the atmospheric pressure over the Tasman Sea is low, the surface of the sea bulges upwards. This raising of sea level causes water to flow into Lake Macquarie, increasing the water depth.
- Low pressure systems in the Tasman Sea almost always generate strong winds and coastal rainfall. The strong winds cause large swells to form that impact the coast. Wave setup at the entrance to Lake Macquarie causes the water level in the lake to rise as large volumes of seawater enter the system.
- Rainfall during a period of low atmospheric pressure causes runoff into catchment rivers and streams to increase. When this extra water reaches the body of Lake Macquarie, the water level rises in proportion to the runoff volume. This water is prevented from exiting the lake by wave setup at the entrance and the state of the tide. Under these circumstances, the level of the lake can rise to heights of a meter or more above AHD (Figure 4.1).

5. Benthos of the study area – February 2012 to September 2022

Table 5.1 shows the organisms found in the sediment samples collected off Summerland Point and in Chain Valley Bay between February 2012 and September 2022. **Plates 5.1** to **5.6** provide information about the benthic organisms present in the basin mud of Lake Macquarie, NSW.

 Table 5.1
 Organisms found in Benthos of Lake Macquarie (2012-2022)

Designated name	Family or Species	Comments
Anemone	Coelenterata	Found associated with mussel shells.
Planaria (Flat worm)	Platyhelminthes	2 specimens found in 2017.
Polychaete	Sthenelais pettiboneae	Most common polychaete present.
Polychaete	Cirratulidae	Present in small numbers.
Polychaete (mud tube)	Not yet identified	Present in small numbers.
Polychaete	Chaetopterus	Present in small numbers.
Polychaete	Pectinaria sp	First found in March 2019
Gastropod	Nassarius jonasii	Present in small numbers.
Gastropod	Lepsiella (Bedeva)	Present in small numbers.
	hanleyi	
Gastropod	Bullimorph slug	One specimen found in August 2014.
Bivalve	Corbula truncata	Common as live animals and dead shells.
Bivalve	Soletellina alba	Common
Bivalve	Paphia undulata	Uncommon as live animals. Common as dead
		shells.
Bivalve	Cyamiomactra mactroides	Uncommon. (Brown or pink bivalve)
Bivalve	Anadara trapezia	Uncommon.
Bivalve	Dosinia sculpta	Many juveniles found in sandy sediment in
		September 2019.
Bivalve	Trichomya hirsuta	Common as dead shells. Found in large clumps at
		C2, C6, R3, R7, IM2 and IM3.
Bivalve	Saccostrea glomerata	Oysters were first observed on mussels and other
		bivalves at C4 and C6 in 2021.
Ophuroid	Brittle star	Uncommon. Found amongst mussel clumps and
		on mud.
Echinoid	Sea urchin	Uncommon. Found at C5 and C7 in 2021.
Sponge	White calcareous sponge	Specimen found associated with mussels.
	Pink sponge	Small species found on mud surface.
	Red sponge	Several specimens found in 2019.
Crabs	Small	Uncommon.
Prawn	Small	One specimen taken in March 2013 at R3 and one
		specimen in September 2013 at C4.

Fish	Small (35mm)	One specimen taken at C3 (September 2012), at
		R1 (September 2013) and at IM4 in March 2017.
		1 specimen in C6 in 2019.

Plate 5.1 Annelid species found in the benthos of Lake Macquarie (February 2012 – September 2022).



Phylum: Annelida
Class: Polychaeta
Subclass: Errantia
Ordor: Phyllodoxid

Order: Phyllodocida Family: Sigalionidae

Species: Sthenelais pettiboneae

Remarks: Found in marine environments.



Phylum: Annelida
Class: Polychaeta
Subclass: Canalipalpata
Order: Terebellida
Family: Cirratulidae

Remarks: Cirratulids vary in size from 1-20 cm long. They are mostly burrowers in soft sediments but some live in rock crevices. The head is conical or wedge-shaped and has no antennae. The body is generally cylindrical, tapering at both ends. Cirratulids are characterised by many simple elongate filaments along the body. The genera are poorly defined.



Phylum: Annelida
Class: Polychaeta
Subclass: Canalipalpata
Order: Terebellida
Family: Chaetopteridae
Genus: Chaetopterus

Remarks: *Chaetopterus* or the parchment worm or parchment tube worm is a genus of marine polychaete worm that live in a tube constructed in sediments or attaches to a rocky or coral reef substrate. The common name arises from the parchment-like appearance of the tubes that house these worms.



Phylum: Annelida
Class: Polychaeta
Subclass: Canalipalpata
Order: Terebellida
Family: Pectinariidae

Remarks: Pectinariidae live vertically, head-down in sandy sediments, with the narrow tip of the conical tube at about the sediment surface. They feed on buried organic matter within the sediments. *Pectinaria anitpoda* is one of the most common and widespread member of this family. Found in inshore waters and off the continental shelf to a depth of about 90 m.

Plate 5.2 Gastropod species found in the benthos of Lake Macquarie (February 2012 – March 2022).



Phylum: Mollusca
Class: Gastropoda
Superfamily: Buccinoidea
Family: Nassariidae
Species: Nassarius jonasii

Remarks: Endemic to Australia; Noosa Heads, Qld, to SA. Inhabit sand and mud flats in estuaries and lagoons, intertidal down to 100 m. Most *Nassarius* species are very active scavengers. They often burrow into marine substrates and then wait with only their siphon protruding, until they smell nearby food.



Phylum: Mollusca Class:

Gastropoda

Order: Neogastropoda Family: Muricidae

Species: Lepsiella (Bedeva) hanleyi

Remarks: Common name mussel drill. Shell up to 32 mm, with angulated whorls, a high spire and moderately long anterior canal and with both spiral threads and axial ribs. Endemic to Australia. Found in temperate and southern parts of tropical Australia. Lives mainly on sheltered shores, including estuaries and often in association with mangroves. Feeds by drilling holes in bivalves. Lays lens-shaped capsules and development is direct.

Plate 5.3 Bivalve species found in the benthos of Lake Macquarie (February 2012 – September 2022).



Phylum: Mollusca

Class: Bivalvia

Order: Myoida

Family: Corbulidae

Species: Corbula truncata

Remarks: Marine bivalve mollusc.



Phylum: Mollusca

Class: Bivalvia

Order: Veneroida

Family: Psammobiidae

Species: Soletellina alba

Remarks: Posterior and anterior margins almost parallel. Shell thin and normally bluish, rarely white. Lives intertidally and subtidally in sand and mud, especially in sheltered environments. Occurs all around Australia; not recorded elsewhere.



Phylum: Mollusca
Class: Bivalvia
Order: Veneroida
Family: Veneridae

Species: Paphia undulata

Remarks: Saltwater clam, marine bivalve mollusc. Inhabits inshore shallow sandy seabeds.



Phylum: Mollusca
Class: Bivalvia
Order: Veneroida
Family: Veneridae
Species: Dosinia sculpta

Remarks: *Dosinia* is a genus of saltwater clams, marine bivalve molluscs in the family Veneridae, (subfamily Dosiniinae). The shell of *Dosinia* species is disc-like in shape, usually white, and therefore is reminiscent of the shells of Lucinid bivalves.

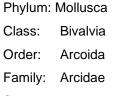
Typically found in the intertidal zone at the water's edge at a mean distance from sea level of -15 meters (-50 feet).



Phylum: Mollusca
Class: Bivalvia
Order: Veneroida
Family: Cyamiidae

Species: Cyamiomactra mactroides





Species: Anadara trapezia

Remarks: Sydney cockle, or ark cockle is an estuarine filter-feeding bivalve. Its calcareous, heavily-ribbed, shell can grow to approximately 7 to 8 cm across. Its current range is along the east coast of Australia, from Queensland to Victoria. It has been used as an indicator species to study levels of the metals selenium, copper and cadmium.



Phylum: Mollusca Class: Bivalvia Order: Mytiloida Mytilidae Family:

Species: Trichomya hirsuta

Remarks: The hairy mussel is a major part of the megafauna of Lake Macquarie. It is tolerant of low oxygen levels in the water and its temperature tolerance range has been researched in connection with using the waters of the lake for cooling power stations.

Hairy mussels have been used as bioindicators to monitor concentrations of heavy metals (namely Pb. Cd, Cu, Zn, Co, Ni, and Ag) in marine environments.

Phylum: Mollusca Class: Bivalvia Order: Ostreoida Family: Pectinidae

Species: Saccostrea glomerata

Remarks: Sydney rock oysters are endemic to Australia and New Zealand. In Australia it is found in bays, inlets and sheltered estuaries from Wingan Inlet in eastern Victoria, along the east coast of NSW and up to Hervey Bay QLD, around northern Australia and down the west coast to Shark Bay in WA. Sydney rock oysters are capable of tolerating a wide range of salinities. They are usually found in the intertidal zone to 3 metres below the low water mark.

Plate 5.4 Brittle stars found amongst the mussel beds of Lake Macquarie, NSW.



Phylum:EchinodermataClass:OphiuroideaOrder:Ophiurida

Family: Ophionereididae

Species: Ophionereis schayeri

Remarks: Largest and most common brittle star found in Sydney waters. Brittle stars have five long, slender arms which radiate out from a central disc. The mouth is located in the centre of the underside of the disc. There is no anus. Offshore, brittle stars form dense aggregations. In intertidal zones, they are typically found as single individuals in crevices, under stones and amongst seaweed. They feed by raising their arms above the substrate; extending tube-feet; and removing particles from the water. They pass food along the arms to the mouth. They also scavenge on decaying matter. They inhabit the hairy mussel beds of Lake Macquarie.

Plate 5.5 Sand dollar sea urchins found in Lake Macquarie, NSW



Phylum: EchinodermataClass: EchinoideaOrder: ClypeasteroidaFamily: Spatangidae

Species: Echinocardium cordatum

Remarks: Sand dollars are small in size. They possess a rigid skeleton called a test. The test consists of calcium carbonate plates arranged in a fivefold symmetric pattern.

Plate 5.6 Crab species found in Lake Macquarie, NSW



Phylum: ArthropodaClass: MalacostracaOrder: Decapoda

6. Molluscs found as dead shells

Benthic organism samples collected between February 2012 and September 2022 included a large component of shell. **Plates 6.1** and **6.2** show the mass of shell obtained from the sixty 200x200x100mm samples of sediment taken in February 2012. **Plate 6.3** and **Plate 6.4** show the mass of shell collected in September 2012 and **Plates 6.5** and **6.6** show the mass of shells collected in March 2013.



Plate 6.1 Large shell removed from samples during sorting process - February 2012 survey.



Plate 6.2 Small shells removed from samples during sorting process - February 2012 survey.



Plate 6.3 Large shells removed from samples - September 2012 survey.



Plate 6.4 Small shells removed from samples during sorting in September 2012.



Plate 6.5. Large shells removed from samples during sorting in March 2013.



Plate 6.6. Small shells removed from samples during sorting in March 2013.

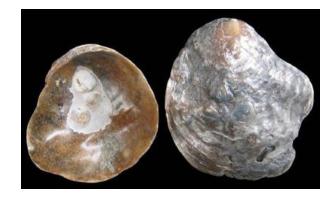
Similar masses of shell were found in the samples of the September 2013 to September 2022 surveys. The following organisms were identified amongst the shell:

- 1. Paphia undulata
- 2. Anomia sp.
- 3. Dosinia sculpta
- 4. Trichomya hirsuta
- 5. Katelysia rhytiphora
- 6. Pecten sp.

- 7. Chlamys sp.
- 8. Saccostrea glomerata
- 9. Corbula truncata
- 10. Batillaria (Velacumantis) australis
- 11. Conuber sp.
- 12. Anadara trapezia

Plates 6.7 and **6.8** provide information about the mollusc and gastropod species found as dead shells in the basin mud of Lake Macquarie, New South Wales during the periods of monitoring.

Plate 6.7 Mollusc species found as dead shells in the benthos of Lake Macquarie, NSW.



Phylum: Mollusca Class: Bivalvia Order: Ostreoida Family: Anomiidae Genus: *Anomia*

Remarks: Genus of saltwater clam, marine bivalve mollusc. Known as "jingle shells". Common in both tropical and temperate oceans and live primarily attached to rock or other shells via a calcified byssus that extends through the lower valve. *Anomia* shells tend to take on the surface shape of what they are attached to; thus if an *Anomia* is attached to a scallop shell, the shell of the *Anomia* will also show ribbing.



Phylum: Mollusca Class: Bivalvia Order: Veneroida Family: Veneridae Genus: Katelysia

Species: Katelysia rhytiphora

Remarks: Commonly known as mud cockles, this group of commercially important bivalves often represents a major faunal component of shallow estuarine and marine embayments. K. rhytiphora is broadly distributed around Australia's temperate coastline from Augusta, Western

Australia to Port Jackson, NSW.



Phylum: Mollusca Class: Bivalvia Order: Ostreoida Family: Pectinidae Genus: Pecten

Remarks: Genus of large saltwater clams or

scallops. Marine bivalve mollusc.



Phylum: Mollusca Class: Bivalvia Order: Ostreoida Family: Pectinidae Genus: Chlamys

Remarks: Genus of saltwater clams or scallops.

Marine bivalve mollusc.

Plate 6.8 Gastropod species found as dead shells in the benthos of Lake Macquarie, NSW.



Phylum: Mollusca Class: Gastropoda Family: Naticidae Genus: *Conuber*

Species: Conuber sordidum

Remarks: Species of predatory sea snail. A marine gastropod mollusc known commonly as the moon snail. Lives on intertidal muddy sand flats near mangroves or sea weed.

Phylum: Mollusca

Class: Gastropoda Family: Batillariidae

Species: Batillaria australis



Remarks: The Australian Mud Whelk is a marine gastropod found on mud flats in estuaries, river mouths and mangrove swamps. The snail has a high resistance to predation and environmental tolerance, which may partially explain its success as an invasive species. This species is one of the hosts for the flatworm parasite *Austrobilharzia*. Larvae of the flatworm are discharged from the snail into the surrounding water. They normally burrow into the legs of wading birds and complete their life cycle, but may burrow though the skin of humans, causing "bathers itch".

7. Benthic organisms in the study area - September 2022

Table 7.1 shows the organisms found at each station sampled off Summerland Point and in Chain Valley Bay and Bardens Bay in September 2022.

 $\textbf{Table 7.1} \ \ \text{Organisms found at sampling stations on 7}^{\text{th}} \ \ \text{and 12}^{\text{th}} \ \ \text{September 2022}.$

Control Station	C1	Depth -4.5	0m AHD		56 364519	6330815		Sampled	7th Sept	ember 2022				
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Chaetopterus	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
C1.1	0	0	0	0	0	0	2	0	0	0	0	0	0	0
C1.2	1	0	0	0	0	1	13	0	0	0	0	0	0	0
C1.3	0	1	0	0	0	3	18	0	0	0	0	0	0	0
C1.4	0	0	0	0	0	1	17	0	0	0	0	0	0	0
C1.5	0	0	0	0	0	1	19	1	0	0	0	0	0	0
Mean/station	0.2	0.2	0.0	0.0	0.0	1.2	13.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	5	5	0	0	0	30	345	5	0	0	0	0	0	0
No. species	5										Total Org	janisms at	Station	78
Control Station	C2	Depth -4.5	0m AHD		56 366214	6332927		Sampled	12th Sep	tember 2022				
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Chaetopterus	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
C2.1	1	1	0	0	0	9	37	0	0	0	0	0	0	0
C2.1 C2.2	1 3	1	0	0	0	9	37 30	0 1	0	0 0	0	0	0	0
C2.2 C2.3	0	2	0	0	0	3	16	0	0	0	0	0	0	0
C2.4	1	1	0	0	0	11	20	0	0	0	0	0	0	0
C2.5	0	1	0	0	0	0	23	0	0	0	0	0	0	0
02.5	Ü	•	O	O	O	O	20	O	O	Ü	Ü	Ü	O	U
Mean/station	1.0	1.2	0.0	0.0	0.0	5.0	25.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	25	30	0	0	0	125	630	5	0	0	0	0	0	0
No. species	5										Total Org	janisms at	Station	163
Control Station	C3	Depth -5.5	0m AHD		E6 266014	6222144			1011 0					
		Бори. 0.0	011171111111111111111111111111111111111		56 366014	6333144		Sampled	12th Sep	tember 2022				
Replicates		Polychaete mud	Polychaete Sthenelais	Polychaete Chaetopterus	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
	Polychaete	Polychaete mud	Polychaete	Polychaete Chaetopterus	Gastropod	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve	Bivalve Cyamiomactra	Trichomya	Saccostrea		
C3.1	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Chaetopterus	Gastropod Nassarius	Bivalve Corbula	Bivalve	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Trichomya 0	Saccostrea 0	0	0
	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Chaetopterus	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Trichomya	Saccostrea		
C3.1 C3.2	Polychaete thin 0 0	Polychaete mud 2 0	Polychaete Sthenelais 1 0	Polychaete Chaetopterus 0 0	Gastropod Nassarius 0 0	Bivalve Corbula 0 0	Bivalve Soletellina 9 4	Bivalve Paphia 0 0	Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0	Trichomya 0 0	Saccostrea 0 0	0	0
C3.1 C3.2 C3.3	Polychaete thin 0 0 4	Polychaete mud 2 0 2	Polychaete Sthenelais 1 0	Polychaete Chaetopterus 0 0 0	Gastropod Nassarius 0 0	Bivalve Corbula 0 0	Bivalve Soletellina 9 4 21	Bivalve Paphia 0 0 0	Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0 0	Trichomya 0 0 0	Saccostrea 0 0 0	0 0 0	0 0 0
C3.1 C3.2 C3.3 C3.4	Polychaete thin 0 0 4 1	Polychaete mud 2 0 2 1	Polychaete Sthenelais 1 0 0 0	Polychaete Chaetopterus 0 0 0	Gastropod Nassarius 0 0 0 0	Bivalve Corbula 0 0 1	Bivalve Soletellina 9 4 21 15	Bivalve Paphia 0 0 0 1	Bivalve Dosinia 0 0 1	Bivalve Cyamiomactra 0 0 0 0	Trichomya 0 0 0 0 0	Saccostrea 0 0 0 0 0	0 0 0	0 0 0 0
C3.1 C3.2 C3.3 C3.4 C3.5	Polychaete thin 0 0 4 1 0	Polychaete mud 2 0 2 1 0	Polychaete Sthenelais 1 0 0 1	Polychaete Chaetopterus 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0	Bivalve Corbula 0 0 1 0	Bivalve Soletellina 9 4 21 15	Bivalve Paphia 0 0 0 1	Bivalve Dosinia 0 0 1 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0	Trichomya 0 0 0 0 0 0	O O O O	0 0 0 0	0 0 0 0
C3.1 C3.2 C3.3 C3.4 C3.5	Polychaete thin 0 0 4 1 0	Polychaete mud 2 0 2 1 0 1.0	Polychaete Sthenelais 1 0 0 1 0 1	Polychaete Chaetopterus 0 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0	Bivalve Corbula 0 0 1 0 0 0 1 0 0	Bivalve Soletellina 9 4 21 15 11	Bivalve Paphia 0 0 0 1 0 1 0	Bivalve Dosinia 0 0 1 0 0 1 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
C3.1 C3.2 C3.3 C3.4 C3.5 Mean/station no./m2	Polychaete thin 0	Polychaete mud 2 0 2 1 0 1.0	Polychaete Sthenelais 1 0 0 1 1 0.4 10	Polychaete Chaetopterus 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0	Bivalve Corbula 0 0 1 0 0 0 1 0 0	Bivalve Soletellina 9 4 21 15 11 12.0 300	Bivalve Paphia 0 0 0 1 0 0 5 5	Bivalve <i>Dosinia</i> 0 0 1 0 0 0 5 5	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
C3.1 C3.2 C3.3 C3.4 C3.5 Mean/station no./m2 No. species	Polychaete thin 0 0 4 1 0 1.0 25 7	Polychaete mud 2 0 2 1 0 2 1 2 5	Polychaete Sthenelais 1 0 0 1 1 0.4 10 0m AHD	Polychaete Chaetopterus 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0	Bivalve <i>Corbula</i> 0 0 1 0 0 0 5 5	Bivalve Soletellina 9 4 21 15 11 12.0 300	Bivalve Paphia 0 0 0 1 0 0 5 5	Bivalve <i>Dosinia</i> 0 0 1 0 0 0 5 5	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	0 0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
C3.1 C3.2 C3.3 C3.4 C3.5 Mean/station no./m2 No. species Control Station	Polychaete thin 0 0 4 1 0 1.0 25 7 C4	Polychaete mud 2 0 2 1 0 1.0 25 Depth -5.5	Polychaete Sthenelais 1 0 0 0 1 1 0.4 10 Om AHD Polychaete	Polychaete Chaetopterus 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve <i>Corbula</i> 0 0 1 0 0 0 0 0 0 0 6332794 Bivalve	Bivalve Soletellina 9 4 21 15 11 12.0 300	Bivalve Paphia 0 0 0 1 0 0.2 5	Bivalve Dosinia 0 0 1 0 0 0 0 7 7th Sept	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0	0 0 0 0 0 0
C3.1 C3.2 C3.3 C3.4 C3.5 Mean/station no./m2 No. species Control Station Replicates	Polychaete thin 0 0 4 1 0 1.0 25 7 C4 Polychaete thin	Polychaete mud 2 0 2 1 0 1.0 25 Depth -5.5	Polychaete Sthenelais 1 0 0 0 1 1 0.4 10 0 0 M AHD Polychaete Sthenelais	Polychaete Chaetopterus 0 0 0 0 0 0 0 0 0 Polychaete Chaetopterus	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 56 364260 Gastropod Nassarius	Bivalve Corbula 0 0 1 0 0 0 0 5 6332794 Bivalve Corbula	Bivalve Soletellina 9 4 21 15 11 12.0 300 Bivalve Soletellina	Bivalve Paphia 0 0 0 1 0 0.2 5 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 1 0 0 0 0 2 5	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra	Trichomya 0 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 0 1 0 0 Saccostrea	0 0 0 0 0 0 0.0 0	0 0 0 0 0 0 0.0 0
C3.1 C3.2 C3.3 C3.4 C3.5 Mean/station no./m2 No. species Control Station Replicates C4.1	Polychaete thin 0 0 4 1 0 1.0 25 7 C4 Polychaete thin 0	Polychaete mud 2 0 2 1 0 1.0 25 Depth -5.5	Polychaete Sthenelais 1 0 0 0 1 1 0.4 10 Om AHD Polychaete Sthenelais 1	Polychaete Chaetopterus 0 0 0 0 0 0 0 0 Polychaete Chaetopterus	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 0 56 364260 Gastropod Nassarius 0	Bivalve Corbula 0 0 1 0 0 0 0.2 5 6332794 Bivalve Corbula	Bivalve Soletellina 9 4 21 15 11 12.0 300 Bivalve Soletellina 11	Bivalve Paphia 0 0 0 1 0 0.2 5 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 1 0 0 0 2 5 7th Septe Bivalve Dosinia 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 0 0 Ember 2022 Bivalve Cyamiomactra	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 0 tanisms at	0 0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 75
C3.1 C3.2 C3.3 C3.4 C3.5 Mean/station no./m2 No. species Control Station Replicates C4.1 C4.2	Polychaete thin 0 0 4 1 0 1.0 25 7 C4 Polychaete thin 0 2	Polychaete mud 2 0 2 1 0 1.0 25 Depth -5.5 Polychaete mud 1 0	Polychaete Sthenelais 1 0 0 0 1 1 0.4 10 Om AHD Polychaete Sthenelais 1 0 0	Polychaete Chaetopterus 0 0 0 0 0 0 0 0 0 Polychaete Chaetopterus	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 56 364260 Gastropod Nassarius 0 1	Bivalve Corbula 0 0 1 0 0 0 0 0 0 0 0 2 5 6332794 Bivalve Corbula 0 0	Bivalve Soletellina 9 4 21 15 11 12.0 300 Bivalve Soletellina 11 15	Bivalve Paphia 0 0 0 1 0 0.2 5 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 1 0 0 0 0.2 5 7th Septi Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 0 2 Station	0 0 0 0 0 0 0 0 75
C3.1 C3.2 C3.3 C3.4 C3.5 Mean/station no./m2 No. species Control Station Replicates C4.1 C4.2 C4.3	Polychaete thin 0 0 4 1 0 1.0 25 7 C4 Polychaete thin 0 2 0	Polychaete mud 2 0 2 1 0 1.0 25 Depth -5.5 Polychaete mud 1 0 0	Polychaete Sthenelais 1 0 0 0 1 1 0.4 10 Om AHD Polychaete Sthenelais 1 0 0 0	Polychaete Chaetopterus 0 0 0 0 0 0 0 0 Polychaete Chaetopterus	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 56 364260 Gastropod Nassarius 0 1 0	Bivalve Corbula 0 0 1 0 0 0 0 0 0 0 0 0 8 6332794 Bivalve Corbula 0 0 1	Bivalve Soletellina 9 4 21 15 11 12.0 300 Bivalve Soletellina 11 15 14	Bivalve Paphia 0 0 0 1 0 0.2 5 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 1 0 0 0 0 0.2 5 7th Septi Bivalve Dosinia 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 0 2 Station	0 0 0 0 0 0 0 75
C3.1 C3.2 C3.3 C3.4 C3.5 Mean/station no./m2 No. species Control Station Replicates C4.1 C4.2 C4.3 C4.4 C4.5	Polychaete thin 0 0 4 1 0 1.0 25 7 C4 Polychaete thin 0 2 0 1	Polychaete mud 2 0 2 1 0 1.0 25 Depth -5.5 Polychaete mud 1 0 0 1 1	Polychaete Sthenelais 1 0 0 0 1 1 0.4 10 Om AHD Polychaete Sthenelais 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Chaetopterus 0 0 0 0 0 0 0 0 0 Polychaete Chaetopterus 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 56 364260 Gastropod Nassarius 0 1 0 0	Bivalve <i>Corbula</i> 0 0 1 0 0 0.2 5 6332794 Bivalve <i>Corbula</i> 0 0 1 1 0	Bivalve <i>Soletellina</i> 9 4 21 15 11 12.0 300 Bivalve <i>Soletellina</i> 11 15 14 7 16	Bivalve Paphia 0 0 0 1 0 0.2 5 Sampled Bivalve Paphia 0 1 0 0 0	Bivalve Dosinia 0 0 1 0 0 0.2 5 7th Sept Bivalve Dosinia 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 2 Station	0 0 0 0 0 0 0 75
C3.1 C3.2 C3.3 C3.4 C3.5 Mean/station no/m2 No. species Control Station Replicates C4.1 C4.2 C4.3 C4.4	Polychaete thin 0	Polychaete mud 2 0 2 1 0 1.0 25 Depth -5.5 Polychaete mud 1 0 0 0	Polychaete Sthenelais 1 0 0 0 1 1 0.4 10 Om AHD Polychaete Sthenelais 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Chaetopterus 0 0 0 0 0 0 0 0 0 Polychaete Chaetopterus	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 56 364260 Gastropod Nassarius 0 1 0 0	Bivalve Corbula 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Soletellina 9 4 21 15 11 12.0 300 Bivalve Soletellina 11 15 14 7	Bivalve Paphia 0 0 0 1 0 0.2 5 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 1 0 0 0.2 5 7th Septe Bivalve Dosinia 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 0 2 Station	0 0 0 0 0 0 0 75

Control Station	C5	Depth -5.5	0m AHD		56 367701	6334510		Sampled	12th Sep	tember 2022				
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Chaetopterus	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
C5.1	2	2	1	0	0	0	7	0	0	0	0	0	0	0
C5.2	0	1	0	0	0	0	5	0	0	0	0	0	0	0
C5.3	0	2	0	0	0	0	13	0	0	0	0	0	1	0
C5.4	0	1	0	0	0	0	19	0	0	0	0	0	1	1
C5.5	1	3	1	0	0	0	8	0	0	0	0	0	0	0
Mean/station	0.6	1.8	0.4	0.0	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.4	0.2
no./m2	15	45	10	0	0	0	260	0	0	0	0	0	10	5
No. species	6										Total Org	janisms at	t Station	69
Control Station	C6	Depth -5.5	0m AHD		56 363988	6332492		Sampled	7th Sept	ember 2022				
Deplicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve	Bivalve Dosinia	Bivalve Cyamiomactra	Bivalve	Bivalve	Ophuroid	Crab
Replicates	uiiii	muu	Sulerielais	Chaetopterus	ivassaiius	Corbuia	Soletellilla	Paphia	Dosiiia	Cyannomacua	Thichonlya	Saccostrea		
C6.1	2	0	0	0	0	3	2	0	0	0	0	0	0	0
C6.2	2	0	0	0	0	2	11	0	0	0	0	0	0	0
C6.3	3	0	0	0	0	3	5	0	0	0	0	0	0	0
C6.4	1	0	1	0	0	2	8	0	0	0	0	0	0	0
C6.5	0	1	1	0	0	2	9	0	0	0	0	0	0	0
Mean/station	1.6	0.2	0.4	0.0	0.0	2.4	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	40	5	10	0.0	0.0	60	175	0.0	0.0	0.0	0.0	0.0	0.0	0.0
No. species	5										Total Org	janisms at	t Station	58
Control Station	C7	Depth -5.5	0m AHD		56 364736	6334947		Sampled	12th Sep	tember 2022				
Control Station Replicates		Depth -5.5 Polychaete mud	0m AHD Polychaete Sthenelais	Polychaete Chaetopterus	56 364736 Gastropod Nassarius	6334947 Bivalve Corbula	Bivalve Soletellina	Sampled Bivalve Paphia	12th Sep Bivalve Dosinia	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Chaetopterus	Gastropod Nassarius	Bivalve Corbula	Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Trichomya	Saccostrea		
	Polychaete thin	Polychaete	Polychaete	Polychaete	Gastropod	Bivalve		Bivalve	Bivalve	Bivalve			Ophuroid 0 0	Crab 0 0
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Chaetopterus	Gastropod Nassarius	Bivalve Corbula	Soletellina 26	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Trichomya 0	Saccostrea 0	0	0
Replicates C7.1 C7.2	Polychaete thin 0 2	Polychaete mud 1 3	Polychaete Sthenelais 0 0	Polychaete Chaetopterus 0 0	Gastropod Nassarius 0 0	Bivalve Corbula 0 1	Soletellina 26 22	Bivalve Paphia 0 0	Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0	Trichomya 0 0	Saccostrea 0 0	0	0
Replicates C7.1 C7.2 C7.3	Polychaete thin 0 2 0	Polychaete mud 1 3 2	Polychaete Sthenelais 0 0 2	Polychaete Chaetopterus 0 0	Gastropod Nassarius 0 0 0	Bivalve Corbula 0 1	Soletellina 26 22 16	Bivalve Paphia 0 0	Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0 0	Trichomya 0 0 0	Saccostrea 0 0 0	0 0 0	0 0 0
Replicates C7.1 C7.2 C7.3 C7.4 C7.5	Polychaete thin 0 2 0 0 0	Polychaete mud 1 3 2 2 1	Polychaete Sthenelais 0 0 2 1	Polychaete Chaetopterus 0 0 0 1	Gastropod Nassarius 0 0 0 0	Bivalve Corbula 0 1 0 0	26 22 16 9 13	Bivalve Paphia 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0	Trichomya 0 0 0 0 0 0	Saccostrea 0 0 0 0 0 0	0 0 0 0	0 0 0 0
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station	Polychaete thin 0 2 0 0	Polychaete mud 1 3 2 2	Polychaete Sthenelais 0 0 2 1	Polychaete Chaetopterus 0 0 0	Gastropod Nassarius 0 0 0	Bivalve Corbula 0 1 0	26 22 16 9	Bivalve Paphia 0 0 0 0	Bivalve Dosinia 0 0 0	Bivalve Cyamiomactra 0 0 0 0	Trichomya 0 0 0 0 0	Saccostrea 0 0 0 0	0 0 0	0 0 0
Replicates C7.1 C7.2 C7.3 C7.4 C7.5	Polychaete thin 0 2 0 0 0 0	Polychaete mud 1 3 2 1 1.8	Polychaete Sthenelais 0 0 2 1 1 0.8	Polychaete Chaetopterus 0 0 0 1 0 1 0	Gastropod Nassarius 0 0 0 0 0 0 0	Bivalve Corbula 0 1 0 0 0 0 0	26 22 16 9 13	Bivalve Paphia 0 0 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0	Saccostrea 0 0 0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station	Polychaete thin 0 2 0 0 0 0	Polychaete mud 1 3 2 1 1.8	Polychaete Sthenelais 0 0 2 1 1 0.8	Polychaete Chaetopterus 0 0 0 1 0 1 0	Gastropod Nassarius 0 0 0 0 0 0 0	Bivalve Corbula 0 1 0 0 0 0 0	26 22 16 9 13	Bivalve Paphia 0 0 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0 0	Saccostrea 0 0 0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station no./m2	Polychaete thin 0 2 0 0 0 0 0.4	Polychaete mud 1 3 2 1 1.8	Polychaete Sthenetais 0 0 2 1 1 0.8 20	Polychaete Chaetopterus 0 0 0 1 0 0 5 5	Gastropod Nassarius 0 0 0 0 0 0 0	Bivalve Corbula 0 1 0 0 0 0 0	26 22 16 9 13	Bivalve Paphia 0 0 0 0 0 0 0 0	Bivalve	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station no./m2 No. species	Polychaete thin 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 6 6	Polychaete mud 1 3 2 2 1 1 1.8 45	Polychaete Sthenelais 0 0 2 1 1 0.8 20	Polychaete Chaetopterus 0 0 0 1 0 0 5 5	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve <i>Corbula</i> 0 1 0 0 0 0 0 5 5	26 22 16 9 13	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve	Bivalve Dosinia 0 0 0 0 0 0 7th Sept	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	0 0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station no./m2 No. species Station R1	Polychaete thin 0 2 0 0 0 0.4 10 6	Polychaete mud 1 3 2 2 1 1.8 45 Depth -4.5	Polychaete Sthenelais 0 0 2 1 1 0.8 20 Om AHD Polychaete	Polychaete Chaetopterus 0 0 0 1 0 0.2 5	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve <i>Corbula</i> 0 1 0 0 0 0 0 0.2 5	Soletellina 26 22 16 9 13 17.2 430	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve	Bivalve Dosinia 0 0 0 0 0 0 7th Sept	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 panisms at	0 0 0 0 0 0	0 0 0 0 0 0 0 0 103
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station no./m2 No. species Station R1 Replicates	Polychaete thin 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete mud 1 3 2 2 1 1 1.8 45 Depth -4.5	Polychaete Sthenelais 0 0 2 1 1 0.8 20 Om AHD Polychaete Sthenelais	Polychaete Chaetopterus 0 0 1 0 0 1 0 0.2 5	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 56 364177 Gastropod Nassarius	Bivalve Corbula 0 1 0 0 0 0 0.2 5	Soletellina 26 22 16 9 13 17.2 430 Bivalve Soletellina	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 0 0 0 0 7th Sept	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra	Trichomya 0 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 0 1 0 0 Saccostrea	0 0 0 0 0 0 0.0 0	0 0 0 0 0 0 0.0 0 103
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station no/m2 No. species Station R1 Replicates R1.1	Polychaete thin 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete mud 1 3 2 2 1 1 1.8 45 Depth -4.5 Polychaete mud 2	Polychaete Sthenelais 0 0 2 1 1 0.8 20 Om AHD Polychaete Sthenelais 0	Polychaete Chaetopterus 0 0 1 1 0 0.2 5 Polychaete Cirratulidae 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 56 364177 Gastropod Nassarius 0	Bivalve Corbula 0 1 0 0 0 0 0 0.2 5 6331535 Bivalve Corbula 0	Soletellina 26 22 16 9 13 17.2 430 Bivalve Soletellina 16	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 0 0 0 0 7th Septe Bivalve Dosinia 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 tanisms at	0 0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 103
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station no/m2 No. species Station R1 Replicates R1.1 R1.2	Polychaete thin 0 2 0 0 0 0.4 10 6	Polychaete mud 1 3 2 2 1 1.8 45 Depth -4.5 Polychaete mud 2 1	Polychaete Sthenelais 0 0 2 1 1 0.8 20 Om AHD Polychaete Sthenelais 0 1	Polychaete Chaetopterus 0 0 0 1 1 0 0.2 5	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 56 364177 Gastropod Nassarius 0 0	Bivalve Corbula 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Soletellina 26 22 16 9 13 17.2 430 Bivalve Soletellina 16 21	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 0	Bivalve Dosinia 0 0 0 0 0 0 7th Septi Bivalve Dosinia 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 comber 2022 Bivalve Cyamiomactra 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 103
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station no./m2 No. species Station R1 Replicates R1.1 R1.2 R1.3	Polychaete thin 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete mud 1 3 2 2 1 1.8 45 Depth -4.5 Polychaete mud 2 1 2	Polychaete Sthenelais 0 0 0 2 1 1 1 0.8 20 Om AHD Polychaete Sthenelais 0 1 0	Polychaete Chaetopterus 0 0 0 1 0 0.2 5 Polychaete Cirratulidae 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 56 364177 Gastropod Nassarius 0 0 0	Bivalve Corbula 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Soletellina 26 22 16 9 13 17.2 430 Bivalve Soletellina 16 21 18	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 7th Septi Bivalve Dosinia 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 103
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station no./m2 No. species Station R1 Replicates R1.1 R1.2 R1.3 R1.4	Polychaete thin 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete mud 1 3 2 2 1 1 1.8 45 Depth -4.5 Polychaete mud 2 1 2 2 2 2	Polychaete Sthenelais 0 0 2 1 1 1 0.8 20 Om AHD Polychaete Sthenelais 0 1 0 1 0 1 0	Polychaete Chaetopterus 0 0 1 1 0 0.2 5 Polychaete Cirratulidae 0 0 0 0	Gastropod Nassarius 0	Bivalve Corbula 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Soletellina 26 22 16 9 13 17.2 430 Bivalve Soletellina 16 21 18 20 22	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 7th Sept Bivalve Dosinia 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 103
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station no./m2 No. species Station R1 Replicates R1.1 R1.2 R1.3 R1.4 R1.5 Mean/station	Polychaete thin 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete mud 1 3 2 2 1 1.8 45 Depth -4.5 Polychaete mud 2 1 2 2 2 2 1.8	Polychaete Sthenelais 0 0 2 1 1 0.8 20 Om AHD Polychaete Sthenelais 0 1 0 1 0 0.4	Polychaete Chaetopterus 0 0 1 1 0 0.2 5 Polychaete Cirratulidae 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Corbula 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Soletellina 26 22 16 9 13 17.2 430 Bivalve Soletellina 16 21 18 20 22 19.4	Bivalve Paphia 0 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 0 0 0 0 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 7th Sept Bivalve Dosinia 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 103
Replicates C7.1 C7.2 C7.3 C7.4 C7.5 Mean/station no./m2 No. species Station R1 Replicates R1.1 R1.2 R1.3 R1.4 R1.5	Polychaete thin 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete mud 1 3 2 2 1 1 1.8 45 Depth -4.5 Polychaete mud 2 1 2 2 2 2	Polychaete Sthenelais 0 0 2 1 1 1 0.8 20 Om AHD Polychaete Sthenelais 0 1 0 1 0 1 0	Polychaete Chaetopterus 0 0 1 1 0 0.2 5 Polychaete Cirratulidae 0 0 0 0	Gastropod Nassarius 0	Bivalve Corbula 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Soletellina 26 22 16 9 13 17.2 430 Bivalve Soletellina 16 21 18 20 22	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 7th Sept Bivalve Dosinia 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 103

Station R2		Depth -4.5	0m AHD		56 365919	6330294		Sampled	7th Septe	ember 2022				
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Cirratulidae	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
R2.1	0	1	0	0	0	3	8	0	0	0	0	0	0	0
R2.2	0	0	0	0	0	0	4	0	0	0	0	0	0	0
R2.3	1	0	1	0	0	1	10	0	0	0	0	0	0	0
R2.4	1	1	0	0	0	1	5	0	0	0	0	0	0	0
R2.5	1	0	0	0	0	1	9	0	0	0	0	0	0	0
Mean/station	0.6	0.4	0.2	0.0	0.0	1.2	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	15	10	5	0	0	30	180	0	0	0	0	0	0	0
No. species	5										Total Org	anisms at	t Station	48
Station R3 (nov	v IM5)	Depth -5.5	0m AHD		56 364660	6332992		Sampled	7th Sept	ember 2022				
	Polychaete	Polychaete	Polychaete	Polychaete	Gastropod	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Ophuroid	Crab
Replicates	thin	mud	Sthenelais	Cirratulidae	Nassarius	Corbula	Soletellina	Paphia	Dosinia	Cyamiomactra	Trichomya	Saccostrea		
R3.1	0	2	0	0	3	0	4	0	0	0	0	0	0	0
R3.2	1	4	0	0	0	1	6	0	0	0	0	0	0	0
R3.3	1	4	0	0	1	0	12	0	0	0	0	0	0	0
R3.4	5	5	0	0	0	1	12	0	0	0	0	0	0	0
R3.5	1	5	1	0	0	0	1	0	0	0	2	0	0	0
Mean/station	1.6	4.0	0.2	0.0	0.8	0.4	7.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
no./m2	40	100	5	0	20	10	175	0	0	0	10	0	0	0
No. species	7										Total Org	anisms at	t Station	72
Station R4 (nov	•	Depth -6.0			56 364771	6332763		•	·	ember 2022				
Station R4 (now	•	Depth -6.0 Polychaete mud		Polychaete Cirratulidae	56 364771 Gastropod Nassarius	6332763 Bivalve Corbula	Bivalve Soletellina	Sampled Bivalve Paphia	7th Septe Bivalve Dosinia	ember 2022 Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
•	Polychaete	Polychaete	Polychaete		Gastropod	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve			Ophuroid 0	Crab 0
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Cirratulidae	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Trichomya	Saccostrea	·	
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Cirratulidae 0	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Trichomya 0	Saccostrea 0	0	0
Replicates R4.1 R4.2	Polychaete thin 0 0 0 0	Polychaete mud 0 2 0 0	Polychaete Sthenelais 0 1 0	Cirratulidae 0 0 0 0	Gastropod Nassarius 0 0 0	Bivalve Corbula 1 0 0	Bivalve Soletellina 2 8 10 5	Bivalve Paphia 1 0 0 0	Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0 0 0	Trichomya 0 0 0 0	Saccostrea 0 0	0	0 0 0
Replicates R4.1 R4.2 R4.3	Polychaete thin 0 0 0	Polychaete mud 0 2 0	Polychaete Sthenelais 0 1	Cirratulidae 0 0 0	Gastropod Nassarius 0 0 0	Bivalve Corbula 1 0	Bivalve Soletellina 2 8 10	Bivalve Paphia 1 0 0	Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0 0	Trichomya 0 0 0	Saccostrea 0 0 0	0 0 0	0 0 0
Replicates R4.1 R4.2 R4.3 R4.4 R4.5	Polychaete thin 0 0 0 1	Polychaete mud 0 2 0 0 0	Polychaete Sthenelais 0 1 0 0	Cirratulidae 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0	Bivalve Corbula 1 0 0 3	Bivalve Soletellina 2 8 10 5	Bivalve Paphia 1 0 0 0 0	Bivalve Dosinia 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0	0 0 0 0 0 0	Saccostrea 0 0 0 0 0 0	0 0 0 0	0 0 0 0
Replicates R4.1 R4.2 R4.3 R4.4	Polychaete thin 0 0 0 0	Polychaete mud 0 2 0 0	Polychaete Sthenelais 0 1 0	Cirratulidae 0 0 0 0	Gastropod Nassarius 0 0 0	Bivalve Corbula 1 0 0	Bivalve Soletellina 2 8 10 5	Bivalve Paphia 1 0 0 0	Bivalve Dosinia 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0	Trichomya 0 0 0 0	Saccostrea 0 0 0 0	0 0 0	0 0 0
Replicates R4.1 R4.2 R4.3 R4.4 R4.5	Polychaete thin 0 0 0 0 1	Polychaete mud 0 2 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0	O	Gastropod Nassarius 0 0 0 0 0 0 0	Bivalve Corbula 1 0 0 3	Bivalve Soletellina 2 8 10 5 8	Bivalve Paphia 1 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Replicates R4.1 R4.2 R4.3 R4.4 R4.5 Mean/station no./m2 No. species	Polychaete thin 0 0 0 0 0 1 1 0.2 5	Polychaete mud 0 2 0 0 0 0 1 1 10	Polychaete Sthenelais 0 1 0 0 0 0 0 0.2 5	O	Gastropod Nassarius 0 0 0 0 0 0 0 0	Bivalve <i>Corbula</i> 1 0 0 0 3 3 0.8 20	Bivalve Soletellina 2 8 10 5 8	Bivalve Paphia 1	Bivalve	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0 0
Replicates R4.1 R4.2 R4.3 R4.4 R4.5 Mean/station no./m2	Polychaete thin 0 0 0 0 0 1 1 0.2 5	Polychaete mud 0 2 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0 0.2 5	O	Gastropod Nassarius 0 0 0 0 0 0 0	Bivalve Corbula 1 0 0 3	Bivalve Soletellina 2 8 10 5 8	Bivalve Paphia 1	Bivalve	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0 0
Replicates R4.1 R4.2 R4.3 R4.4 R4.5 Mean/station no./m2 No. species	Polychaete thin 0 0 0 0 0 1 1 0.2 5 6	Polychaete mud 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0 0.2 5	O	Gastropod Nassarius 0 0 0 0 0 0 0 0	Bivalve <i>Corbula</i> 1 0 0 0 3 3 0.8 20	Bivalve Soletellina 2 8 10 5 8	Bivalve Paphia 1	Bivalve Dosinia 0 0 0 0 0 0 12th Sep	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 0 anisms at	0 0 0 0 0	0 0 0 0 0 0
Replicates R4.1 R4.2 R4.3 R4.4 R4.5 Mean/station no/m2 No. species Station R5 (nov	Polychaete thin 0 0 0 1 0.2 5 6 v IM7) Polychaete	Polychaete mud 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0.2 5	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve <i>Corbula</i> 1 0 0 0 3 3 0.8 20 6333889	Bivalve Soletellina 2 8 10 5 8 6.6 165	Bivalve Paphia 1 0 0 0 0 0.2 5 Sampled Bivalve	Bivalve Dosinia 0 0 0 0 0 0 12th Sep	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 tember 2022 Bivalve	7 Trichomya 0 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 0 anisms at	0 0 0 0 0 0	0 0 0 0 0 0
Replicates R4.1 R4.2 R4.3 R4.4 R4.5 Mean/station no/m2 No. species Station R5 (now	Polychaete thin 0 0 0 0 1 0.2 5 6 v IM7) Polychaete thin	Polychaete mud 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0.2 5	Cirratulidae 0 0 0 0 0 0 0 0 0 Polychaete Cirratulidae	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 56 364229 Gastropod Nassarius	Bivalve Corbula 1 0 0 0 3 0.8 20 6333889 Bivalve Corbula	Bivalve Soletellina 2 8 10 5 8 6.6 165	Bivalve Paphia 1 0 0 0 0 0 0.2 5 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 0 0 0 0 0 12th Sep Bivalve	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 tember 2022 Bivalve Cyamiomactra	O O O O O O O Total Org	Saccostrea 0 0 0 0 0 0 0 0 anisms at	0 0 0 0 0 0 0.0 0	0 0 0 0 0 0 0.0 0
Replicates R4.1 R4.2 R4.3 R4.4 R4.5 Mean/station no/m2 No. species Station R5 (nov	Polychaete thin O O O O O 1 O.2 5 6 v IM7) Polychaete thin O	Polychaete mud 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0.2 5	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 56 364229 Gastropod Nassarius 0	Bivalve Corbula 1 0 0 0 3 3 0.8 20 6333889 Bivalve Corbula 0	Bivalve Soletellina 2 8 10 5 8 6.6 165	Bivalve Paphia 1 0 0 0 0 0 0 5 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 0 0 0 0 0 12th Sep Bivalve Dosinia 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 tember 2022 Bivalve Cyamiomactra 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 0 anisms at	0 0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 0 42
Replicates R4.1 R4.2 R4.3 R4.4 R4.5 Mean/station no/m2 No. species Station R5 (now Replicates R5.1 R5.2	Polychaete thin 0 0 0 1 0.2 5 6 v IM7) Polychaete thin 0 0	Polychaete mud 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0.2 5 Om AHD Polychaete Sthenelais 0 1	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 56 364229 Gastropod Nassarius 0 0	Bivalve Corbula 1 0 0 0 3 3 0.8 20 6333889 Bivalve Corbula 0 0	Bivalve Soletellina 2 8 10 5 8 6.6 165	Bivalve Paphia 1 0 0 0 0 0.2 5 Sampled Bivalve Paphia 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 12th Sep Bivalve Dosinia 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 tember 2022 Bivalve Cyamiomactra 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 sanisms at	0 0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 0 0 42 Crab
Replicates R4.1 R4.2 R4.3 R4.4 R4.5 Mean/station no./m2 No. species Station R5 (nov Replicates R5.1 R5.2 R5.3	Polychaete thin 0 0 0 1 0.2 5 6 v IM7) Polychaete thin 0 0 2	Polychaete mud 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0.2 5	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 56 364229 Gastropod Nassarius 0 0 0	Bivalve Corbula 1 0 0 0 3 3 0.8 20 6333889 Bivalve Corbula 0 0 0 2	Bivalve Soletellina 2 8 10 5 8 6.6 165 Bivalve Soletellina 15 12 3	Bivalve Paphia 1 0 0 0 0 0.2 5 Sampled Bivalve Paphia 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 12th Sep Bivalve Dosinia 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 tember 2022 Bivalve Cyamiomactra 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 sanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 0 42 Crab
Replicates R4.1 R4.2 R4.3 R4.4 R4.5 Mean/station no/m2 No. species Station R5 (nov Replicates R5.1 R5.2 R5.3 R5.4 R5.5	Polychaete thin 0 0 0 0 1 0.2 5 6 v IM7) Polychaete thin 0 0 2 0 0	Polychaete mud 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0 0.2 5 Om AHD Polychaete Sthenelais 0 1 0 0	Cirratulidae 0 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0 0 0	Gastropod Nassarius 0	Bivalve Corbula 1 0 0 0 3 3 0.8 20 6333889 Bivalve Corbula 0 0 2 1 0 0	Bivalve Soletellina 2	Bivalve Paphia 1 0 0 0 0 0 0 0 5 Sampled Bivalve Paphia 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 tember 2022 Bivalve Cyamiomactra 0 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 sanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 42 Crab
Replicates R4.1 R4.2 R4.3 R4.4 R4.5 Mean/station no/m2 No. species Station R5 (nov Replicates R5.1 R5.2 R5.3 R5.4 R5.5 Mean/station	Polychaete thin 0 0 0 0 1 0.2 5 6 cv IM7) Polychaete thin 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete mud 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0.2 5 DOM AHD Polychaete Sthenelais 0 1 0 0 0 0.4	Cirratulidae 0 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0	Bivalve Corbula 1 0 0 0 3 3 0.8 20 6333889 Bivalve Corbula 0 0 0 2 1 0 0 0.6	Bivalve Soletellina 2 8 10 5 8 6.6 165 Bivalve Soletellina 15 12 3 15 4 9.8	Bivalve Paphia 1 0 0 0 0 0.2 5 Sampled Bivalve Paphia 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 tember 2022 Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0	Trichomya 0 0 0 0 0 0 0 Total Org Bivalve Trichomya 0 0 0 0 0 0 0 0 0 0	Saccostrea 0 0 0 0 0 0 0 sanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 0 42 Crab
Replicates R4.1 R4.2 R4.3 R4.4 R4.5 Mean/station no/m2 No. species Station R5 (nov Replicates R5.1 R5.2 R5.3 R5.4 R5.5	Polychaete thin 0 0 0 0 1 0.2 5 6 v IM7) Polychaete thin 0 0 2 0 0	Polychaete mud 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0 0.2 5 Om AHD Polychaete Sthenelais 0 1 0 0	Cirratulidae 0 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0 0 0	Gastropod Nassarius 0	Bivalve Corbula 1 0 0 0 3 3 0.8 20 6333889 Bivalve Corbula 0 0 2 1 0 0	Bivalve Soletellina 2	Bivalve Paphia 1 0 0 0 0 0 0 0 5 Sampled Bivalve Paphia 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 tember 2022 Bivalve Cyamiomactra 0 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 sanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 42 Crab

Station R6 (nov	v IM8)	Depth -6.0	0m AHD		56 364533	6334146		Sampled	12th Sep	tember 2022				
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Cirratulidae	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
R6.1	2	0	0	0	0	0	12	0	0	0	0	0	0	0
R6.2	0	1	0	0	0	1	21	0	0	0	0	0	0	0
R6.3	0	1	0	0	0	2	18	0	0	0	0	0	0	0
R6.4	0	1	0	0	0	1	18	0	0	0	0	0	0	0
R6.5	0	0	0	0	0	3	25	0	0	0	0	0	0	0
Mean/station no./m2	0.4 10	0.6 15	0.0 0	0.0	0.0	1.4 35	18.8 470	0.0	0.0	0.0 0	0.0	0.0	0.0	0.0
No. species	4										Total Org	janisms a	t Station	106
Station R7		Depth -6.0	0m AHD		56 366232	6333856		Sampled	12th Sep	tember 2022				
		Polychaete		Polychaete	Gastropod	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Bivalve	Ophuroid	Crab
Replicates	thin	mud	Sthenelais	Cirratulidae	Nassarius	Corbula	Soletellina	Paphia	Dosinia	Cyamiomactra	Inchomya	Saccostrea		
R7.1	0	0	0	1	0	0	0	0	0	0	12	0	0	0
R7.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
R7.3	0	0	1	0	0	0	0	0	0	0	0	0	0	0
R7.4	0	0	1	0	0	0	0	0	0	0	18	1	0	0
R7.5	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Mean/station	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	6.2	0.2	0.0	0.0
no./m2	0	0	10	5	0	0	0	0	0	0	155	5	0	0
No. species	4										Total Org	janisms a	t Station	35
Station R8		Depth -6.0	0m AHD		56 364323	63322010		Sampled	7th Sept	ember 2022				
Station R8 Replicates	Polychaete thin	Depth -6.0 Polychaete mud		Polychaete Cirratulidae	56 364323 Gastropod Nassarius	63322010 Bivalve Corbula	Bivalve Soletellina	Sampled Bivalve Paphia	7th Sept Bivalve Dosinia	ember 2022 Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
Replicates	thin	Polychaete mud	Polychaete Sthenelais	Cirratulidae	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Trichomya	Saccostrea		
Replicates	thin 2	Polychaete mud	Polychaete Sthenelais	Cirratulidae 0	Gastropod	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Trichomya 0	Saccostrea 0	0	0
Replicates R8.1 R8.2	thin	Polychaete mud	Polychaete Sthenelais	Cirratulidae	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina 11 7	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Trichomya	Saccostrea		
Replicates	thin 2 0	Polychaete mud 1 0	Polychaete Sthenelais 0 1	Cirratulidae 0 0	Gastropod Nassarius 0 1	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia 0 0	Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0	Trichomya 0 0	Saccostrea 0 0	0	0
Replicates R8.1 R8.2 R8.3	thin 2 0 0	Polychaete mud 1 0 0	Polychaete Sthenelais 0 1	Cirratulidae 0 0 0	Gastropod Nassarius 0 1	Bivalve Corbula 1 0	Bivalve Soletellina 11 7 13	Bivalve Paphia 0 0	Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0 0	Trichomya 0 0 0	Saccostrea 0 0 0	0 0 0	0 0 0
Replicates R8.1 R8.2 R8.3 R8.4 R8.5	thin 2 0 0 0 0 0 0	Polychaete mud 1 0 0 1 0 1 0 0 1 0	Polychaete Sthenelais 0 1 0 0 0 0 0	O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 1 0 0 0 0 0	Bivalve Corbula 1 0 0 0 0 0	Bivalve Soletellina 11 7 13 6 11	Bivalve Paphia 0 0 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Replicates R8.1 R8.2 R8.3 R8.4 R8.5	thin 2 0 0 0 0	Polychaete mud 1 0 0 1 0	Polychaete Sthenelais 0 1 0 0	Cirratulidae 0 0 0 0 0 0	Gastropod Nassarius 0 1 0 0 0 0	Bivalve Corbula 1 0 0 0	Bivalve Soletellina 11 7 13 6 11	Bivalve Paphia 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0	Trichomya 0 0 0 0 0 0	Saccostrea 0 0 0 0 0 0	0 0 0 0	0 0 0 0
Replicates R8.1 R8.2 R8.3 R8.4 R8.5	thin 2 0 0 0 0 0 0	Polychaete mud 1 0 0 1 0 1 0 0 1 0	Polychaete Sthenelais 0 1 0 0 0 0 0	O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 1 0 0 0 0 0	Bivalve Corbula 1 0 0 0 0 0	Bivalve Soletellina 11 7 13 6 11	Bivalve Paphia 0 0 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Replicates R8.1 R8.2 R8.3 R8.4 R8.5 Mean/station no./m2	thin 2 0 0 0 0 0 0 1 10	Polychaete mud 1 0 0 1 0 1 0 0 1 0	Polychaete Sthenelais 0 1 0 0 0 0 0 0.2 5	O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 1 0 0 0 0 0	Bivalve Corbula 1 0 0 0 0 0	Bivalve Soletellina 11	Bivalve Paphia 0 0 0 0 0 0 0	Bivalve	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Replicates R8.1 R8.2 R8.3 R8.4 R8.5 Mean/station no/m2 No. species	thin 2 0 0 0 0 0 0 1.4 10	Polychaete mud 1	Polychaete Sthenelais 0 1 0 0 0 0 0 0.2 5	O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 1 0 0 0 0 0 0.2 5	Bivalve <i>Corbula</i> 1 0 0 0 0 0 0 0 0.2 5	Bivalve Soletellina 11	Bivalve Paphia 0 0 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 7th Sept	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 0 0	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0	0 0 0 0 0
Replicates R8.1 R8.2 R8.3 R8.4 R8.5 Mean/station no./m2 No. species Station R9	thin 2 0 0 0 0 0 0 4 10 6	Polychaete mud 1 0 0 1 0 0 0.4 10 Depth -6.0	Polychaete Sthenelais 0 1 0 0 0 0 0.2 5	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete	Gastropod Nassarius 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve <i>Corbula</i> 1 0 0 0 0 0 0.2 5	Bivalve Soletellina 11 7 13 6 11 9.6 240	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve	Bivalve Dosinia 0 0 0 0 0 0 7th Sept	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 continued by the second of the sec	7 Trichomya 0 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0	0 0 0 0 0 0
Replicates R8.1 R8.2 R8.3 R8.4 R8.5 Mean/station no./m2 No. species Station R9 Replicates	thin 2 0 0 0 0 0 0 0.4 10 6	Polychaete mud 1 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 0 0 1 1 0 0 1 1 0 1 1 0 1	Polychaete Sthenelais 0 1 0 0 0 0 0.2 5	Cirratulidae 0 0 0 0 0 0 0 0 0 Polychaete Cirratulidae	Gastropod Nassarius 0 1 0 0 0 0 0 0.2 5	Bivalve Corbula 1 0 0 0 0 0 0.2 5	Bivalve Soletellina 11 7 13 6 11 9.6 240 Bivalve Soletellina	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 0 0 0 0 7th Sept	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0.0 0 55
Replicates R8.1 R8.2 R8.3 R8.4 R8.5 Mean/station no/m2 No. species Station R9 Replicates R9.1	thin 2 0 0 0 0 0 0 0.4 10 6	Polychaete mud 1 0 0 1 0 0.4 10 Depth -6.0 Polychaete mud 0	Polychaete Sthenelais 0 1 0 0 0 0 0 0.2 5	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0	Gastropod Nassarius 0 1 0 0 0 0 0 0.2 5 56 366232 Gastropod Nassarius 0	Bivalve Corbula 1 0 0 0 0 0 0.2 5 6331210 Bivalve Corbula	Bivalve Soletellina 11 7 13 6 11 9.6 240 Bivalve Soletellina 0	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 0 0 0 0 7th Sept	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 0 55
Replicates R8.1 R8.2 R8.3 R8.4 R8.5 Mean/station no./m2 No. species Station R9 Replicates R9.1 R9.2	thin 2 0 0 0 0 0 0 4 10 6	Polychaete mud 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0.2 5 Om AHD Polychaete Sthenelais 7 0	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0	Gastropod Nassarius 0 1 0 0 0 0 0.2 5 56 366232 Gastropod Nassarius 0 1	Bivalve Corbula 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Soletellina 11 7 13 6 11 9.6 240 Bivalve Soletellina 0 22	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 7th Septi Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 0 55
Replicates R8.1 R8.2 R8.3 R8.4 R8.5 Mean/station no./m2 No. species Station R9 Replicates R9.1 R9.2 R9.3	thin 2 0 0 0 0 0 0 4 10 6 Polychaete thin 2 0 0	Polychaete mud 1 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Polychaete Sthenelais 0 1 0 0 0 0 0.2 5 Om AHD Polychaete Sthenelais 7 0 0	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0	Gastropod Nassarius 0 1 0 0 0 0 0.2 5 56 366232 Gastropod Nassarius 0 1 0	Bivalve Corbula 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Soletellina 11 7 13 6 11 9.6 240 Bivalve Soletellina 0 22 16	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 7th Septi Bivalve Dosinia 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 55 Crab
Replicates R8.1 R8.2 R8.3 R8.4 R8.5 Mean/station no./m2 No. species Station R9 Replicates R9.1 R9.2 R9.3 R9.4 R9.5 Mean/station	thin 2 0 0 0 0 0 0 0.4 10 6 Polychaete thin 2 0 0 0 0 0 0 1.4	Polychaete mud 1	Polychaete Sthenelais 0 1 0 0 0 0 0.2 5 DOM AHD Polychaete Sthenelais 7 0 0 0 1.4	Cirratulidae 0 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0	Bivalve Corbula 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Soletellina 11	Bivalve Paphia 0 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 0 1 0 0 0.2	Bivalve Dosinia 0 0 0 0 0 0 7th Sept Bivalve Dosinia 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 55 Crab
Replicates R8.1 R8.2 R8.3 R8.4 R8.5 Mean/station no./m2 No. species Station R9 Replicates R9.1 R9.2 R9.3 R9.4 R9.5	thin 2 0 0 0 0 0 0 0.4 10 6 Polychaete thin 2 0 0 0 0 0	Polychaete mud 1	Polychaete Sthenelais 0 1 0 0 0 0 0 0.2 5 Om AHD Polychaete Sthenelais 7 0 0 0 0	Cirratulidae 0 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0 0 0	Gastropod Nassarius 0	Bivalve Corbula 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Soletellina 11	Bivalve Paphia 0 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 0 0 1 0	Bivalve Dosinia 0 0 0 0 0 0 7th Sept Bivalve Dosinia 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0 0	Trichomya 0 0 0 0 0 0 Total Org	Saccostrea 0 0 0 0 0 0 0 spanisms at	0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 55 Crab

Station R10		Depth -6.0	0m AHD		56 365172	6334708		Sampled	12th Sep	tember 2022				
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Chaetopterus	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
R10.1	0	1	0	0	0	2	51	0	9	0	0	0	0	0
R10.2	3	4	0	2	0	3	36	0	2	0	0	0	0	0
R10.3	1	2	0	0	0	0	80	0	10	0	0	0	0	0
R10.4	0	2	0	0	0	4	49	0	4	0	0	0	0	0
R10.5	2	3	0	0	0	2	26	0	4	0	0	0	0	0
Mean/station	1.2	2.4	0.0	0.4	0.0	2.2	48.4	0.0	5.8	0.0	0.0	0.0	0.0	0.0
no./m2	30	60	0	10	0	55	1210	0	145	0	0	0	0	0
No. species	6										Total Org	anisms at	Station	302
Station R11		Depth -6.0	0m AHD		56 367072	6333638		Sampled	12th Sep	tember 2022				
Poplicator	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Cirratulidae	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve	Bivalve	Bivalve	Ophuroid	Crab
Replicates	uiii	muu	Sulerielais	Ciriatulidae	ivassaiius	Corbula	Soletellilla	гарша	Dosinia	Cyamiomactra	Trichomya	Saccosirea		
R11.1	0	1	0	0	0	0	7	0	0	0	0	0	0	0
R11.2	1	0	0	0	0	0	14	1	0	0	0	0	0	0
R11.3	0	3	0	0	0	0	13	0	0	0	0	0	0	0
R11.4	0	2	1	0	0	0	7	1	0	0	0	0	0	0
R11.5	0	2	0	0	0	0	12	0	0	0	0	0	0	0
Mean/station	0.2	1.6	0.2	0.0	0.0	0.0	10.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	5	40	5	0	0	0	265	10	0	0	0	0	0	0
No. species	5										Total Org	anisms at	Station	65
Station IM1		Depth -4.5			56 364738	6330734			•	ember 2022				
Station IM1 Replicates	Polychaete thin	Depth -4.5 Polychaete mud		Polychaete Cirratulidae	56 364738 Gastropod Nassarius	6330734 Bivalve Corbula	Bivalve Soletellina	Sampled Bivalve Paphia	7th Septe Bivalve Dosinia	ember 2022 Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
Replicates	thin	Polychaete mud	Polychaete	Cirratulidae	Gastropod	Bivalve	Bivalve Soletellina	Bivalve Paphia	Bivalve	Bivalve Cyamiomactra				
		Polychaete	Polychaete Sthenelais		Gastropod Nassarius	Bivalve Corbula	Bivalve	Bivalve	Bivalve Dosinia	Bivalve	Trichomya	Saccostrea	Ophuroid 0 0	Crab 0 0
Replicates	thin 3	Polychaete mud	Polychaete Sthenelais	Cirratulidae 0	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Trichomya 0	Saccostrea 0	0	0
Replicates IM1.1 IM1.2	thin 3 0	Polychaete mud 2 1	Polychaete Sthenelais 0 0	Cirratulidae 0 0	Gastropod Nassarius 0 0	Bivalve Corbula 1 2	Bivalve Soletellina 16 3	Bivalve Paphia 0 0	Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0	Trichomya 0 0	Saccostrea 0 0	0	0
Replicates IM1.1 IM1.2 IM1.3	thin 3 0 0	Polychaete mud 2 1 0	Polychaete Sthenelais 0 0 2	Cirratulidae 0 0 0	Gastropod Nassarius 0 0 0	Bivalve Corbula 1 2 0	Bivalve Soletellina 16 3 20	Bivalve Paphia 0 0	Bivalve Dosinia 0 0	Bivalve Cyamiomactra 0 0 0	Trichomya 0 0 0	Saccostrea 0 0 0	0 0 0	0 0 0
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5	thin 3 0 0 5 2	Polychaete mud 2 1 0 0	Polychaete Sthenelais 0 0 2 2 1	Cirratulidae 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0	Bivalve Corbula 1 2 0 1 1	Bivalve Soletellina 16 3 20 10 17	Bivalve Paphia 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0	0 0 0 0 0 2	Saccostrea 0 0 0 0 0 0	0 0 0 0	0 0 0 0
Replicates IM1.1 IM1.2 IM1.3 IM1.4	thin 3 0 0 5	Polychaete mud 2 1 0 0	Polychaete Sthenelais 0 0 2 2	Cirratulidae 0 0 0 0	Gastropod Nassarius 0 0 0 0	Bivalve Corbula 1 2 0 1	Bivalve Soletellina 16 3 20 10	Bivalve Paphia 0 0 0 0	Bivalve Dosinia 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0	Trichomya 0 0 0 0	Saccostrea 0 0 0 0	0 0 0	0 0 0
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station no./m2	thin 3 0 0 5 2 2.0 50	Polychaete mud 2 1 0 0 0 0	Polychaete Sthenelais 0 0 2 2 1	O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0	Bivalve Corbula 1 2 0 1 1 1.0	Bivalve <i>Soletellina</i> 16 3 20 10 17	Bivalve Paphia 0 0 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 2 0.4 10	0 0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0 0
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station	thin 3 0 5 2	Polychaete mud 2 1 0 0 0 0	Polychaete Sthenelais 0 0 2 2 1	O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0	Bivalve Corbula 1 2 0 1 1 1.0	Bivalve <i>Soletellina</i> 16 3 20 10 17	Bivalve Paphia 0 0 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 2 0.4 10	0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station no./m2	thin 3 0 0 5 2 2.0 50	Polychaete mud 2 1 0 0 0 0	Polychaete Sthenelais 0 0 2 2 1 1.0 25	O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0	Bivalve Corbula 1 2 0 1 1 1.0	Bivalve <i>Soletellina</i> 16 3 20 10 17	Bivalve Paphia 0 0 0 0 0 0 0 0	Bivalve	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 2 0.4 10	0 0 0 0 0 0 0	0 0 0 0 0	0 0 0 0 0 0
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station no/m2 No. species	thin 3 0 0 5 2 2.0 50 6	Polychaete mud 2 1 0 0 0 15 Depth -4.5	Polychaete Sthenelais 0 0 2 2 1 1.0 25	O 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0 0	Bivalve <i>Corbula</i> 1 2 0 1 1 1 1 1.0 25	Bivalve <i>Soletellina</i> 16 3 20 10 17	Bivalve Paphia 0 0 0 0 0 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 7th Septe	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 2 0.4 10 Total Org	Saccostrea 0 0 0 0 0 0 0 0 anisms at	0 0 0 0 0	0 0 0 0 0 0
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station no./m2 No. species Station IM2	thin 3 0 0 5 2 2.0 50 6	Polychaete mud 2 1 0 0 0 0 0.6 15	Polychaete Sthenelais 0 0 2 2 1 1.0 25	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve <i>Corbula</i> 1 2 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Bivalve Soletellina 16 3 20 10 17 13.2 330	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve	Bivalve Dosinia 0 0 0 0 0 0 7th Septe	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 cember 2022 Bivalve	7 Trichomya 0 0 0 0 2 0.4 10 Total Org	Saccostrea 0 0 0 0 0 0 0 0 anisms at	0 0 0 0 0 0	0 0 0 0 0 0
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station no/m2 No. species Station IM2 Replicates	thin 3 0 0 5 2 2.0 50 6	Polychaete mud 2 1 0 0 0 0.6 15 Depth -4.5	Polychaete Sthenelais 0 0 2 2 1 1.0 25 Om AHD Polychaete Sthenelais	Cirratulidae 0 0 0 0 0 0 0 0 0 Polychaete Cirratulidae	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 56 364842 Gastropod Nassarius	Bivalve Corbula 1 2 0 1 1 1 1.0 25 6332237 Bivalve Corbula	Bivalve Soletellina 16 3 20 10 17 13.2 330 Bivalve Soletellina	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 0 0 0 0 7th Septe	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 0 Ember 2022 Bivalve Cyamiomactra	O O O O O O O Total Org	Saccostrea 0 0 0 0 0 0 0 0 anisms at	0 0 0 0 0 0 0.0 0	0 0 0 0 0 0 0.0 0
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station no/m2 No. species Station IM2 Replicates IM2.1	thin 3 0 0 5 2 2.0 50 6 Polychaete thin 0	Polychaete mud 2 1 0 0 0 0 15 Depth -4.5	Polychaete Sthenelais 0 0 2 2 1 1.0 25 Om AHD Polychaete Sthenelais 0	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 56 364842 Gastropod Nassarius 0	Bivalve Corbula 1 2 0 1 1 1 1.0 25 6332237 Bivalve Corbula 0	Bivalve Soletellina 16 3 20 10 17 13.2 330 Bivalve Soletellina 6	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia	Bivalve Dosinia 0 0 0 0 0 0 7th Septe Bivalve Dosinia 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0	Trichomya 0 0 0 2 0.4 10 Total Org Bivalve Trichomya	Saccostrea 0 0 0 0 0 0 0 0 anisms at	0 0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 0 91 Crab
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station no/m2 No. species Station IM2 Replicates IM2.1 IM2.2	thin 3 0 0 5 2 2.0 50 6 Polychaete thin 0 2	Polychaete mud 2 1 0 0 0 0 0.6 15 Depth -4.5 Polychaete mud 3 1	Polychaete Sthenelais 0 0 2 2 1 1.0 25 Om AHD Polychaete Sthenelais 0 0	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 56 364842 Gastropod Nassarius 0 2	Bivalve Corbula 1 2 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Bivalve Soletellina 16 3 20 10 17 13.2 330 Bivalve Soletellina 6 2	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 1	Bivalve Dosinia 0 0 0 0 0 0 7th Septe Bivalve Dosinia 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Trichomya 0 0 0 2 0.4 10 Total Org Bivalve Trichomya 4 0	Saccostrea 0 0 0 0 0 0 0 sanisms at	0 0 0 0 0 0 0 0 2 Station	0 0 0 0 0 0 0 0 0 91 Crab
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station no./m2 No. species Station IM2 Replicates IM2.1 IM2.2 IM2.3	thin 3 0 0 5 2 2.0 50 6 Polychaete thin 0 2 0	Polychaete mud 2 1 0 0 0 0 0.6 15 Depth -4.5	Polychaete Sthenelais 0 0 2 2 1 1.0 25 Om AHD Polychaete Sthenelais 0 0 3	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 56 364842 Gastropod Nassarius 0 2 0	Bivalve Corbula 1 2 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Bivalve Soletellina 16 3 20 10 17 13.2 330 Bivalve Soletellina 6 2 6	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 1 0	Bivalve Dosinia 0 0 0 0 0 0 7th Septe Bivalve Dosinia 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 sember 2022 Bivalve Cyamiomactra 0 0 0	7 Trichomya 0 0 0 0 2 0.4 10 Total Org Bivalve Trichomya 4 0 0	Saccostrea 0 0 0 0 0 0 0 sanisms at	0 0 0 0 0 0 0 0 2 Station	0 0 0 0 0 0 0 0 91 Crab
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station no/m2 No. species Station IM2 Replicates IM2.1 IM2.2 IM2.3 IM2.4 IM2.5	thin 3 0 0 5 2 2.0 50 6 Polychaete thin 0 2 0 0 3	Polychaete mud 2 1 0 0 0 0 15 Depth -4.5 Polychaete mud 3 1 0 3 3	Polychaete Sthenelais 0 0 2 2 1 1.0 25 Om AHD Polychaete Sthenelais 0 0 3 2 3	Cirratulidae 0 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0 0 0	Gastropod Nassarius 0	Bivalve Corbula 1 2 0 1 1 1 1.0 25 6332237 Bivalve Corbula 0 1 2 0 0 1 2 0 0 1 2 0 0 1 1 1 1 1 1 1	Bivalve Soletellina 16 3 20 10 17 13.2 330 Bivalve Soletellina 6 2 6 9 3	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 1 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 7th Septe Bivalve Dosinia 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0 0	7 Trichomya 0 0 0 0 2 0.4 10 Total Org Bivalve Trichomya 4 0 0 0 0	Saccostrea 0 0 0 0 0 0 0 sanisms at	0 0 0 0 0 0 0 0 t Station	0 0 0 0 0 0 0 91
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station no./m2 No. species Station IM2 Replicates IM2.1 IM2.2 IM2.3 IM2.4 IM2.5 Mean/station	thin 3 0 0 0 5 2 2 2.0 50 6 Polychaete thin 0 2 0 0 3 3 1.0	Polychaete mud 2 1 0 0 0 0 0.6 15 Depth -4.5 Polychaete mud 3 1 0 3 3 2.0	Polychaete Sthenelais 0 0 2 2 1 1.0 25 Om AHD Polychaete Sthenelais 0 0 3 2 3 1.6	Cirratulidae 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0 0 0 0 0 0 0 0 0	Gastropod Nassarius 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Bivalve Corbula 1 2 0 1 1 1 1 1.0 25 6332237 Bivalve Corbula 0 1 2 0 0 2 1.0 0 1.0 0 1 1 2 0 0 2 1.0 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 0 1 1 1 0 1 1 1 0 1	Bivalve Soletellina 16 3 20 10 17 13.2 330 Bivalve Soletellina 6 2 6 9 3 5.2	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 1 0 0 0 0 0 0 0 0	Bivalve	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0	7 Trichomya 0 0 0 0 2 0.4 10 Total Org Bivalve Trichomya 4 0 0 0 0 0 0.8	Saccostrea 0 0 0 0 0 0 0 sanisms at	0 0 0 0 0 0 0 0 2 Station	0 0 0 0 0 0 0 0 91
Replicates IM1.1 IM1.2 IM1.3 IM1.4 IM1.5 Mean/station no/m2 No. species Station IM2 Replicates IM2.1 IM2.2 IM2.3 IM2.4 IM2.5	thin 3 0 0 5 2 2.0 50 6 Polychaete thin 0 2 0 0 3	Polychaete mud 2 1 0 0 0 0 15 Depth -4.5 Polychaete mud 3 1 0 3 3	Polychaete Sthenelais 0 0 2 2 1 1.0 25 Om AHD Polychaete Sthenelais 0 0 3 2 3	Cirratulidae 0 0 0 0 0 0 0 0 0 Polychaete Cirratulidae 0 0 0 0	Gastropod Nassarius 0	Bivalve Corbula 1 2 0 1 1 1 1.0 25 6332237 Bivalve Corbula 0 1 2 0 0 1 2 0 0 1 2 0 0 1 1 1 1 1 1 1	Bivalve Soletellina 16 3 20 10 17 13.2 330 Bivalve Soletellina 6 2 6 9 3	Bivalve Paphia 0 0 0 0 0 0 0 Sampled Bivalve Paphia 0 1 0 0 0	Bivalve Dosinia 0 0 0 0 0 0 7th Septe Bivalve Dosinia 0 0 0 0 0 0	Bivalve Cyamiomactra 0 0 0 0 0 0 0 0 0 0 ember 2022 Bivalve Cyamiomactra 0 0 0 0	7 Trichomya 0 0 0 0 2 0.4 10 Total Org Bivalve Trichomya 4 0 0 0 0 0 0.8 20	Saccostrea 0 0 0 0 0 0 0 sanisms at	0 0 0 0 0 0 0 0 2 Station	0 0 0 0 0 0 0 91

Station IM3		Depth -5.50m AHD			56 364693	6332101		Sampled	7th Septe	ember 2022				
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Cirratulidae	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
IM3.1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
IM3.2	0	0	0	0	2	0	10	1	0	0	0	0	0	0
IM3.3	2	0	0	0	0	1	11	0	0	0	0	0	0	0
IM3.4	0	0	0	0	0	0	14	0	0	0	0	0	0	0
IM3.5	0	1	0	0	0	2	13	0	0	0	0	0	0	0
Mean/station	0.4	0.2	0.0	0.0	0.4	0.6	9.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	10	5	0	0	10	15	245	5	0	0	0	0	0	0
No. species	6										Total Org	janisms at	t Station	58
Station IM4		Depth -6.0	0m AHD		56 364673	6332705		Sampled	7th Sept	ember 2022				
Replicates	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Cirratulidae	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiomactra	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
IM4.1	1	0	0	0	0	0	8	0	0	0	0	0	0	0
IM4.2	0	1	0	0	0	0	9	0	0	0	0	0	0	0
IM4.3	0	3	0	0	0	0	2	0	0	0	0	0	0	0
IM4.4	1	3	0	0	0	0	9	0	0	0	0	0	0	0
IM4.5	0	1	0	0	0	0	1	0	0	0	0	0	0	0
Mean/station	0.4	1.6	0.0	0.0	0.0	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
no./m2	10	40	0	0	0	0	145	0	0	0	0	0	0	0
No. species	3										Total Or	ganisms a	at Station	39
										Total	Total or number o	ganisms (1981 12

A total of 1981 benthic marine organisms greater than 1 mm in size were captured in the study area of Lake Macquarie during the September 2022 survey of 22 stations (**Table 7.1**). Twelve species of benthic marine organisms were found. The fauna included four species of polychaete worm (**Plate 5.1**); six species of bivalve (**Plate 5.3**); one species of brittle star (**Plate 5.4**); and one crab species.

In September 2022, the greatest numbers of organisms were collected at stations R10 (302 organisms), C2 (163 organisms), R1 (121 organisms), R6 now IM8 (106 organisms), and C7 (103 organisms). The stations with the least numbers of organisms were R7 (35 total), IM4 (39 organisms), R4 now IM6 (42 total), R2 (48 total) and R8 (55 total) (**Table 7.1**).

The bivalve *Soletellina alba* was the most commonly encountered organism and was collected in relatively large numbers throughout the study area. The number of *S. alba* in each replicate sample ranged from 0 to 80 and the species was present at 21 out of the 22 stations. The majority of *S. alba* were juveniles. Polychaete worms were also common in the benthos (**Table 7.1**). Other species recorded included the bivalves *Corbula truncata*, *Dosinia sculpta* and *Paphia undulata*; the gastropod *Nassarius jonassii*; and the brittle star *Ophionereis schayeri*.

Very few mussels were found alive during the survey. *Trichomya hirsuta* was found alive in small numbers at stations R7, R3 now IM5, IM1 and IM2 only (**Table 7.1**). The mussel mortality may be due to the inflow of freshwater into the lake as opposed to low dissolved oxygen concentrations. Mine subsidence is unlikely to be a factor. The station with the greatest number of living mussels was R7 where samples were collected at around -5.85m AHD.

At the time of survey, species diversity at each station ranged from 3 to 8 species and was comparable with previous years (**Table 7.2**). In September 2022, Control stations had a range of 5 to 7 species; Reference stations had a range of 4 to 7 species; and the Impact stations had a range of 3 to 8 species.

 Table 7.2
 Number of species found at each Station from February 2012 to September 2022

Station	C1	C2	C3	C4	C5	C6	C7	R1	R2	R3	R4
Feb 2012	10	5	5	7				8	8	5	5
Sept 2012	3	6	4	4				6	3	4	5
March 2013	4	5	7	7				6	5	6	5
Sept 2013	6	6	3	7				5	6	5	4
March 2014	4	3	5	5				6	4	5	3
Sept 2014	3	4	4	8				6	5	6	6
March 2015	3	3	5	3				5	3	6	5
Sept 2015	5	4	4	3				5	3	4	6
March 2016	6	4	5	5	5			6	5	6	4
Sept 2016	7	3	6	5	4	8		8	4	5	6
March 2017	2	4	5	3	5	5		4	5	4	5
Sept 2017	4	4	4	4	4	5		4	3	6	5
March 2018	4	4	8	4	4	3	5	7	8	5	4
Sept 2018	3	4	4	6	5	5	5	4	4	5	5
March 2019	6	3	4	4	6	5	3	4	5	7	3
Sept 2019	5	6	5	5	4	5	6	4	3	7	4
March 2020	5	6	6	4	7	3	6	6	6	7	4
August 2020	6	5	4	4	3	5	5	4	5	7	4
March 2021	5	6	3	4	5	2	2	5	4	7	4
Sept 2021	4	4	7	6	7	7	6	5	4	8	3
March 2022	5	6	4	7	6	7	4	6	4	9	7
Sept 2022	5	5	7	7	6	5	6	6	5	7	6

Station	R5	R6	R7	R8	R9	R10	R11	IM1	IM2	IM3	IM4
Feb 2012								7	4	4	5
Sept 2012								4	4	3	5
March 2013								7	5	5	5
Sept 2013								4	3	4	5
March 2014	4	3						5	9	4	5
Sept 2014	3	3						5	6	3	6
March 2015	3	3						5	4	4	5
Sept 2015	5	4						5	5	4	4
March 2016	4	4	8					6	6	3	4
Sept 2016	6	7	7	5	8			6	4	6	3
March 2017	4	4	4	3	5			3	4	3	4
Sept 2017	4	4	4	5	4			5	5	5	5
March 2018	6	3	4	3	4	4	4	5	7	3	4
Sept 2018	5	4	6	4	5	4	4	4	8	4	4
March 2019	5	4	4	4	4	6	6	5	5	2	4
Sept 2019	4	4	5	4	4	4	3	6	5	7	5
March 2020	4	4	8	3	4	4	4	7	7	4	4
August 2020		5	8	4	5	5	4	5	6	4	6
March 2021	5	5	5	4	6	5	8	7	7	5	7
Sept 2021 March 2022	4	4	7 8	3 3	4 5	6 6	7	3 5	7	4	4
Sept 2022	4 5	4 4	8 4	6	7	6	6 5	6	6 8	5 6	6 3

Table 7.3 shows the mean number of marine benthic organisms for each station and species sampled in September 2022. The table includes depths relative to AHD for each station. At the time of sampling, water depth does not appear to be influencing the marine fauna present in the benthos of Lake Macquarie.

Figure 7.1 shows a biplot representing the relationship between marine benthic organisms and stations for the September 2022 survey. Information on biplots is provided in **Appendix 2**.

Table 7.3 Mean number of marine benthic organisms at Control (C), Reference (R) and Impact Stations (IM)

	Depth (m)	Polychaete thin	Polychaete mud	Polychaete Sthenelais	Polychaete Chaetopterus	Gastropod Nassarius	Bivalve Corbula	Bivalve Soletellina	Bivalve Paphia	Bivalve Dosinia	Bivalve Cyamiom	Bivalve Trichomya	Bivalve Saccostrea	Ophuroid	Crab
C1	-4.5	0.2	0.2	0.0	0.0	0.0	1.2	13.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0
C2	-4.5	1.0	1.2	0.0	0.0	0.0	5.0	25.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
C3	-5.5	1.0	1.0	0.4	0.0	0.0	0.2	12.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0
C4	-6.0	0.6	0.4	0.2	0.0	0.2	0.4	12.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0
C5	-6.0	0.6	1.8	0.4	0.0	0.0	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.4	0.2
C6	-5.5	1.6	0.2	0.4	0.0	0.0	2.4	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C7	-5.5	0.4	1.8	8.0	0.2	0.0	0.2	17.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R1	-4.5	0.4	1.8	0.4	0.0	0.2	2.0	19.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R2	-4.5	0.6	0.4	0.2	0.0	0.0	1.2	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R3 (IM5)	-5.5	1.6	4.0	0.2	0.0	0.8	0.4	7.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
R4 (IM6)	-6.0	0.2	0.4	0.2	0.0	0.0	0.8	6.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0
R5 (IM7)	-5.5	0.4	0.4	0.4	0.0	0.0	0.6	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R6	-6.0	0.4	0.6	0.0	0.0	0.0	1.4	18.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R7	-6.0	0.0	0.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	6.2	0.2	0.0	0.0
R8	-5.5	0.4	0.4	0.2	0.0	0.2	0.2	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R9	-4.5	0.4	0.8	1.4	0.0	0.2	1.2	10.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0
R10	-5.5	1.2	2.4	0.0	0.4	0.0	2.2	48.4	0.0	5.8	0.0	0.0	0.0	0.0	0.0
R11	-6.0	0.2	1.6	0.2	0.0	0.0	0.0	10.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0
IM1	-4.5	2.0	0.6	1.0	0.0	0.0	1.0	13.2	0.0	0.0	0.0	0.4	0.0	0.0	0.0
IM2	-4.5	1.0	2.0	1.6	0.0	0.4	1.0	5.2	0.2	0.0	0.0	8.0	0.0	0.0	0.0
IM3	-5.5	0.4	0.2	0.0	0.0	0.4	0.6	9.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0
IM4	-6.0	0.4	1.6	0.0	0.0	0.0	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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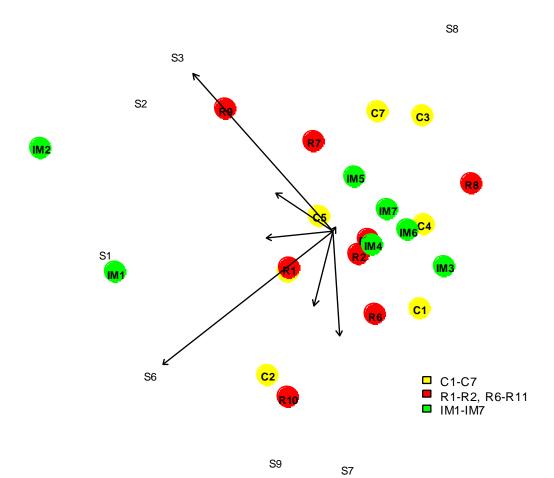


Figure 7.1 Relationship between benthic organisms and sampling stations – Lake Macquarie benthos survey September 2022 (PC biplot goodness-of-fit: 59.0)

Station		Organism
C1 – Control Station C1	R8 – Reference Station R8	S1 Polychaete thin
C2 – Control Station C2	R9 – Reference Station R9	S2 Polychaete mud
C3 – Control Station C3	R10 – Reference Station R10	S3 Sthenelais pettiboneae
C4 – Control Station C4	R11 – Reference Station R11	S6 Corbula truncata
C5 – Control Station C5	IM1 – Impact Station IM1	S7 Soletellina alba
C6 – Control Station C6	IM2 – Impact Station IM2	S8 Paphia undulata
C7 – Control Station C7	IM3 – Impact Station IM3	S9 Dosinia sculpta
R1 – Reference Station R1	IM4 – Impact Station IM4	
R2 – Reference Station R2	IM5 – Impact Station IM5	
R6 – Reference Station R6	IM6 – Impact Station IM6	
R7 – Reference Station R7	IM7 – Impact Station IM7	

Seven species differentiated sampling stations during the September 2022 sampling period (**Figure 7.1**):

- Polychaete designated thin (S1) characterized the Impact stations IM1 and IM2.
- Polychaete designated S2 characterised stations IM2, R9, R7, and C5.
- Polychaete Sthenelais petitiboneae (S3) characterised the Reference Stations R9 and R7, and the Control Station C5.
- Bivalve Corbula truncata (S6) defined Stations C2, R1 and C6.
- Bivalve Soletellina alba (S7) characterised Control Stations C1 and C2; the Reference Stations R1, R6, R10 and R2; and the Impact Stations IM3 and IM4.
- The bivalve Dosinia sculpta (S9) differentiated station R10.
- The bivalve *Trichomya hirsuta* (not included in biplot) differentiated the Reference Station R7.

8. Sediment Analysis

In September 2022, the sediment in the mud basin of Lake Macquarie off Summerland Point, Chain Valley Bay and Bardens Bay was largely composed of fine grey silt that was mildly plastic in nature (able to be molded into a coherent shape). Small to large shell fragments were present in the sediment at most stations (**Table 8.1**).

Sediment collected at stations C7 and R10 contained a large amount of coarse grey sand and silt (**Table 8.2**). The sediment sample collected at R7 was 98% shell (**Table 8.2**).

Table 8.1 Description of sediment collected from sampling stations in September 2022.

Station	Description
C1	Dark grey silt with some shell fragments.
C2	Dark grey silt with some shell fragments.
C3	Dark grey silt with some shell fragments.
C4	Dark grey silt with some shell fragments.
C5	Dark grey silt with some coarse grey sand, gravel and shell fragments.
C6	Dark grey silt with large shell fragments.
C7	Dark grey silt and coarse grey sand with some shell fragments.
R1	Dark grey silt with coarse grey sand. No shell fragments.
R2	Dark grey silt with some shell fragments.
R6	Dark grey silt with some shell fragments.
R7	Large shell fragments with some silt.
R8	Dark grey silt with some shell.
R9	Dark grey silt with some shell.
R10	Dark grey silt and sand. No shell fragments.
R11	Dark grey silt.
IM1	Dark grey silt with large shell fragments and some sand
IM2	Dark grey silt with large shell fragments.
IM3	Dark grey silt with large shell fragments.
IM4	Dark grey silt with some large shell fragments.
	Dark grey silt with large shell fragments.
	Dark grey silt with some shell fragments.
R5 (IM7)	Dark grey silt with some sand and shell fragments.

Table 8.2 Percentage of silt, sand, gravel and shell for control, reference and impact stations

	% Silt	% Sand	% Gravel	% Shall
- 4				
C1	98	0	0	2
C2	99	0	0	1
C3	98	0	0	2
C4	98	0	0	2
C5	96	2	1	1
C6	83	0	0	17
C7	56	43	0	1
R1	96	4	0	0
R2	98	0	0	2
R3 (IM5)	82	0	0	18
R4 (IM6)	99	0	0	1
R5 (IM7)	98	1	0	1
R6	99	0	0	1
R7	2	0	0	98
R8	99	0	0	1
R9	99	0	0	1
R10	61	39	0	0
R11	100	0	0	0
IM1	80	1	0	19
IM2	80	0	0	20
IM3	90	0	0	10
IM4	99	0	0	1

September 2022

9. Physical characteristics of water in Lake Macquarie - September 2022

At each station, a water quality profile was taken using a calibrated Yeo-Kal 618RU Analyser. The physical characteristics were measured on 12th September 2022. Units of measurement were temperature - degrees Celsius; conductivity - mS/cm; salinity - parts per thousand; pH; dissolved oxygen - % saturation and mg/L; and turbidity - NTU.

The water quality profile for each station is presented in **Appendix 1**. At the time of sampling,

the water profile had the following characteristics:

Conductivity was relatively uniform throughout the water column and the study area. For instance, at:

- R1, conductivity ranged from 50.02 mS/cm at the surface to 51.23 mS /cm at -4.5m AHD.
- R2, conductivity ranged from 50.04 mS /cm at the surface to 49.99 mS at -4.6m AHD.
- R10, conductivity ranged from 50.13 mS/cm at the surface to 50.12 mS/cm at -5.0m AHD.
- R11, conductivity ranged from 50.18 mS /cm at the surface to 51.84 mS /cm at -6.1m AHD.

Salinity increased slightly with water depth, and the concentration of salinity at similar depths were consistent across the study area:

- C1, salinity ranged from 32.72 ppt at the surface to 33.12 ppt at -4.6m AHD.
- C6, salinity ranged from 32.65 ppt at the surface to 33.64 ppt at -6.0m AHD.
- R6 now IM8, salinity ranged from 32.83 ppt at the surface to 34.02 ppt at -6.0m AHD.
- R3 now IM5, salinity ranged from 32.75 ppt at the surface to 34.01 ppt at -5.6m AHD.
- C5, salinity ranged from 32.96 ppt at the surface to 34.00 ppt at -6.0m AHD.

pH decreased slightly with water depth:

- IM1, pH ranged from 8.39 at the surface to 8.24 at -4.6m AHD.
- C4, pH ranged from 9.13 at the surface to 8.72 at -6.0m AHD
- R5 now IM7, pH ranged from 8.71 at the surface to 8.29 at -5.6m AHD.
- C3, pH ranged from 8.46 at the surface to 8.38 at -5.6m AHD.

Water temperature decreased with depth:

- R9, water temperature ranged from 18.05°C at the surface to 17.75°C at -4.9m AHD.
- R7, water temperature ranged from 17.99°C at the surface to 17.34°C at -5.6m AHD.
- C7, water temperature ranged from 18.53°C at the surface to 17.69°C at -4.0m AHD.
- IM4, water temperature ranged from 17.92°C at the surface to 17.16°C at -6.0m AHD.

Dissolved oxygen generally decreased slightly with depth however concentrations were over 93% saturation throughout the water column:

 C2, dissolved oxygen decreased from 105.4% saturation at the surface to 103.5% saturation at -4.7m AHD.

- R4, dissolved oxygen decreased from 107.4% saturation at the surface to 96.3% saturation at -6.1m AHD.
- R2, dissolved oxygen increased from 107.1% saturation at the surface to 108.5% saturation at
 -4.6m AHD
- C6, dissolved oxygen decreased from 97.5% saturation at the surface to 95.1 % saturation at -4.7m AHD (**Appendix 1**).

The physical characteristics of the bottom waters of Lake Macquarie in September 2022 were as follows:

- Water Temperature ranged from 17.09°C to 17.87°C. Mean water temperature was 17.42°C.
- Conductivity ranged from 49.99 mS/cm to 51.84 mS/cm. Mean conductivity was 51.04 mS/cm.
- Salinity ranged from 32.72 ppt to 34.07 ppt. Mean salinity was 33.49 ppt.
- Turbidity ranged from 2.3 NTU to 39.3 NTU. Mean turbidity was 12.05 NTU.
- pH ranged from 8.09 and 9.16. Mean pH was 8.31.
- Dissolved oxygen (% saturation) ranged from 93.8% to 109.2%. Mean dissolved oxygen was 101.1% saturation.
- Dissolved oxygen (mg/L) ranged from 7.34 mg/L to 8.54 mg/L. Mean dissolved oxygen was 7.92 mg/L (**Table 9.1**).

Rainfall in the months preceding the survey were 11mm, 402.8mm, and 37.8mm for June, July and August respectively (Cooranbong Lake Macquarie AWS No. 61412). By 12th September a further 69 mm had fallen in the catchment.

Table 9.1 Physical characteristics of the bottom water – September 2022

Station	Temperature	Conductivity	Salinity	Dissolved Oxygen	Dissolved Oxygen	рН	Turbidity	Depth
	°C	mS/cm	ppt	% sat	mg/L		NTU	m
C1	17.85	50.54	33.12	100.3	7.81	8.29	28.6	-4.60
C2	17.29	50.08	32.78	103.5	8.17	8.42	12.7	-4.70
C3	17.47	50.70	33.24	106.3	8.33	8.38	4.9	-5.60
C4	17.40	51.17	33.58	99.8	7.82	8.72	5.0	-6.00
C5	17.10	51.74	34.00	101.0	7.95	8.09	12.7	-6.00
C6	17.36	51.25	33.64	95.1	7.46	9.16	6.0	-6.00
C7	17.69	50.24	32.90	109.2	8.54	8.09	2.3	-4.00
R1	17.51	51.23	33.63	93.8	7.34	8.16	24.1	-4.60
R2	17.87	49.99	32.72	108.5	8.47	8.36	9.0	-4.60
R3 (IM5)	17.09	51.75	34.01	98.2	7.72	8.31	8.2	-5.50
R4 (IM6)	17.14	51.75	34.01	96.3	7.57	8.17	12.8	-6.10
R5 (IM7)	17.38	51.10	33.53	101.3	7.95	8.29	39.3	-4.50
R6	17.24	51.76	34.02	94.5	7.41	8.22	19.9	-4.60
R7	17.34	51.04	33.49	105.5	8.28	8.14	3.8	-5.60
R8	17.23	51.69	33.97	96.9	7.60	8.15	10.2	-6.10
R9	17.75	50.69	33.23	99.7	7.77	8.25	6.8	-5.60
R10	17.84	50.12	32.81	105.4	8.23	8.41	17.3	-6.00
R11	17.14	51.84	34.07	95.7	7.52	8.09	14.3	-5.90
IM1	17.76	50.69	33.23	99.4	7.76	8.24	10.2	-5.60
IM2	17.42	50.99	33.45	105.2	8.25	8.31	5.7	-4.90
IM3	17.31	50.81	33.32	108.4	8.52	8.31	2.9	-5.00
IM4	17.16	51.67	33.96	99.2	7.79	8.21	8.3	-6.10
Mean	17.42	51.04	33.49	101.1	7.92	8.31	12.05	
Min	17.09	49.99	32.72	93.8	7.34	8.09	2.3	
Max	17.87	51.84	34.07	109.2	8.54	9.16	39.3	

10. Conclusions

The results from the September 2022 benthic communities monitoring results show compliance to the Schedule 4 Environmental Conditions - underground mining of SSD5465 - Modification 4 in the Performance Measures table with respect to the Subsidence Impact Performance Measure for Benthic communities which display nil to minor environmental consequences due to underground mining.

The below summary of findings outlines the historical basis for this compliance statement and the compliance is detailed in the table below.

Conditions from SSD-5465 – Mod 4	Compliance Status and Comments							
Schedule 4 Environmental Conditions – underground mining Performance Measures – Natural Environment Biodiversity – Benthic Communities Subsidence Impact Performance Measure – Minor environmental consequences, including minor changes composition and/or distribution.	Compliant – See section 16 - Conclusions							
Measurements undertaken by generally accepted methods.	Compliant – See section 4 and 5							
Measures Methods fully described.	Compliant – See section 4 and 5							

In September 2022, 22 benthic stations were sampled in the study area. A total of 1981 organisms greater than 1mm in size were found, comprising 12 species. This compares with the results from September 2018, September 2019, September 2020 and September 2021 where 1576, 815, 1367, 1032 and 2096 organisms respectively were recorded representing approximately twelve species. As in previous years, polychaete worms and bivalve molluscs were the most frequently encountered animals. Stations were distinguished by the relative abundance of the dominant species. Water depth was not in any way important in determining the species composition at a station.

Physical variables such as salinity, conductivity and turbidity of the bottom water had little influence on the species composition of the benthos. Dissolved oxygen concentration, however, can have a major effect on abundance. Major extinction events have occurred in the mud basin of Lake Macquarie. The evidence for this lies in the presence of large numbers of intact but dead bivalve shells entombed in the mud. The cause of extinction events appears to be prolonged dissolved oxygen depletion of bottom water. Prolonged dissolved oxygen depletion of the bottom water was measured during the water quality study conducted by Laxton and Laxton (1983 to 1997) and low dissolved oxygen levels were measured during the March 2020 benthic survey. In September 2022, dissolved oxygen levels of Lake Macquarie ranged from 7.34 mg/L to 8.54 mg/L or 93.8% to 109.2%.saturation. Surface waters had higher concentrations of dissolved oxygen than the bottom waters.

Bottom sediment in the study area was composed of fine black mud with varying proportions of

black sand and shell fragments.

These results appear to support the notion that increasing the water depth by up to 0.78m (SSD-5465 subsidence limit in Lake Macquarie) has, to date, had little to no discernible effect on the composition and abundance of organisms making up the benthos of the mud basin.

11. References

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12. Acknowledgements

We wish to acknowledge the help of Mr Lachlan McWha in facilitating the study.

Appendix 1 – Water quality profiles for control, impact and reference stations Sept 22

C1	Date	Time	Denth (m)	Temp (C)	Cond (ms/cm)	Sal (nnt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
C1	12/09/2022	8:15:48	0.5	17.74	50.00	32.72	8.39	107.1	8.38	7.0
	12/09/2022	8:16:13	1.0	17.75	50.01	32.73	8.40	107.4	8.40	6.1
	12/09/2022	8:16:31	1.5	17.72	50.02	32.74	8.40	107.5	8.42	6.5
	12/09/2022	8:16:45	2.0	17.71	50.03	32.74	8.40	107.4	8.41	6.5
	12/09/2022	8:17:11	2.5	17.69	50.02	32.74	8.39	108.3	8.48	6.1
	12/09/2022	8:17:28	3.0	17.68	50.03	32.74	8.39	108.3	8.49	6.5
	12/09/2022		3.5	17.66	50.03	32.74	8.38	108.5	8.50	5.8
	12/09/2022	8:18:00	4.0	17.65	50.03	32.74	8.38	108.6	8.51	6.7
	12/09/2022	8:19:15	4.5	17.83	50.36	32.99	8.31	100.5	7.84	16.7
	12/09/2022	8:19:27	4.6	17.85	50.54	33.12	8.29	100.3	7.81	28.6
C2	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	9:16:59	0.4	17.69	50.10	32.79	8.59	105.4	8.25	4.2
	12/09/2022	9:17:27	0.5	17.67	50.06	32.77	8.59	105.6	8.27	4.0
	12/09/2022	9:17:52	1.0	17.64	50.10	32.80	8.58	106.2	8.33	3.5
	12/09/2022	9:18:08	1.5	17.66	50.13	32.82	8.58	106.5	8.34	2.9
	12/09/2022	9:18:11	2.0	17.66	50.13	32.82	8.58	106.5	8.34	3.0
	12/09/2022	9:18:27	2.5	17.63	50.13	32.82	8.57	106.7	8.36	3.0
	12/09/2022	9:18:49	3.0	17.59	50.14	32.83	8.56	106.9	8.38	3.1
	12/09/2022	9:19:10	3.5	17.53	50.12	32.81	8.54	106.7	8.38	3.2
	12/09/2022	9:19:31	4.0	17.45	50.11	32.80	8.50	106.5	8.38	5.2
	12/09/2022	9:20:09	4.5	17.24	50.05	32.76	8.44	104.6	8.27	16.1
	12/09/2022	9:21:33	4.7	17.29	50.08	32.78	8.42	103.5	8.17	12.7
С3	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	8:58:36	0.5	17.67	50.14	32.82	8.46	107.9	8.45	3.2
	12/09/2022	8:59:04	1.0	17.66	50.15	32.83	8.46	107.9	8.45	3.3
	12/09/2022	8:59:24	1.5	17.68	50.16	32.84	8.46	107.8	8.44	3.0
	12/09/2022	8:59:27	2.0	17.68	50.16	32.84	8.46	107.8	8.44	3.0
	12/09/2022	8:59:44	2.5	17.66	50.16	32.84	8.45	108.1	8.46	3.6
	12/09/2022	9:00:06	3.0	17.65	50.16	32.84	8.45	108.0	8.46	3.2
	12/09/2022	9:00:22	3.5	17.63	50.16	32.84	8.44	107.9	8.46	3.1
	12/09/2022	9:00:42	4.0	17.61	50.16	32.84	8.44	107.6	8.44	2.9
	12/09/2022	9:00:58	4.5	17.60	50.15	32.84	8.43	107.6	8.44	3.1
	12/09/2022	9:01:14	5.0	17.59	50.14	32.82	8.43	107.5	8.43	4.0
	12/09/2022	9:01:31	5.5	17.59	50.11	32.81	8.42	107.4	8.43	3.0
	12/09/2022	9:02:34	5.6	17.47	50.70	33.24	8.38	106.3	8.33	4.9

C4	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	6:52:14	0.5	18.24	49.89	32.64	9.13	101.5	7.87	4.1
	12/09/2022	6:52:37	1.0	18.15	49.98	32.71	9.12	103.2	8.01	4.0
	12/09/2022	6:53:00	1.5	18.09	50.01	32.73	9.09	104.5	8.12	3.7
	12/09/2022	6:53:17	2.0	18.02	50.03	32.75	9.07	105.2	8.19	3.9
	12/09/2022	6:53:34	2.5	17.98	50.06	32.77	9.04	105.3	8.20	3.6
	12/09/2022	6:53:48	3.0	17.97	50.06	32.77	9.02	105.5	8.22	3.5
	12/09/2022	6:54:03	3.5	17.96	50.06	32.77	9.00	105.7	8.23	3.5
	12/09/2022	6:54:22	4.0	17.95	50.06	32.76	8.98	105.8	8.25	3.6
	12/09/2022	6:54:37	4.5	17.95	50.05	32.76	8.96	106.1	8.27	3.4
	12/09/2022	6:54:50	4.6	17.94	50.00	32.72	8.94	106.3	8.29	3.4
	12/09/2022	6:55:06	5.0	17.43	51.10	33.53	8.82	107.6	8.43	4.9
	12/09/2022	6:55:09	5.5	17.42	51.14	33.56	8.81	107.4	8.41	5.1
	12/09/2022	6:56:03	6.0	17.4	51.17	33.58	8.72	99.8	7.82	5.0
C5	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	10:34:24	0.5	18.34	50.33	32.96	8.22	109.0	8.42	5.4
	12/09/2022	10:34:58	1.0	17.91	50.40	33.01	8.19	110.3	8.59	2.1
	12/09/2022	10:35:39	1.5	17.8	50.33	32.96	8.15	109.9	8.58	2.7
	12/09/2022	10:36:12	2.0	17.77	50.33	32.97	8.15	109.6	8.56	2.4
	12/09/2022	10:36:25	2.1	17.77	50.36	32.99	8.14	109.6	8.56	2.7
	12/09/2022	10:36:53	2.5	17.67	50.50	33.09	8.14	109.2	8.54	1.7
	12/09/2022	10:37:27	3.0	17.62	50.54	33.12	8.14	109.3	8.55	1.5
	12/09/2022			17.48	50.58	33.15	8.13	109.5	8.59	2.2
	12/09/2022	10:38:39	4.0	17.17	51.32	33.70	8.07	107.5	8.45	2.6
	12/09/2022	10:39:10	4.5	17.12	51.46	33.80	8.07	106.8	8.40	2.1
	12/09/2022	10:39:34	5.0	17.06	51.67	33.95	8.06	106.3	8.37	7.2
	12/09/2022	10:40:35	5.5	17.09	51.73	34.00	8.06	102.2	8.03	9.4
	12/09/2022	10:42:00	6.0	17.1	51.74	34.00	8.09	101.0	7.95	12.7
C6	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	6:42:30	0.5	18.17	49.89	32.65	9.90	94.2	7.31	3.4
	12/09/2022	6:43:07	0.6	18.20	49.90	32.65	9.85	97.5	7.57	3.7
	12/09/2022		1.0	18.22	49.96	32.70	9.83	98.3	7.62	3.7
	12/09/2022			18.14	50.05	32.76	9.81	99.3	7.71	3.6
	12/09/2022			18.13	50.05	32.76	9.78	99.7	7.74	4.0
	12/09/2022			18.12	50.05	32.76	9.74	100.4	7.80	4.0
	12/09/2022			18.11	50.06	32.77	9.70	101.3	7.87	3.7
	12/09/2022			18.02	50.11	32.80	9.67	101.5	7.89	3.5
	12/09/2022			18.02	50.10	32.80	9.67	101.5	7.90	3.4
	12/09/2022			17.91	50.18	32.85	9.64	102.2	7.97	3.2
	12/09/2022			17.73	50.31	32.95	9.60	102.8	8.04	2.8
	12/09/2022			17.48	50.66	33.21	9.53	103.7	8.13	3.8
	12/09/2022			17.43	51.00	33.46	9.38	99.1	7.77	5.5
	12/09/2022			17.31	51.48	33.81	9.28	97.4	7.64	8.1
	12/09/2022	6:48:52	6.0	17.36	51.25	33.64	9.16	95.1	7.46	6.0

C7	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	11:02:00	0.5	18.53	50.22	32.88	8.17	109.7	8.44	2.2
	12/09/2022	11:02:31	1.0	18.09	50.17	32.85	8.14	111.1	8.63	2.4
	12/09/2022	11:02:58	1.5	17.90	50.22	32.88	8.10	111.1	8.66	2.3
	12/09/2022	11:03:19	2.0	17.81	50.22	32.88	8.09	110.8	8.65	2.6
	12/09/2022	11:03:48	2.5	17.77	50.20	32.87	8.08	109.9	8.59	2.9
	12/09/2022	11:04:06	3.0	17.74	50.21	32.88	8.08	109.6	8.57	2.7
	12/09/2022	11:04:28	3.5	17.71	50.22	32.88	8.08	109.2	8.54	2.9
	12/09/2022	11:05:17	4.0	17.69	50.24	32.90	8.09	109.2	8.54	2.3
IM1	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022		0.5	17.83	50.00	32.72	8.39	106.9	8.35	5.5
	12/09/2022		0.5	17.83	50.01	32.73	8.39	107.3	8.38	5.5
	12/09/2022		1.0	17.82	50.01	32.73	8.39	107.7	8.41	5.6
	12/09/2022		1.5	17.82	50.03	32.75	8.39	108.3	8.46	5.5
	12/09/2022		2.0	17.81	50.04	32.75	8.38	108.8	8.50	5.2
	12/09/2022		2.5	17.81	50.04	32.75	8.38	108.8	8.50	5.3
	12/09/2022		3.0	17.80	50.05	32.76	8.38	108.9	8.51	5.0
	12/09/2022	8:24:53	3.0	17.80	50.05	32.76	8.37	108.6	8.49	4.7
	12/09/2022	8:25:12	3.5	17.79	50.04	32.76	8.36	108.8	8.50	4.6
	12/09/2022	8:26:58	4.0	17.69	50.87	33.36	8.23	98.6	7.69	17.9
	12/09/2022	8:27:39	4.5	17.64	51.00	33.46	8.21	97.2	7.59	42.6
	12/09/2022	8:29:01	4.6	17.76	50.69	33.23	8.24	99.4	7.76	10.2
IM2	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	7:37:05	0.5	17.94	50.02	32.74	8.52	108.3	8.44	3.4
	12/09/2022	7:37:23	0.5	17.93	50.02	32.74	8.52	108.5	8.46	3.4
	12/09/2022	7:37:49	1.0	17.94	50.02	32.74	8.51	109.1	8.50	3.4
	12/09/2022	7:38:12	1.5	17.93	50.03	32.74	8.50	109.2	8.51	3.5
	12/09/2022	7:38:31	2.0	17.91	50.03	32.74	8.49	109.1	8.51	3.5
	12/09/2022	7:38:53	2.5	17.90	50.02	32.74	8.48	109.4	8.54	3.5
	12/09/2022	7:39:10	2.5	17.90	50.03	32.75	8.48	109.5	8.54	3.7
	12/09/2022	7:39:24	3.0	17.71	50.37	33.00	8.45	110.3	8.62	2.8
	12/09/2022	7:40:06	3.5	17.63	50.44	33.05	8.41	109.3	8.55	2.7
	12/09/2022	7:40:22	4.0	17.32	50.60	33.17	8.38	110.1	8.66	2.0
	12/09/2022	7:40:44		17.36	50.91	33.39	8.35	109.5	8.60	3.2
	12/09/2022	7:42:02	4.6	17.42	50.99	33.45	8.31	105.2	8.25	4.5
IM3	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	7:46:59	0.5	18.02	50.04	32.75	8.49	108.2	8.42	4.0
	12/09/2022	7:47:17	1.0	18.02	50.04	32.75	8.48	108.3	8.43	4.3
	12/09/2022	7:47:32	1.5	18.02	50.04	32.75	8.48	108.5	8.44	3.7
	12/09/2022	7:47:51	2.0	18.01	50.05	32.76	8.47	108.6	8.45	3.7
	12/09/2022	7:48:13	2.5	18.01	50.04	32.75	8.46	108.6	8.46	3.7
	12/09/2022	7:48:33	3.0	17.97	50.12	32.81	8.44	109.0	8.49	3.9
	12/09/2022	7:48:49	3.5	17.68	50.37	32.99	8.42	109.9	8.60	2.7
	12/09/2022	7:49:11	4.0	17.54	50.56	33.14	8.38	110.1	8.63	2.8
	12/09/2022	7:50:01	4.5	17.53	50.70	33.23	8.33	107.3	8.41	3.1
	12/09/2022	7:50:15	5.0	17.32	50.78	33.30	8.33	107.8	8.48	2.7
	12/09/2022	7:51:09	5.5	17.31	50.81	33.32	8.31	108.4	8.52	2.9

IM4	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	7:25:09	0.5	17.92	50.01	32.73	8.55	107.6	8.39	6.5
	12/09/2022	7:25:30	0.5	17.93	50.02	32.74	8.55	108.0	8.42	5.8
	12/09/2022	7:25:50	1.0	17.93	50.01	32.73	8.55	108.5	8.46	5.8
	12/09/2022	7:26:11	1.5	17.92	50.01	32.73	8.54	109.1	8.51	5.7
	12/09/2022	7:26:14	2.0	17.92	50.02	32.73	8.54	109.1	8.51	5.6
	12/09/2022	7:26:34	2.5	17.93	50.02	32.74	8.53	108.9	8.49	5.3
	12/09/2022	7:26:37	2.5	17.93	50.02	32.74	8.53	108.8	8.49	5.3
	12/09/2022	7:26:54	3.0	17.93	50.01	32.73	8.53	108.8	8.48	5.2
	12/09/2022	7:27:18	3.5	17.93	50.02	32.74	8.51	108.8	8.48	5.1
	12/09/2022	7:27:44	4.0	17.93	50.04	32.75	8.50	108.9	8.49	4.8
	12/09/2022	7:28:00	4.5	17.89	50.16	32.84	8.49	109.1	8.51	4.4
	12/09/2022	7:28:20	5.0	17.73	50.22	32.89	8.46	109.5	8.56	4.0
	12/09/2022	7:29:59	5.5	17.21	51.52	33.84	8.28	104.2	8.18	6.2
	12/09/2022	7:30:39	6.0	17.13	51.76	34.02	8.21	99.6	7.83	11.3
	12/09/2022	7:32:04	6.1	17.16	51.67	33.96	8.21	99.2	7.79	8.3
R1	Date	Time			Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)		Turb (ntu)
	12/09/2022	8:05:17		17.92	50.02	32.74	8.44	107.2	8.36	4.5
	12/09/2022	8:05:44		17.91	50.02	32.74	8.44	107.9	8.41	5.0
	12/09/2022			17.91	50.03	32.74	8.43	108.2	8.44	4.2
	12/09/2022			17.90	50.03	32.75	8.42	108.8	8.49	3.9
	12/09/2022			17.90	50.03	32.74	8.42	109.0	8.50	4.2
	12/09/2022			17.90	50.04	32.75	8.41	109.1	8.51	4.2
	12/09/2022			17.88	50.04	32.76	8.39	109.1	8.51	4.6
	12/09/2022			17.83	50.34	32.97	8.34	106.4	8.30	8.8
	12/09/2022			17.58	51.15	33.57	8.20	99.5	7.77	23.8
	12/09/2022	8:10:16	4.5	17.51	51.23	33.63	8.16	93.8	7.34	24.1
R2	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	8:34:35		17.94	50.04	32.75	8.42	107.1	8.35	5.6
	12/09/2022					32.75	8.42		8.38	6.6
	12/09/2022			17.91	50.04	32.75	8.42	107.7	8.4	5.7
	12/09/2022			17.91	50.04	32.76	8.42	107.8	8.41	6.0
	12/09/2022			17.90	50.04	32.76	8.41	107.8	8.41	5.6
	12/09/2022			17.89	50.05	32.76	8.40	107.9	8.42	6.9
	12/09/2022			17.88	50.05	32.76	8.39	108.0	8.43	13.4
	12/09/2022			17.88	50.04	32.75	8.39	107.9	8.42	7.7
	12/09/2022	8:37:39	4.0	17.87	49.99	32.72	8.38	107.9	8.42	8.4
	12/09/2022	8:38:41	4.5	17.87	49.99	32.72	8.36	108.5	8.47	8.6
	12/09/2022	8:38:44	4.6	17.87	49.99	32.72	8.36	108.5	8.47	9.0

R3 (IM5)	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	6:59:23	0.5	17.93	50.03	32.75	8.77	106.00	8.27	4.6
	12/09/2022	6:59:26	0.5	17.93	50.03	32.75	8.76	106.10	8.27	4.5
	12/09/2022	6:59:46	1.0	17.92	50.03	32.74	8.75	106.80	8.33	4.7
	12/09/2022	7:00:02	1.5	17.93	50.02	32.74	8.74	107.40	8.38	4.4
	12/09/2022	7:00:24	2.0	17.94	50.03	32.74	8.73	108.10	8.42	4.5
	12/09/2022	7:00:39	2.5	17.93	50.02	32.74	8.72	108.60	8.47	4.4
	12/09/2022	7:01:14	3.0	17.94	50.05	32.76	8.69	109.30	8.52	4.3
	12/09/2022	7:01:33	3.5	17.95	50.06	32.77	8.67	109.60	8.54	4.3
	12/09/2022	7:01:49	4.0	17.95	50.18	32.86	8.66	109.80	8.55	3.6
	12/09/2022	7:03:12	4.5	17.34	51.09	33.52	8.46	102.40	8.04	5.6
	12/09/2022	7:04:11	5.0	17.22	51.58	33.89	8.36	99.20	7.79	8.6
	12/09/2022	7:04:35	5.5	17.12	51.72	33.99	8.35	98.70	7.76	9.5
	12/09/2022	7:05:51	5.6	17.09	51.75	34.01	8.31	98.20	7.72	8.2
R4 (IM6)	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	7:09:56	0.5	17.91	50.01	32.73	8.58	107.4	8.38	3.4
	12/09/2022	7:09:59	0.5	17.91	50.01	32.73	8.59	107.5	8.38	3.3
	12/09/2022	7:10:22	1.0	17.92	50.01	32.73	8.59	108.4	8.46	3.5
	12/09/2022	7:10:44	1.5	17.91	50.01	32.73	8.58	109.3	8.52	3.5
	12/09/2022	7:11:00	2.0	17.92	50.01	32.73	8.58	109.5	8.54	3.4
	12/09/2022	7:11:18	2.0	17.93	50.01	32.73	8.57	109.6	8.55	3.4
	12/09/2022	7:11:35	2.5	17.92	50.01	32.73	8.56	110.0	8.58	3.5
	12/09/2022	7:11:58	3.0	17.91	50.02	32.74	8.55	110.2	8.59	3.5
	12/09/2022	7:12:19	3.1	17.91	50.06	32.77	8.53	110.3	8.60	3.4
	12/09/2022	7:12:48	3.5	17.87	50.14	32.82	8.51	110.6	8.63	3.1
	12/09/2022	7:13:13	4.0	17.30	50.74	33.26	8.44	112.1	8.82	1.9
	12/09/2022	7:14:15	4.5	17.32	51.12	33.55	8.36	107.8	8.46	3.3
	12/09/2022	7:14:48	5.0	17.33	51.17	33.59	8.34	106.8	8.38	3.7
	12/09/2022	7:15:48	5.5	17.23	51.45	33.79	8.30	102.0	8.01	3.8
	12/09/2022	7:17:03	6.0	17.16	51.68	33.96	8.21	98.2	7.71	8.5
	12/09/2022	7:19:11	6.1	17.14	51.75	34.01	8.17	96.3	7.57	12.8
R5 (IM7)	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	12:18:36	0.5	19.33	50.14	32.82	8.71	107.2	8.13	6.5
	12/09/2022	12:19:06	1.0	19.31	50.09	32.79	8.68	107.3	8.15	3.6
	12/09/2022	12:19:38	1.5	18.91	50.05	32.76	8.62	108.4	8.29	3.3
	12/09/2022	12:19:59	2.0	18.76	50.03	32.75	8.59	108.3	8.31	3.2
	12/09/2022	12:20:23	2.5	18.26	50.14	32.83	8.53	109.3	8.47	3.0
	12/09/2022	12:20:38	3.0	18.19	50.09	32.79	8.50	109.0	8.45	3.1
	12/09/2022	12:20:56	3.5	18.14	50.02	32.74	8.48	108.5	8.43	2.7
	12/09/2022	12:20:59	4.0	18.14	50.02	32.74	8.48	108.5	8.42	2.7
	12/09/2022	12:21:16	4.5	18.04	50.08	32.78	8.45	108.3	8.42	4.0
	12/09/2022	12:21:55	5.0	17.84	50.22	32.88	8.39	106.7	8.32	8.9
	12/09/2022	12:23:12	5.5	17.42	51.22	33.62	8.28	101.4	7.94	7.0
	12/09/2022	12:24:18	5.6	17.38	51.10	33.53	8.29	101.3	7.95	39.3

R6 (IM8)	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	11:53:24	0.5	19.14	50.14	32.83	8.68	106.3	8.09	2.9
	12/09/2022	11:53:56	1.0	18.89	50.06	32.77	8.62	107.3	8.21	3.1
	12/09/2022	11:54:29	1.5	18.30	50.14	32.83	8.57	108.5	8.39	3.0
	12/09/2022	11:54:52	1.5	18.19	50.17	32.85	8.54	108.2	8.39	2.8
	12/09/2022	11:55:13	2.0	18.16	50.18	32.85	8.52	107.8	8.36	3.3
	12/09/2022	11:55:33	2.5	17.98	50.15	32.83	8.50	108.0	8.41	3.1
	12/09/2022	11:55:53	3.0	17.93	50.18	32.85	8.47	107.6	8.38	3.2
	12/09/2022	11:56:07	3.5	17.87	50.18	32.85	8.45	107.2	8.36	3.3
	12/09/2022	11:56:24	4.0	17.79	50.30	32.94	8.43	107.0	8.35	4.4
	12/09/2022	11:57:31	4.5	17.67	50.51	33.10	8.35	101.5	7.94	7.4
	12/09/2022	11:59:17	5.5	17.42	51.45	33.79	8.26	95.2	7.45	10.1
	12/09/2022	11:59:53	6.0	17.24	51.76	34.02	8.22	94.5	7.41	19.9
R7	Date	Time	Denth (m)	Temn (C)	Cond (ms/cm)	Sal (nnt)	n⊔	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
N/	12/09/2022			17.99	50.16	32.84	8.33	107.0	8.33	2.9
	12/09/2022			17.91	50.15	32.83	8.31	107.0	8.37	2.8
	12/09/2022			17.83	50.15	32.83	8.29	107.4	8.41	2.8
	12/09/2022			17.83	50.15	32.84	8.27	107.7	8.44	2.9
	12/09/2022			17.74	50.19	32.86	8.25	108.0	8.46	2.7
	12/09/2022			17.67	50.19	32.86	8.24	108.2	8.48	2.6
	12/09/2022			17.66	50.26	32.92	8.23	108.3	8.47	2.6
	12/09/2022			17.53	50.43	33.04	8.22	108.2	8.53	2.3
	12/09/2022			17.45	50.43	33.04	8.20	109.2	8.57	1.7
	12/09/2022			17.37	50.51	33.10	8.18	109.3	8.59	1.7
	12/09/2022			17.28	50.78	33.30	8.17	109.0	8.58	1.6
	12/09/2022			17.34	51.04	33.49	8.13	105.6	8.29	3.8
	12/09/2022			17.34	51.04	33.49	8.14	105.5	8.28	3.8
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R8	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	7:54:58	0.4	17.96	50.03	32.75	8.44	107.4	8.37	4.1
	12/09/2022	7:55:31	0.5	17.95	50.03	32.75	8.44	108.3	8.44	4.1
	12/09/2022	7:55:55	1.0	17.96	50.04	32.75	8.44	108.2	8.43	4.0
	12/09/2022	7:56:09	1.5	17.96	50.04	32.75	8.44	108.1	8.43	4.0
	12/09/2022	7:56:30	2.0	17.94	50.04	32.76	8.43	108.3	8.44	4.1
	12/09/2022	7:56:47	2.5	17.94	50.04	32.76	8.42	108.6	8.47	4.3
	12/09/2022	7:57:04	3.0	17.94	50.05	32.76	8.41	108.6	8.46	3.9
	12/09/2022	7:57:26	3.5	17.77	50.35	32.98	8.39	109.1	8.52	3.6
	12/09/2022	7:57:42	4.0	17.73	50.43	33.04	8.37	109.0	8.51	4.0
	12/09/2022	7:58:01	4.5	17.51	50.70	33.24	8.34	109.2	8.56	3.3
	12/09/2022	7:58:20	5.0	17.42	50.94	33.42	8.29	108.6	8.52	4.5
	12/09/2022	8:00:20	5.5	17.28	51.59	33.89	8.17	97.7	7.66	9.0
	12/09/2022	8:00:42	5.6	17.23	51.69	33.97	8.15	96.9	7.60	41.2

R9	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022	8:43:23	0.4	18.05	50.06	32.76	8.42	106.5	8.28	4.1
	12/09/2022	8:43:26	0.5	18.05	50.05	32.76	8.42	106.5	8.28	4.1
	12/09/2022	8:43:49	1.0	17.98	50.06	32.76	8.41	107.5	8.37	4.0
	12/09/2022	8:44:06	1.5	17.95	50.06	32.77	8.40	107.9	8.41	3.8
	12/09/2022	8:44:25	2.0	17.94	50.07	32.77	8.40	108.2	8.43	4.5
	12/09/2022	8:44:53	2.5	17.93	50.07	32.77	8.39	108.5	8.46	4.2
	12/09/2022	8:45:09	3.0	17.92	50.07	32.77	8.39	108.9	8.49	4.1
	12/09/2022	8:45:23	3.5	17.88	50.09	32.79	8.38	108.8	8.49	4.7
	12/09/2022	8:45:49	4.0	17.85	50.10	32.79	8.35	107.8	8.42	8.1
	12/09/2022	8:46:40	4.5	17.82	50.29	32.94	8.30	103.3	8.06	8.8
	12/09/2022	8:47:51	4.9	17.76	50.67	33.22	8.25	99.6	7.77	7.0
	12/09/2022	8:47:56	4.9	17.75	50.69	33.23	8.25	99.7	7.77	6.8
R10	Date	Time	Depth (m)	Temp (C)	Cond (ms/cm)	Sal (ppt)	рН	D.O. (%sat)	D.O. (mg/L)	Turb (ntu)
	12/09/2022			18.28	50.13	32.82	8.56	107.8	8.34	3.0
	12/09/2022			18.3	50.14	32.82	8.55	107.8	8.34	3.0
	12/09/2022			18.22	50.12	32.81	8.54	108.1	8.38	2.9
	12/09/2022		2.0	18.21	50.13	32.82	8.53	108.0	8.37	2.7
	12/09/2022	11:30:39		18.02	50.14	32.82	8.51	108.6	8.45	2.9
	12/09/2022			17.97	50.15	32.83	8.48	108.3	8.43	3.2
	12/09/2022	11:31:15	3.5	17.94	50.17	32.85	8.48	107.7	8.39	3.1
	12/09/2022	11:31:44		17.86	50.18	32.85	8.45	107.6	8.39	4.8
	12/09/2022	11:32:12	4.5	17.84	50.14	32.82	8.43	106.7	8.33	14.9
	12/09/2022	11:33:24	5.0	17.84	50.12	32.81	8.41	105.4	8.23	17.3
	D-4-	T :	Double (m)	T (C)	Canal (a (a)	C-1 (+)		D O (0/+)	D.O. ((1))	Touch (otto)
R11	Date	Time			Cond (ms/cm)		-	D.O. (%sat)		
	12/09/2022			17.93	50.18	32.86	8.25	109.1	8.5	2.6
	12/09/2022			17.69	50.22	32.89	8.22	109.8	8.6	2.5
	12/09/2022			17.58	50.23	32.89	8.20	109.6	8.6	2.7
	12/09/2022		2.0	17.46	50.26	32.91	8.18	109.6	8.6	3.9
	12/09/2022			17.39	50.25	32.91		109.0	8.6	3.2
	12/09/2022		3.0	17.33	50.28	32.93	8.17	108.5	8.6	3.4
	12/09/2022		3.5	17.33	50.28	32.93	8.17	108.4	8.5	3.4
	12/09/2022		4.0	17.33	50.44	33.04	8.16	108.0	8.5	3.5
	12/09/2022		4.5	17.4	50.49	33.08	8.19	107.7	8.5	1.4
	12/09/2022		5.0	17.36	50.55	33.13	8.18	108.6	8.5	1.6
	12/09/2022		5.5	17.39	50.68	33.22	8.16	97.4	7.7	13.1
	12/09/2022		6.0	17.21	51.69	33.97	8.08	95.8	7.5	11.9
	12/09/2022	10:13:14	6.1	17.14	51.84	34.07	8.09	95.7	7.5	14.3

Appendix 2 – Principal Component Biplots

Statistics

Principal component (PC) biplots or multivariate scatterplots produced by the R-statistical program were used to explore the relationship between benthos study sites, animal species found in the sediment, and water quality variables at the lake bed. Points in the matrix were obtained by standardizing the data by subtracting the variable (column) mean from the species (cell) mean and dividing the subsequent value by the variable or column mean (Gabriel, 1971; Gabriel and Odoroff, 1990).

Biplots

A biplot is a particular kind of scatterplot used for displaying multivariate data which results from mapping a matrix of field observations, **X**, into a 2-dimensional graphical display. The name derives from the fact that this is a *joint* display of the rows and columns of **X**. Sample units (rows) are shown by points and variables (columns) by arrows. Biplots have several appealing properties. Firstly, they are capable of presenting graphically large amounts of information on composition, structure and relationships with surpassing ease and efficiency. It enables a truly global look at the data.

Interpretation of Biplots

Sample Points

- The proximity of any pair of sample points is directly proportional to their resemblance with respect to all the variables studied, the closer the points the greater the resemblance;
- Points close to the origin tend to be representative of the sample as a whole, that is, they tend to be average samples,
- Points far from the origin are atypical in that they possess usually large or small values of one or more variables.

Variable Arrows

- The origin of the configuration of arrows marks the mean value of each variable, an important reference point.
- Arrows can be extended through the origin (by eye) in either direction to any desired extent.
- With increasing distance from the origin along an arrow in the direction of an arrow, the value of the variable increases steadily above its mean; similarly, with increasing distance from the origin along an arrow extended by eye in the opposite direction, the value of a variable falls increasingly below its mean.
- Arrow length is directly proportional to the correlation coefficient, r, between the two variables. The smaller the angle the stronger the correlation. Variables x and y with arrows subtending an angle of:

1. 0° are perfectly correlated $r_{xy}=1$ 2. 90° are strictly uncorrelated $r_{xy}=0$ 3. 0° \leq Angle < 90° $0 \leq r_{xy} \leq 1$ 4. 90° \geq Angle \leq 180° $0 \leq r_{xy} \leq -1$

From 3 it follows that variables whose arrows subtend angles less than 90° are positively correlated, and from 4, that variables whose arrows subtend angles greater than 90° are negatively correlated; in particular, where the angle is 180° , $r_{xy} = -1$.

In general, long arrows can be regarded as more useful in interpretation than short arrows. They have greater influence in differentiating sites.



Appendix 6: 2022 Benthic Communities Statistical Review

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Benthic Communities Monitoring - Statistical Review 2022

Chain Valley Colliery

Prepared for Delta Coal

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Benthic Communities Monitoring - Statistical Review 2022

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Approved by

Nathan Garvey

Associate Director - Ecology

27 January 2023

Level 3 175 Scott Street Newcastle NSW 2300

This report has been prepared in accordance with the brief provided by Delta Coal and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of Delta Coal and no responsibility will be taken for its use by other parties. Delta Coal may, at its discretion, use the report to inform regulators and the public.

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Executive Summary

Chain Valley Colliery (CVC) is an underground coal mine located beneath the southern end of Lake Macquarie, approximately 60 kilometres (km) south of Newcastle, NSW. CVC produces thermal coal for the domestic and export markets. As part of CVC's environmental performance, and to satisfy Condition 7(h), Schedule 4 of Development Consent for SSD-5465 (Modification 2), a Benthic Communities Management Plan (BCMP) was developed (CVC 2019).

Since 2012, CVC has monitored the soft sediment benthic community in shallow lake environments above their coal workings. The overall aim of the monitoring is to assess potential impacts of underground coal operations (primarily subsidence) on aquatic ecology using benthic communities as the specific indicator of impact. CVC undertakes six-monthly sampling of lake sediments for analysis of benthic community composition and environmental variables (water depth and sediment grain size). Samples are collected in Spring (March) and Autumn (September) at (potential) Impact, Reference, and Control sites.

At each site, Laxton Environmental Consultants P/L collected five replicate sediment samples by diver using 200 x 200 x 100 millimetre (mm) sieve boxes with 1 mm mesh. Samples were sieved to remove particles less than 1 mm and captured material preserved for laboratory sorting and enumeration of infauna. Sediment grain size analysis was undertaken on one 250 millilitre (mL) sample of sediment from each site. Infauna were categorised into operational taxonomic units (OTUs) comprising molluscs, polychaete worms and various higher taxa, such as terebellids, ophiuroids, echinoids, sponges, crabs, barnacles and fish.

EMM Consulting Pty Ltd (EMM) conducted statistical analysis on the full benthic dataset from September 2012—September 2022. Descriptive statistics (means, standard deviations, standard errors, minimums, maximums, and counts) were calculated within MS Excel. Summary statistics were subsequently used for visualisation of trends by site and by treatment (Impact versus Control versus Reference).

Raw abundance data were imported into PRIMER v6 for univariate and multivariate analysis. Raw benthic counts were used to calculate univariate diversity indices comprising total number of species (S), total number of individuals (N), species richness (Margalef, d), evenness (Pielou, J') and diversity (Shannon-Wiener, log e, H'). Multivariate analysis of the benthic community data included non-metric multidimensional scaling (nMDS), analysis of similarities (ANOSIM) and similarity percentage analysis (SIMPER), correlated with environmental variables (water depth and grain size) using principal components analysis (PCA).

From 19 sampling events between September 2012 and September 2022, a total of 24,265 benthic individuals from the 26 OTUs were counted in sediment samples from across the study area. The three most abundant taxa were the bivalve mollusc *Soletellina* (7,021 individuals), bivalve *Corbula* (6,167 individuals) and polychaetes-thin (6,126 individuals). Together these taxa accounted for 79% of the total number of benthic individuals collected. Each of these biodiversity indices were broadly similar across the sampling sites.

Ongoing development of CVC's underground coal extraction led to the redesignation of several Reference sites as Impact sites, with R3, R4, R5 and R6 becoming IM5, IM6, IM7 and IM8, respectively. To help discern greater relationship information, EMM focused univariate and multivariate statistical analysis of the different site treatments (Impact, Reference, and Control) for the monitoring period after redesignation of these sites (from September 2016 onwards).

From 13 sampling events between September 2016 and September 2022, a total of 16,347 benthic individuals from 26 OTUs were counted. Between 7 and 16 OTUs (mean 12.0) were reported per site, with the lowest number of OTUs at IM4 (7) and C2 (8) and the highest number of OTUs at IM2 and R7 (16). There was no clear spatial pattern associated with the number of OTUs per site treatments.

The total number of individuals per site varied between 494 (R8 and R11) and 1,152 (IM2). Abundances were lowest (<500 individuals) at R8 and R11 (494) and highest (>1,000 individuals) at C2 (1,017), IM2 (1,152) and IM5 (1,046). There was no clear spatial pattern associated with the abundance of benthic species per site treatments.

Multivariate pairwise test results (ANOSIM) indicated highly non-significant differences between all treatment pairs – Control versus Reference (99.2%), Control versus Impact (25.4%) and Reference versus Impact (30.1%) with a global R value of –0.019 at a significance level (p) of 0.6. Negative R-values are attributed to benthic habitats that are patchy and exhibit high variability between replicates (Chapman & Underwood 1999).

Cluster analysis of pair-wise Bray Curtis similarity between sites indicated that at 75% similarity level there were four site clusters: C5-C7-R11; IM2-IM5-R7; R10; and all remaining sites. Importantly, the Impact sites did not cluster together as a discrete group but were spread along the x-axis, interspersed amongst Reference and Control sites. Similarity patterns evident in the cluster analysis were further explored using an nMDS plot for abundance data at each site. The distribution (in nMDS space) of Impact, Reference and Control sites did not indicate site groupings attributed to impacts from CVC operations since benthic communities at most sites were tightly grouped (similar) and, except for IM2 and IM5, most sites with benthic communities that were significantly different to the main cluster of sites were Reference (R7, R10, R11) and Control (C5 and C7) sites.

SIMPER analysis of square-root transformed biological data indicated that more than 80% of the differences between the site clusters were mostly attributed to abundances of two polychaetes (mud and thin) and three bivalve molluscs, *Corbula*, *Soletellina* and *Trichomya*.

Mud polychaete abundances varied between site groups and over time, with notably lower abundances (and variability) apparent in the IM2-IM5-R7 cluster and at R10 compared to the other site clusters. Thin polychaete abundances were broadly similar for three of the four site clusters at each monitoring event, with higher abundances apparent within the 'all other' site cluster at most sampling times.

Abundances of bivalves *Corbula* and *Soletellina* were significantly higher within the 'all other' site cluster compared to the other three site clusters. *Trichomya* abundances were significantly higher within the IM2-IM5-R7 site cluster, driving the separation of this site's benthic community from the other sites. *Trichomya* abundances varied across time, being notably higher in samples collected in 2020 and 2021. This may be driven by changes in benthic habitats, such as higher levels of fine sediment, or a recruitment pulse due to favourable conditions in previous years. The exact cause is difficult to determine.

Importantly, the IM2-IM5-R7 cluster, that differed in benthic community structure from all other sites, did not change consistently over time (abundances neither increasing or decreasing) and therefore was not indicative of impacts from the CVC operations.

PCA, undertaken on the normalised environmental data, indicated that the three main site groups differentiated primarily due to silt, sand, and shell content, with minor differences in water depth being less important. The site groupings based on environmental variables (PCA) were different to the site groupings evident in benthic community structure (nMDS) which suggests that factors other than, or in addition to, sediment composition are driving the benthic structure.

From an ecological perspective, the benthic assemblages across the monitoring area fell into several groups that did not appear to be a response to CVC operations but were most likely due to subtle environmental variations driven by unknown environmental factors.

Monitoring sites C5-C7-R11 and R10 are furthest north and likely to be exposed to greater water circulation within greater Lake Macquarie that may provide increased food availability and/or better water quality that influences benthic community composition. Three of these sites – C5, C7 and R10 – had sediments with higher sand content which may support different benthic communities compared to the high silt areas further south and/or reflect greater water circulation likely at those sites.

Statistical analysis of CVC's benthic monitoring data did not indicate exceedance of the BCMP (CVC 2019) subsidence impact performance measure of "minor environmental consequences, including minor changes to species composition and/or distribution" has occurred.

EMM recommends that benthic monitoring could be scaled-back to annual data collection (in March) since the non-photosynthetic benthic communities are unlikely to exhibit strong seasonal variability.

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1 Introduction

Chain Valley Colliery (CVC) is an underground coal mine located beneath the southern end of Lake Macquarie, approximately 60 kilometres (km) south of Newcastle, NSW. CVC produces thermal coal for the domestic and export markets.

As part of CVC's environmental performance, and to satisfy Condition 7(h), Schedule 4 of Development Consent for SSD-5465 (Modification 2), a Benthic Communities Management Plan (BCMP) has been developed (CVC 2019). The stated purpose of this BCMP is to:

- outline details of the benthic communities monitoring data collected;
- outline existing and predicted subsidence levels;
- outline the methodology to be used to identify depth changes at monitoring locations;
- identify benthic community monitoring locations;
- identify reporting requirements;
- detail benthic community management measures;
- identify the requirements for incident or exceedances reporting and reviews of the document; and
- identify persons responsible for implementation of requirements.

Since 2012, CVC has monitored the soft sediment benthic community in shallow lake environments above their coal workings. The overall aim of the monitoring is to assess potential impacts of underground coal operations (primarily subsidence) on aquatic ecology, with benthic community composition as the specific indicator of impact.

CVC undertakes six-monthly sampling of lake sediments for analysis of benthic community composition and environmental variables (water depth and sediment grain size). Samples are collected in Spring (March) and Autumn (September) at (potential) Impact, Reference, and Control sites (Appendix A).

The BCMP defines the three site types:

- Impact sites potentially currently or historically impacted upon by subsidence.
- Reference sites not currently impacted by subsidence but fall within the proposed future mining footprint. Following undermining, Reference sites are redesignated as Impact sites.
- Control sites will not be impacted upon by subsidence, comprising those areas lying outside the footprint of current and future coal workings.

Full details of the benthic sampling and analysis regime are provided in Section 4 of the BCMP (CVC 2019). At each site, five replicate sediment samples are collected by diver using 200 x 200 x 100 mm sieve boxes with 1 mm mesh. Samples are sieved to remove particles less than 1 mm and captured material is preserved in formaldehyde for laboratory sorting and enumeration of infauna. Sediment grain size analysis is undertaken on one 250 millilitres (mL) sample of sediment from each site.

The BCMP prescribes statistical analysis methods for univariate and multivariate analysis of the benthic monitoring data – biological and environmental (Table 1.1).

Table 1.1 Benthic monitoring data statistical methods (BCMP, CVC 2019)

Variable type	Analysis	Description
Environmental: Water Quality	ANZECC/ARMCANZ Guidelines	Trigger values for slightly – moderately disturbed
Biotic and Environmental	Univariate	Descriptive graphical statistics
		Analysis of Variance (2-way nested)
		Analysis of Similarity (2-way nested)
Biotic and Environmental	Multivariate	Square-root transformed, Bray-Curtis similarity matrices, Cluster analysis and dendrograms
	Multidimensional Scaling Ordination	Sites represented as points in space, relative distances indicate similarity
	BIOENV	Correlation between biotic and environmental data using PRIMER

EMM has undertaken statistical analysis of the supplied benthic monitoring data in accordance with the BCMP.

2 Methods

Statistical analysis was undertaken on the full benthic dataset (September 2012–September 2022) from Laxton Environmental, who undertake the field sampling programs on behalf of Delta Coal. The supplied benthic data were checked and reordered within multiple MS Excel worksheets to facilitate statistical analysis in accordance with the BCMP (CVC 2019).

Descriptive statistics (ie means, standard deviations, standard errors, minimums, maximums and counts) were calculated within MS Excel. Summary statistics were subsequently used for visualisation of trends by site and by treatment (impact versus control versus reference sites). For the purposes of analysis, the control and reference groups have been kept separate.

Raw data were imported into PRIMER v6 for univariate and multivariate analysis. PRIMER (Plymouth Routines in Multivariate Ecological Research) consists of a "wide range of univariate, graphical and multivariate routines for analysing arrays of species-by-samples data from community ecology" (Clarke & Gorley 2006) and is the software of choice for benthic ecology.

Univariate diversity indices were calculated from the raw benthic count data. Total number of species (S), total number of individuals (N), species richness (Margalef, d), evenness (Pielou, J') and diversity (Shannon-Wiener, log e, H') were calculated within PRIMER v6 (DIVERSE) and graphically presented to identify any site-by-site trends in benthic community structure.

Due to the high frequency of zeros in the benthic count data, the data were square root transformed to downplay taxa with comparatively high counts and to increase the statistical visibility of the rarer taxonomic groups.

Bray-Curtis similarity (resemblance) matrices were subsequently developed from the transformed data and statistical analysis of these multivariate data was undertaken using PRIMER v6 routines.

Simple agglomerative hierarchical clustering was undertaken, producing dendrograms to visually identify distinct data groups based on different levels of similarity in benthic community structure. Dendrograms (also known as tree diagrams) display groups of samples in successively smaller numbers of clusters as the threshold of similarity at which two groups merge decreases. Groups (clusters) of sites (or other factors) can be identified for further data exploration with respect to the potential drivers of the groupings.

Non-metric multidimensional scaling (nMDS) was undertaken using PRIMER v6. nMDS is a powerful multivariate tool used to analyse benthic community data whereby points (eg sites) are plotted in 2-dimensional space such that the relative distance between points is relative to the same rank order as relative dissimilarities of each sample; ie points close together represent samples that are very similar in community composition and points further apart are more different. Distance between points cannot be used an absolute measure of similarity or dissimilarity, rather relative distance between points indicates relative similarity/dissimilarity.

The PRIMER v6 routine for analysis of similarities (ANOSIM) provides an approximate analogue of standard univariate analysis of variance (ANOVA). Using the resemblance matrix calculated from benthic count data, ANOSIM was used to test the null hypothesis that there are no differences between treatments (ie CVC's Impact, Reference and Control sites) allowing for potential differences between individual sites. A two-way crossed design – sites within treatments – was used. ANOSIM produces p and R values, where p indicates the level of significance for differences between benthic communities, in this case grouped into the three different site types, and R values indicate the strength of any differences. As R values approach 1 the strength of the difference between groups increases. R values close to zero indicate no difference between the groups. This is an important consideration given the inherently variable nature of benthic community data where small-scale variability (between replicates) can often be as great (or greater) than the larger scale differences between sites.

Subsequent interpretation of which individual benthic taxa are driving any of the observed differences between treatments and/or sites was undertaken using similarity percentage analysis (SIMPER) within PRIMER v6. SIMPER outputs indicate the percentage that each taxa contributes to the observed pairwise differences and informs the investigation of why the abundance (or absence) of certain species occur at individual sites.

Environmental data – water depth and sediment grain size – collected at each of CVC's benthic monitoring sites were investigated as potential influencing factors in benthic community composition. The environmental data were normalised (subtract mean and divide by standard deviation) to allow comparison between factors with different units of measure, such as metres water depth, percent silt and percent sand. Principle components analysis (PCA) was used to visualise site-by-site groupings based on water depth and sediment grain size (PRIMER v6).

The variation in environmental data was subsequently used to help identify potential factors, for example water depth, that are driving the development of the benthic assemblages. This approach is critical in defining the potential reasons for variation in benthic community structure within the context of natural variability, driven by environmental factors, and potential impacts from project-related activities.

Ongoing development of CVC's underground coal extraction has led to the redesignation of several of the early Reference sites as Impact sites (Table 2.1). Sites R3, R4, R5 and R6 have become IM5, IM6, IM7 and IM8, respectively and to compensate for the loss of reference sites, additional reference and control sites were added.

Changing the 'treatment' designation of sites is necessary to account for the ongoing expansion of the coal workings but it does complicate the statistical analysis process since the potential for impacts from subsidence at these sites changes over time. To help discern greater relationship information, EMM focused statistical analysis of the different site types (impact, reference, and control) for the monitoring period after redesignation of the earlier reference sites to impact sites and after the addition of most of the new reference and control sites (from September 2016 onwards).

Table 2.1 List of benthic monitoring sites indicating sites redesignated due to expansion of CVC mining operations

Reference sites	Control sites	Potential impact sites
R1	C1	IM1
R2	C2	IM2
R3 (becomes IM5 in March 2014)	С3	IM3
R4 (becomes IM6 in March 2014)	C4	IM4
R5 (becomes IM7 in September 2015)	C5 (added in March 2016)	IM5 (=R3 prior to September 2015)
R6 (becomes IM8 in September 2015)	C6 (added in September 2016)	IM6 (=R4 prior to September 2015)
R7 (added in March 2016)	C7 (added in March 2018)	IM7 (=R5 prior to September 2015)
R8 (added in September 2016)		IM8 (=R6 prior to September 2015)
R9 (added in September 2016)		
R10 (added in March 2018)		
R11 (added in March 2018)		

3 Analysis results

In the laboratory, biological samples were sorted into different taxonomic groups - operational taxonomic units (OTUs) – comprising, molluscs and four polychaete worms sorted to genus level and all other fauna split into broader groups. These broader groups were higher taxa (such as terebellids, ophiuroids), general organism groups (sponges, crabs, barnacles, fish) or specific descriptive types (such as mud polychaetes, thin polychaetes and thick polychaetes).

Infauna were categorised into 26 OTUs (Table 3.1) and these have been used to differentiate sites during statistical analysis.

Table 3.1 Operational taxonomic units (OTUs) derived for CVC benthos, 2016-2022

Polychaetes – thin (P)	Nassarius jonasii (G)	prawns (C)
Polychaetes – thick (P)	Anadara trapezia (B)	crabs (C)
Polychaetes – mud (P)	Corbula truncata (B)	barnacles (C)
terebellids (P)	Cyamiomactra mactroides (B)	ophiuroids (E)
Chaetopterus sp. (P)	Dosinia sculpta (B)	echinoids (E)
Cirratulidae (P)	Paphia undulata (B)	planaria (F)
Pectinaria sp. (P)	Saccostrea glomerata (B)	sponges
Sthenelais pettiboneae (P)	Soletellina alba (B)	fish
Lepsiella (Bedeva) hanleyi (G)	Trichomya hirsuta (B)	

Key: (P) = polychaete worm (C) = crustacean (G) = gastropod mollusc (E) = Echinoderm (B) = bivalve mollusc (F) = flatworm (Platyhelminth)

3.1 Benthic data 2012-2022

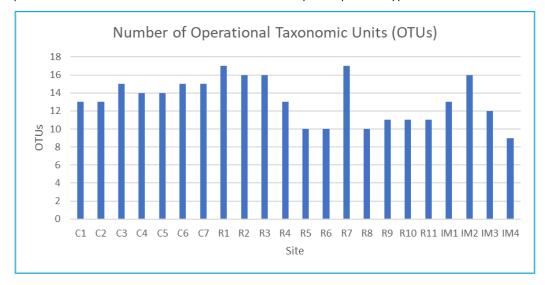
From 19 sampling events between September 2012 and September 2022, a total of 24,265 benthic individuals from the 26 different taxonomic groups were counted in sediment samples from across the study area. The three most abundant taxa were the bivalve mollusc *Soletellina* (7,021 individuals), bivalve *Corbula* (6,167 individuals), and polychaetes-thin (6,126 individuals). Together these taxa account for 79% of the total number of benthic individuals collected in sediment samples throughout the monitoring period. The most speciose faunal group is bivalve molluscs, with seven species collected.

The number of OTUs and individuals identified for each site over time are shown in Figure 3.1. In these figures the site numbering reflects the original reference site designations rather than changes that were made due to subsequent undermining.

Between 9 and 17 OTUs (mean 13.2) were reported per site. The lowest number of OTUs was at IM4 (9) and R5, R6 and R8 (10), and the highest number of OTUs was at R1 and R7 (17) and R2, R3 and IM2 (16). There is no clear spatial pattern associated with the number of OTUs per site type.

The total number of individuals per site varied between 494 (R8 and R11) and 1,976 (C2). Abundances were lowest (<750 individuals) at C6 (679), C7 (648), R7 (666), R8 (494) and R11 (494).

Abundances were highest (>1,500) at C2 (1,976), C4 (1,559), R2 (1,557) and IM2 (1,583). There is no clear spatial pattern associated with the abundance of benthic species per site type.



(a)

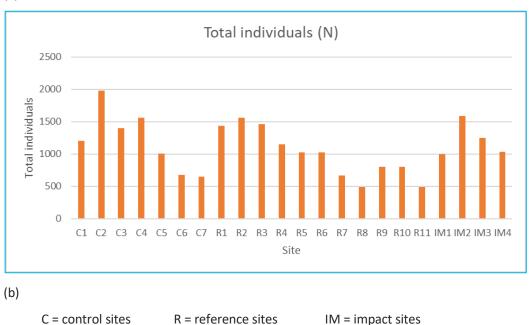
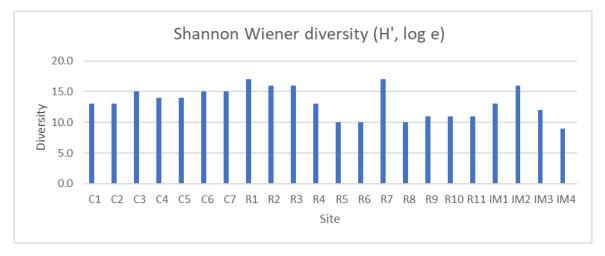


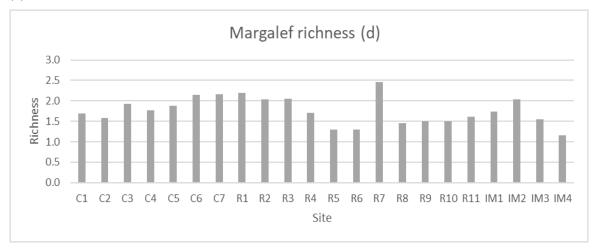
Figure 3.1 Total number of (a) operational taxonomic units (OTUs) and (b) individuals identified in benthic samples from each CVC monitoring site for the period 2012–2022

Shannon Wiener diversity (H', log e), Margalef richness (d) and Pielou's evenness (J') values for each site over time are shown in Figure 3.2.

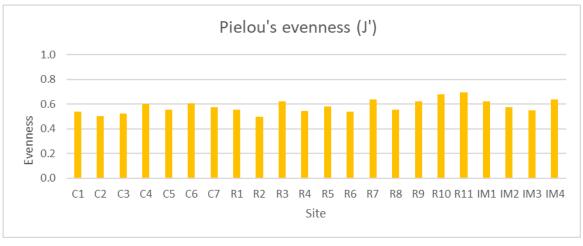
Each of these biodiversity indices are broadly similar across all sampling sites. Margalef richness most closely follows the distribution of OTUs per site, with marginally lower richness (<1.3) apparent at R5, R6 and IM4. The diversity and evenness vary across the sites within a narrow range of 1.24-1.81 and 0.49-0.69, respectively.



(a)



(b)



(c) $C = Control \ sites \qquad \qquad R = Reference \ sites \qquad \qquad IM = Impact \ sites$

Figure 3.2 (a) Shannon Weiner diversity, (b) Margalef's richness and (c) Pielou's evenness for benthic samples from each CVC monitoring site for the period 2012-2022

As indicated in Methods (Section 2), to help discern greater relationship information EMM has focused statistical analysis of the different site types (Impact, Reference, and Control) on the monitoring period after redesignation of sites R3, R4, R5 and R6 as IM5, IM6, IM7 and IM8, respectively. The analysis focus was shifted to the monitoring period from September 2016 onwards.

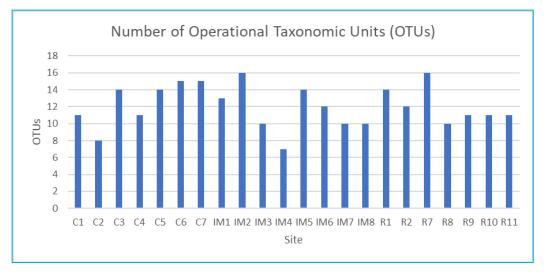
3.2 Benthic data 2016–2022

From 13 sampling events between September 2016 and September 2022, a total of 16,347 benthic individuals from 26 different taxonomic groups were counted in sediment samples from across the study area.

The number of OTUs and individuals identified for each site over time is shown in Figure 3.3. In these figures the site numbering reflects the redesignation of reference sites (R3-R6) as impact sites (IM5-IM8) due to ongoing expansion of the underground coal workings.

Between 7 and 16 OTUs (mean 12.0) were reported per site. The lowest number of OTUs were at IM4 (7) and C2 (8) and the highest number of OTUs were at IM2 and R7 (16). There is no clear spatial pattern associated with the number of OTUs per site.

The total number of individuals per site varied between 494 (R8 and R11) and 1,152 (IM2). Abundances were lowest (<500 individuals) at R8 and R11 (494). Abundances were highest (>1,000 individuals) at C2 (1,017), IM2 (1,152) and IM5 (1,046). There is no clear spatial pattern associated with the abundance of benthic species per site.



(a)

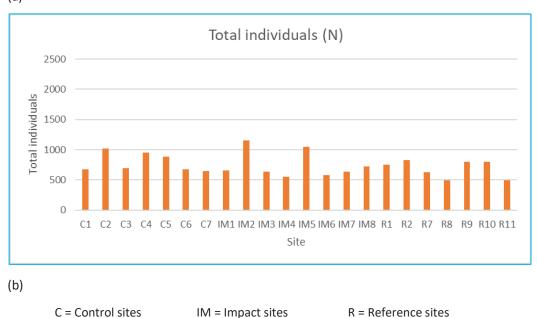
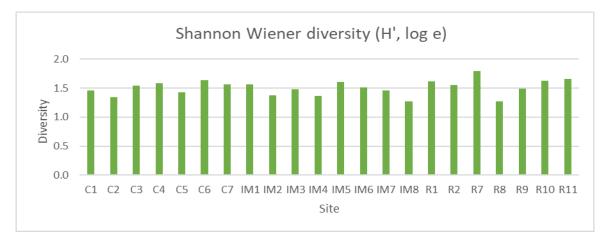


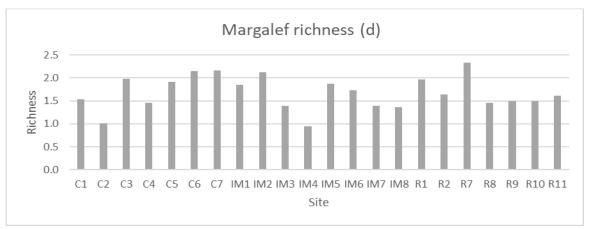
Figure 3.3 Total number of (a) operational taxonomic units (OTUs) and (b) individuals identified in benthic samples from each CVC monitoring site for the period 2016-2022

Shannon Wiener diversity, Margalef richness and Pielou's evenness values for each site over time (2016–2022) are shown in Figure 3.4.

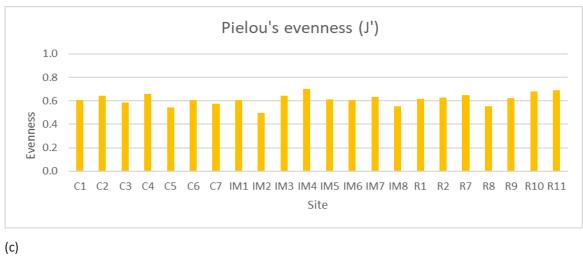
Each of these biodiversity indices are broadly similar across all sampling sites. Margalef richness most closely follows the distribution of OTUs per site, with marginally lower richness (<1.0) apparent at C2 and IM4. The diversity and evenness vary across the sites within a narrow range of 1.27-1.79 and 0.50-0.70, respectively.



(a)



(b)



(c) C = Control sites R = Reference sites IM = Impact sites

Figure 3.4 (a) Shannon Weiner diversity, (b) Margalef's richness and (c) Pielou's evenness for benthic samples from each CVC monitoring site for the period 2016-2022

3.3 Analysis of similarity

In accordance with the statistical analysis suite identified in Table 1.1 of the BCMP, benthic data were explored using ANOSIM, cluster analysis and nMDS.

For ANOSIM, a two-way nested design was used to test for similarities between the three different site types (Impact, Reference and Control). Testing for differences in benthic communities between the three site types during the period September 2016 to September 2022 derived a global R value of -0.019 at a significance level (p) of 0.6 (well above the statistical significance level of 0.05). Pairwise test results indicate highly non-significant differences between all treatment pairs — Control versus Reference (0.992), Control versus Impact (0.254) and Reference versus Impact (0.301). Negative R-values are attributed to benthic habitats that are patchy and exhibit high variability between replicates (Chapman & Underwood 1999).

The ANOSIM plot indicates that there are no significant differences between the three site types (Figure 3.5) since the global R value (black vertical line) falls within the wider distribution of R values (blue bars).

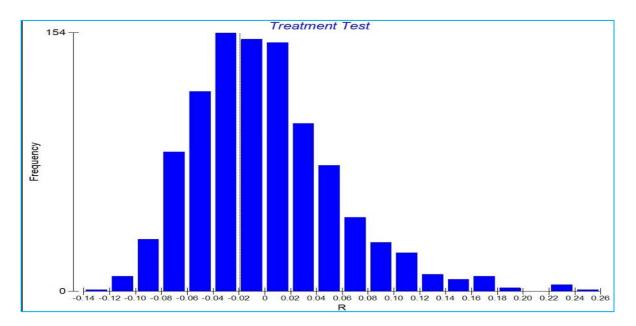


Figure 3.5 ANOSIM test results for benthic data across site types, September 2016 to September 2022.

Vertical line indicates the global R value of -0.019

3.4 Cluster analysis

Cluster analysis was used to visualise pair-wise similarity between sites based on levels of Bray Curtis similarity for the monitoring period September 2016 to September 2022 (Figure 3.6). The dendrogram indicates that at 75% similarity level there are four clusters: C5-C7-R11; IM2-IM5-R7; R10; and all remaining sites.

Importantly, the Impact sites do not cluster together as a discrete cluster but rather are spread along the x-axis, interspersed amongst Reference and Control sites.

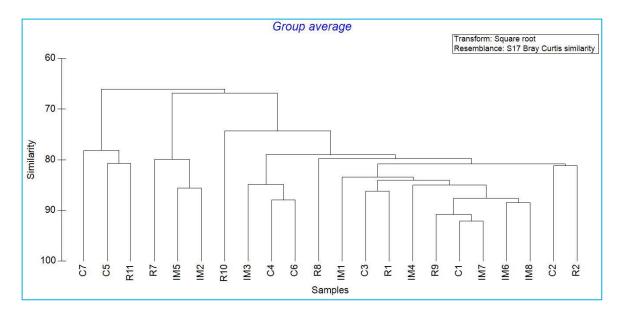


Figure 3.6 Dendrogram derived from cluster analysis of CVC benthic community monitoring data across all sites between September 2016 and September 2022

3.5 Multi-dimensional scaling

Non-metric multi-dimensional scaling (nMDS) is used to represent samples as points in 2D space such that points that are close together represent samples that are very similar in community composition (Clarke & Gorley 2006). The similarity patterns indicated in the cluster analysis are further explored using an nMDS plot for abundance data at each site (Figure 3.7). The green circles indicate site groupings that correspond to the 75% similarity level.

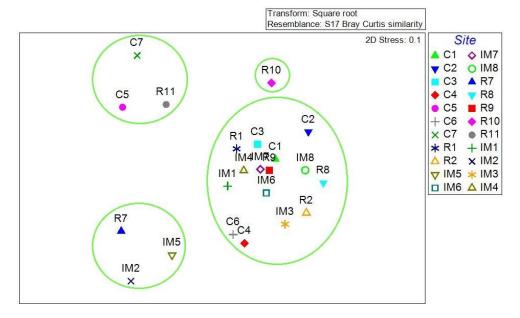


Figure 3.7 Patterns in community structure depicted as nMDS plot based on square-root transformed abundance data of all taxa (OTUs) for each site, September 2016–September 2022

The distribution (in nMDS space) of Impact, Reference and Control sites does not indicate site groupings that could be attributed to impacts from CVC operations since most sites have similar benthic communities (tightly grouped). Except for IM2 and IM5, most of the sites that exhibit significantly different benthic communities to the main group are designated as reference (R7, R10, R11) and control (C5 and C7) site types.

3.6 SIMPER

SIMPER analysis was undertaken on the square-root transformed biological data to identify which taxa are contributing to the separation between benthic communities evident at the C5-C7-R11, IM2-IM5-R7 and R10 site clusters identified during cluster analysis and confirmed by nMDS.

SIMPER results indicate that more than 80% of the differences between the site clusters are mostly attributed to abundances of two polychaetes (mud and thin) and three bivalve molluscs, *Corbula*, *Soletellina* and *Trichomya*.

Specific differences between the clusters are:

<u>C5-C7-R11 (Cluster A)</u>:

- much higher abundances of polychaete-mud compared to other site clusters; and
- lower abundances of *Corbula and Soletellina* compared to Cluster D.

• <u>IM2-IM5-R7 (Cluster B)</u>:

- higher abundances of *Trichomya* compared to other site clusters;
- lower abundances of *Soletellina* compared to Cluster C; and
- lower abundances of *Corbula* compared to Cluster D.

R10 (Cluster C):

- higher abundances of Soletellina compared to other site clusters; and
- higher abundances of *Corbula* compared to Cluster A and Cluster B.

All other sites (Cluster D):

- higher abundances of polychaete thin, *Corbula* and *Soletellina* compared to other clusters at most sampling times.

3.7 Temporal comparison of site groups

Comparison of temporal variation in abundances (mean + standard deviation) for each site cluster (C5-C7-R11, IM2-IM5-R7, R10, and 'all other') are provided for the five most abundant OTUs reported across the benthic monitoring area (Figure 3.8 and Figure 3.9).

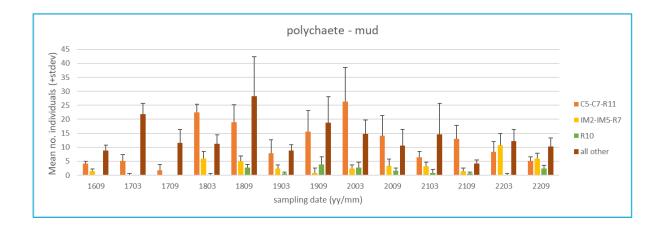
Mud polychaete abundances are variable between site clusters and over time. The notable differences are lower abundances (and variability) apparent in the IM2-IM5-R7 cluster and at R10 compared to the other site clusters.

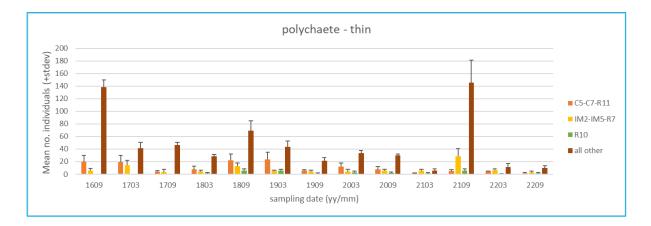
Thin polychaete abundances are broadly similar for three of the four site clusters at each monitoring event, with higher abundances apparent within the 'all other' site cluster at most sampling times.

Abundances of bivalves *Corbula* and *Soletellina* are significantly higher within the 'all other' site cluster compared to the other three site clusters.

Trichomya abundances are significantly higher within the IM2-IM5-R7 site cluster, which drives the separation of this site's benthic community from the other sites. Abundances vary across time, notably higher in samples collected in 2020 and 2021.

The important aspect to note from these plots is that the IM2-IM5-R7 cluster, that differs in benthic community structure from all other sites, is not changing consistently over time (abundances neither increasing or decreasing) and therefore is not indicative of an impact from the CVC operations.





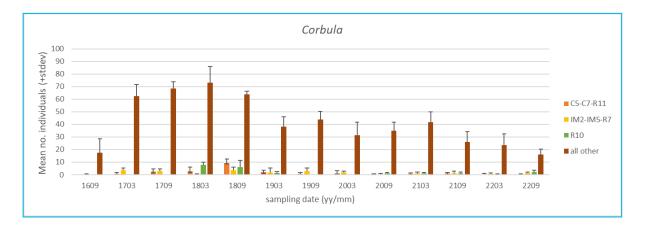
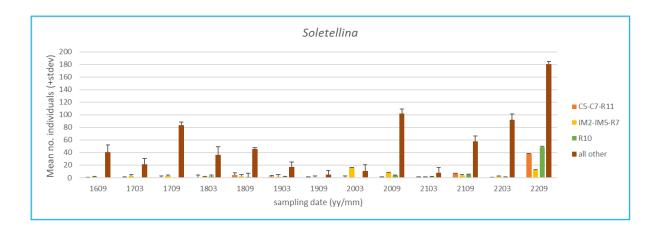


Figure 3.8 Temporal comparison of benthic abundances by site group for mud and thin polychaetes and the bivalve mollusc *Corbula*



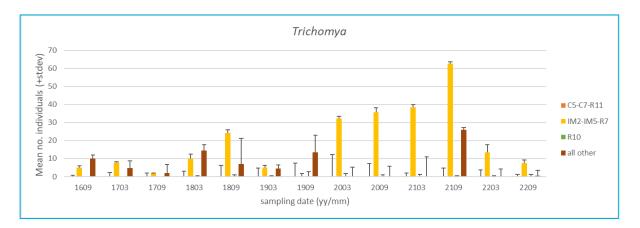


Figure 3.9 Temporal comparison of benthic abundances by site group for the bivalve molluscs *Soletellina* and *Trichomya*

3.8 Environmental data

Water depths and sediment grain size were reported for each site and these environmental variables were analysed alongside the biological data to discern potential environmental drivers of the observed variation in benthic community structure (Figure 3.10).

The sediments at all sites sampled in September 2022 were described as 'largely composed of fine grey silt' with 'small to large shell fragments...at most stations' (Laxton & Laxton 2022).

PCA was undertaken on the normalised environmental data (Figure 3.10). The results indicate three main site groups that are differentiated primarily due to silt, sand, and shell content, with minor differences in water depth being less important:

- Group 1: high shell (98%), no sand (0%) and low silt (2%) R7.
- Group 2: low shell (<1%), moderate sand (39–43%) and medium silt (56–61%) C7 and R10.
- Group 3: variable shell (<20%), low sand (<4%) and high silt (>80%) all other sites.

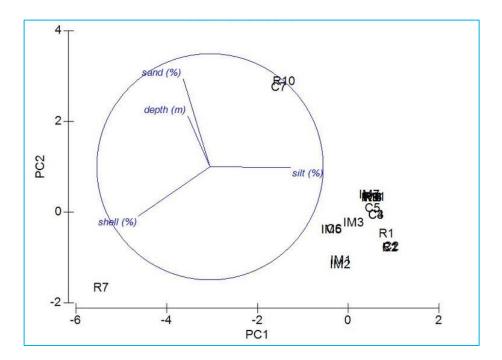


Figure 3.10 Principle components analysis (PCA) plot for normalised September 2022 environmental data – water depth (m), percentage shell, sand and silt for all sites

The site groupings based on environmental variables (PCA) are different to the site groupings evident in benthic community structure (nMDS). This suggests that factors other than, or in addition to, sediment composition are driving the benthic structure.

4 Discussion and recommendations

4.1 Discussion

Benthic communities are inherently variable across different spatial and temporal scales, typically in response to differences in local environmental conditions such as water depths, water circulation, tides and sediment characteristics. When assessing potential impacts from project activities it is important not to attribute site-by-site differences to project impacts without due consideration of the environmental and biological context.

The soft sediment benthic communities within the CVC monitoring area are dominated by polychaete worms and bivalve molluscs. Fauna abundances and diversity indices (richness, evenness, and diversity) differ between each site (as expected) although were found to be within a relatively narrow range across the monitoring area. Statistical analysis of the benthic data indicates a level of variability within the treatment groups (Impact, Reference and Control) that is similar to or greater than the variability between treatment groups. There are no significant differences between the treatment groups – Impact versus Reference versus Control.

From an ecological perspective, the benthic assemblages across the monitoring area fall into several groups that do not appear to be a response to CVC operations but are most likely grouping because of currently unconfirmed environmental factors.

For example, monitoring sites C5-C7-R11 and R10 are furthest north and likely to be exposed to greater water circulation within greater Lake Macquarie that may provide increased food availability and/or better water quality that is reflected in benthic community composition. In addition, three of these sites – C5, C7 and R10 – have sediments with higher sand content which may support different benthic communities compared to the high silt areas further south. Higher sand content is often correlated with higher water movement.

Monitoring sites IM2-IM5-R7 have benthic communities that are statistically distinct from the other monitoring sites although the contributing factors driving the differences are unclear, as evidenced by the results of the PCA. Importantly, these monitoring sites are not distinctly associated with CVC operations and the differences in benthic community are unlikely to be attributed to mining activities. Differences are more likely associated with local environmental conditions such as a combination of water depth, sediment characteristics, water circulation and/or water quality.

Statistical analysis of CVC's benthic monitoring data, primarily undertaken for the period September 2016 to September 2022, did not identify statistical differences between the benthic assemblages evident at sites designated as Impact, Reference and Control.

In conclusion, the results of statistical analysis of CVC's benthic monitoring data indicate that no exceedance of the BCMP (CVC 2019) subsidence impact performance measure of "minor environmental consequences, including minor changes to species composition and/or distribution" has occurred. Consequently, CVC is not required to implement any additional investigations of benthic communities within the project study area at this time and should continue the routine monitoring of benthic assemblages.

4.2 Recommendations

Currently, CVC conducts twice annual (seasonal) monitoring of benthic communities in southern Lake Macquarie. The overarching aim of the project is to monitor for detectable changes in benthic assemblages associated with potential subsidence of the lakebed due to undermining.

Subtidal benthic habitats, like those monitored by CVC, that are not dominated by benthic primary producers (such as seagrass and/or macroalgae), typically do not exhibit strong seasonal variation since the benthic species do not photosynthesise (and are therefore largely unaffected by changing light levels). Additionally, benthic environments are often quite stable with respect to sediment conditions that do not change on a regular cyclical nature with the seasons.

For these reasons and given the current absence of statistically relevant differences between benthic assemblages at CVC's impact monitoring sites when compared to the reference and control sites, EMM recommends that the frequency of CVC's benthic monitoring could be reduced to once per year. The recommended timing of annual monitoring is March (Autumn) to capture any variation in benthic assemblages that might occur following summer temperature extremes, while allowing ongoing statistical analysis of the historical and future March monitoring data.

Importantly, the frequency of monitoring should be reviewed if future monitoring results indicate impacts to benthic assemblages that are potentially associated with CVC operations, or if the local benthic environmental conditions change substantially.

5 References

Chapman MG & Underwood MJ (1999) Ecological patterns in multivariate assemblages: information and interpretation of negative values in ANOSIM tests. *Mar Ecol Prog Ser* 180:257-265

Clarke KR & Gorley RN (2006) PRIMER v6: User Manual/Tutorial. PRIMER-E, Plymouth 190pp.

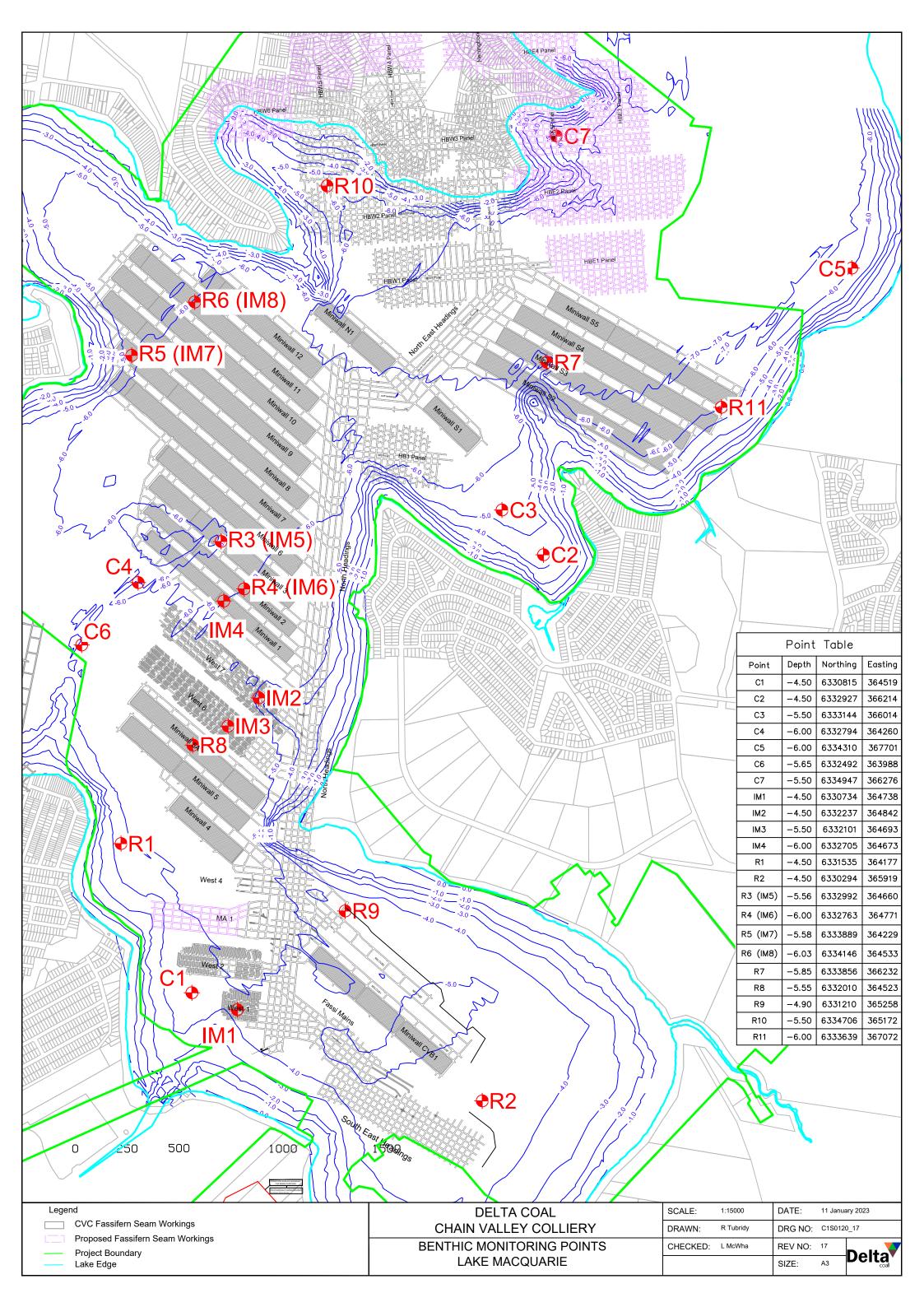
CVC (2019) Benthic Communities Management Plan – Environmental Management Plan, Chain Valley Colliery (14 November 2019)

Laxton JH & Laxton ES (2022) *Lake Macquarie Benthos Survey Results No. 22.* Report prepared for Delta Coal, Mannering & CVC Collieries by JH & ES Laxton Environmental Consultants P/L, September 2022. 54pp.

Appendix A

CVC benthic monitoring sites map





Australia

SYDNEY

Ground floor 20 Chandos Street St Leonards NSW 2065 T 02 9493 9500

NEWCASTLE

Level 3 175 Scott Street Newcastle NSW 2300 T 02 4907 4800

BRISBANE

Level 1 87 Wickham Terrace Spring Hill QLD 4000 T 07 3648 1200

CANBERRA

Suite 2.04 Level 2 15 London Circuit Canberra City ACT 2601

ADELAIDE

Level 4 74 Pirie Street Adelaide SA 5000 T 08 8232 2253

MELBOURNE

Suite 8.03 Level 8 454 Collins Street Melbourne VIC 3000 T 03 9993 1900

PERTH

Suite 9.02 Level 9 109 St Georges Terrace Perth WA 6000 T 08 6430 4800

Canada

TORONTO

2345 Younge Street Suite 300 Toronto ON M4P 2E5 T 647 467 1605

VANCOUVER

60 W 6th Ave Vancouver BC V5Y 1K1 T 604 999 8297







Appendix 7: Weed Action Plan

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DOCUMENT UNCONTROLLED WHEN PRINTED				



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Weed Action Plan

Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft

Total Earth Care Pty Ltd January 20



total earth care

Weed Action Plan

Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft

January 20

Quality Control	© Total Earth Care Pty Ltd 2019		
Revision/Version No.	Final	Date of revision	17 January 2020
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Approved by	G Barron, W Thurston		
Prepared for:	Delta Coal		
TEC Job No.	C11483		

Total Earth Care Pty Ltd January 20

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Job No: C11483

1 INTRODUCTION

1.1 Background

Total Earth Care (TEC) has been commissioned by Delta Coal to prepare this update for the Weed Action Plan for the three (3) Delta Coal sites: Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft. The site is within the Central Coast LGA (formerly Wyong LGA).

A Weed Action Plan was developed for Lake Coal in 2016 to guide weed management of the aforementioned sites in a consolidated report. The sites are now managed by Delta Coal and an updated Weed Action Plan is required to assess the current weed densities on the site and provide relevant management actions that will assist in the development of updated Biodiversity Management Plans for each site. The Weed Action Plan will guide on ground weed management and assist in tracking the progress of since the previous Weed Action Plan developed in 2016.

1.2 Subject Sites and Study Area

The "Study Area" has been defined as each of the three (3) sites: Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft. Management Zones have previously been defined for these sites. Please see the Maps 1 to 3 below which indicate the boundaries of the Project Area and the existing management zones.

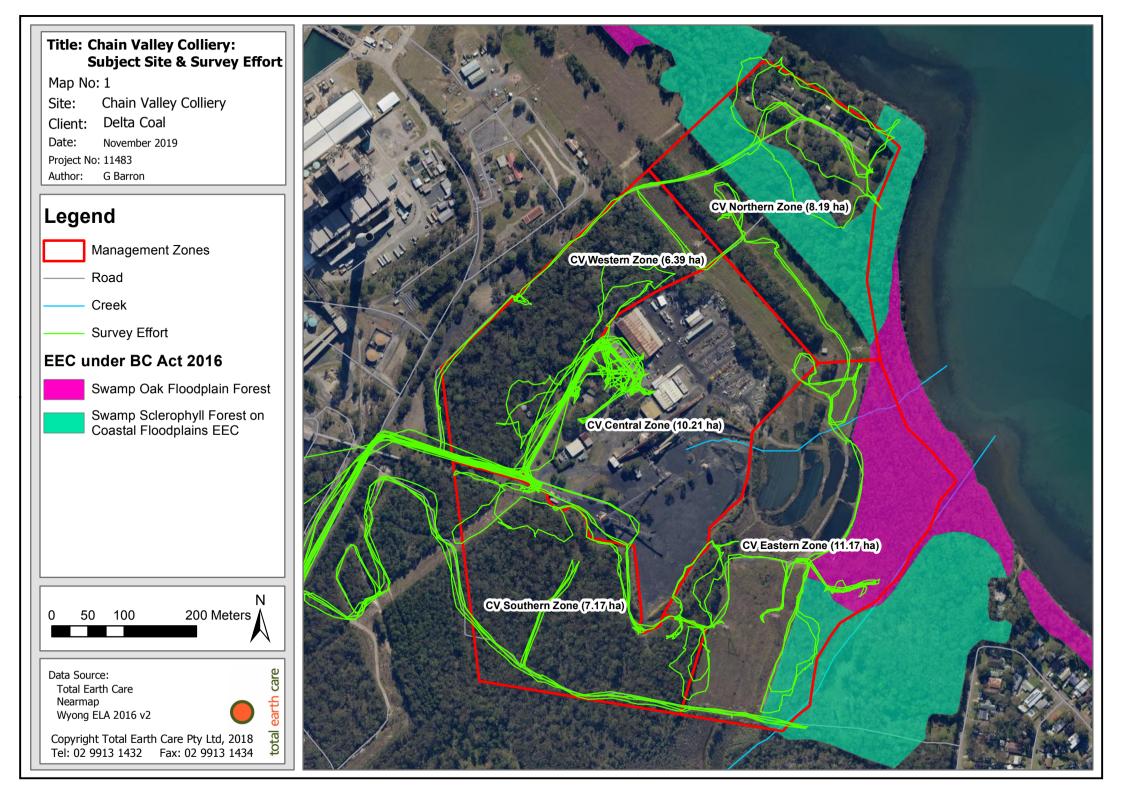
All three (3) sites fall within the Local Land Services Greater Sydney Region, bordering on the Hunter Region.

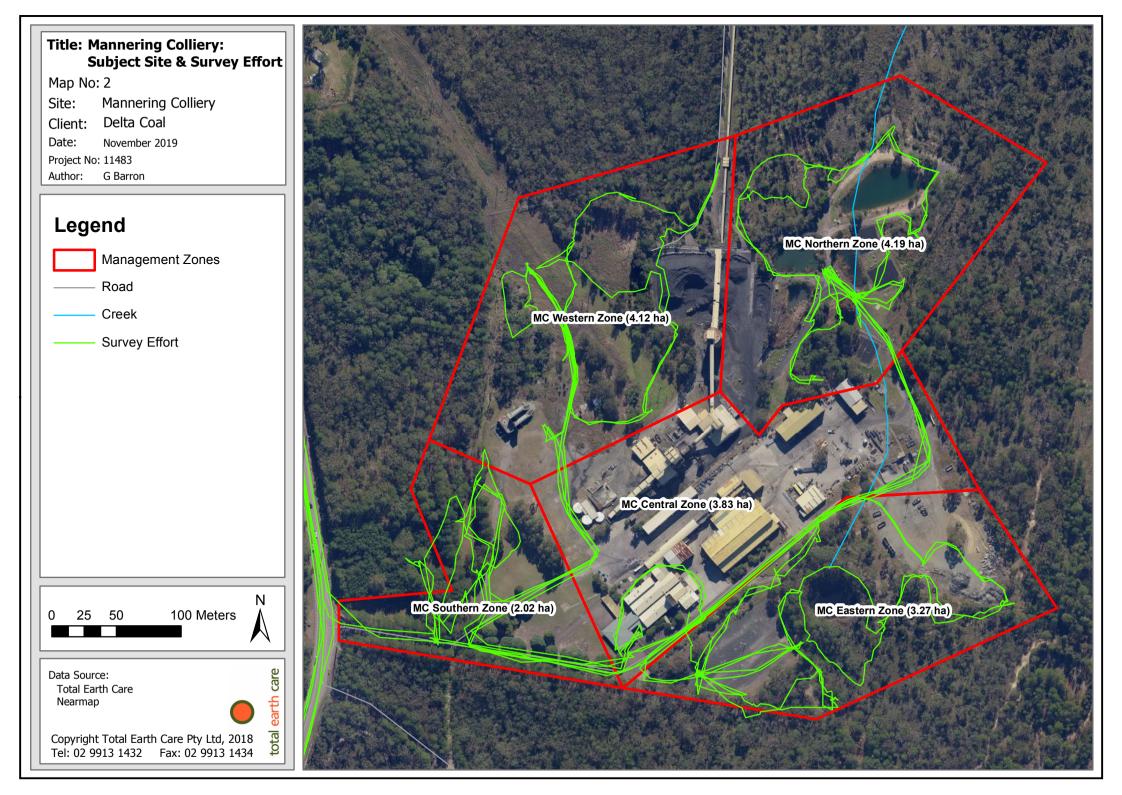
1.3 Goals and Objectives

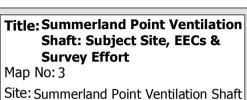
The objectives of this management program are to:

- Describe the existing flora and fauna within the subject site based on current survey effort and database searches of the subject site and surveys of the wider study area.
- Provide ground-truthed weed density maps, highlighting priority weeds under the NSW Biosecurity Act 2015.
- Report any threats to Endangered Ecological Communities.
- Provide a program for ongoing weed management and/or eradication.

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Delta Coal Client: Date: November 2019

Project No: 11483 Author: G Barron

Legend

Summerland Point

Road

Creek

Survey Effort

EEC under BC Act 2016

Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion

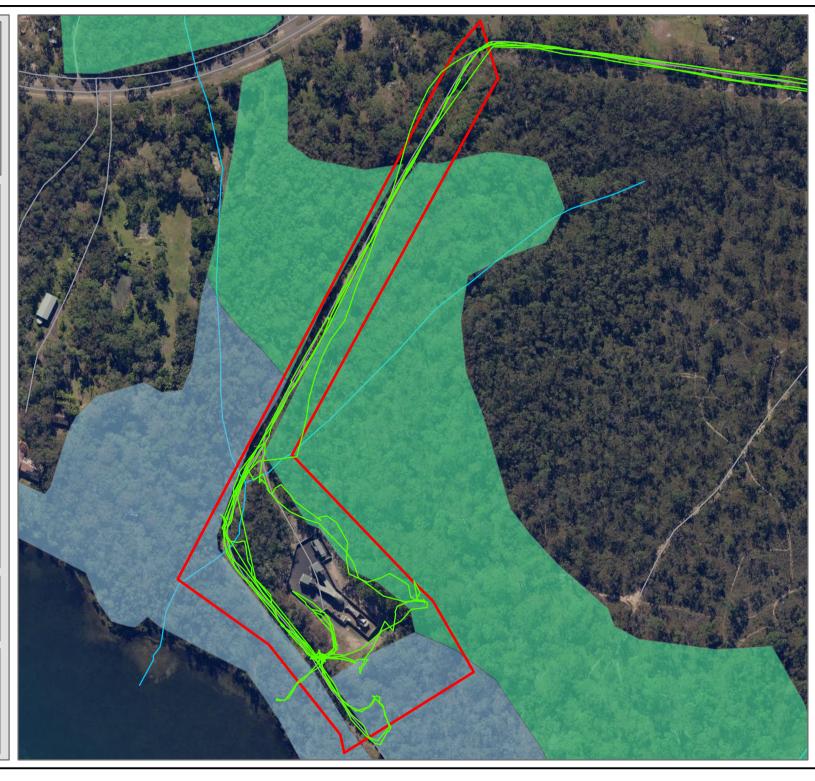
Swamp Sclerophyll Forest on Coastal Floodplains EEC

Ν 100 Meters

Data Source: Total Earth Care SIX Maps

Wyong ELA 2016 v2 Copyright Total Earth Care Pty Ltd, 2018

Tel: 02 9913 1432 Fax: 02 9913 1434



1.4 Relevant Legislation and Strategies

This Weed Action Plan will be written in accordance with:

- 1 Commonwealth laws including:
 - a. Environment Protection and Biodiversity Conservation Act 1999
- 2 NSW laws including:
 - a. Biodiversity Conservation Act 2016
 - b. Biosecurity Act 2015
- 3 Local laws LGA:
 - a. Wyong Local Environment Plan 2013
 - b. Wyong Development Control Plan 2013
- 4 Weed Strategies
 - a. Australian Weeds Strategy 2017-2027
 - Greater Sydney Regional Strategic Management Plan

1.4.1 NSW Biosecurity Act 2015 - Weeds

The NSW Biosecurity Act 2015, repealed the NSW Noxious Weeds Act 1993 on the 1st of July 2017.

The purpose of the NSW *Biosecurity Act 2015* is to provide framework for risk-based prevention, elimination and minimisation of biosecurity risks. These include pests, diseases, contaminants, non-indigenous animals, bees, weeds and other biosecurity matter. One of the main objectives of the Biosecurity Act 2015 is to promote biosecurity issues as a shared responsibility between government, industry, and communities, i.e. private and public land managers have the same obligations under the Act. Local Council is the control authority who enforces this Act. A State Weeds Committee has been established, as well as eleven (11) Regional Weeds Committees who will provide guidance and facilitate community and stake holder input into weed management.

Under the *Biosecurity Act 2015*, the definition of a weed is a plant that is a pest, and the definition of a pest is a plant or animal (other than a human) that has an adverse effect on, or is suspected of having an adverse effect on, the environment, the economy or the community.

Schedule 1 describes the special provisions relating to weeds. Under this Schedule, land occupiers have a duty to:

- control weeds on roads which bound their occupied land;
- control aquatic weeds along a watercourse, river, or inland water which bound their occupied land; and
- control weeds on land extended from their occupied land if that land is an irrigation area forming any part of a public road, public reserve or public channel, or watercourse, river or inland water.

Regional Strategic Weed Management Plans have been developed which describe the land occupier's expectations for managing weeds and form the basis for an enforceable general biosecurity duty. The three (3) Delta Coal sites fall within the Greater Sydney Local Land Services area, therefore the *Greater Sydney Regional Strategic Management Plan* applies to these sites.

1.4.2 Australian Weeds Strategy – Weeds of National Significance (WoNS)

Australian Weeds Strategy provides a national framework for addressing weed issues. It lists thirty-two (32) weed species or genera that are required to be managed under state legislation. These are Weeds of National Significance (WoNS). Five (5) of these have been identified on site and are listed in Section 3 of this management plan.

1.4.3 NSW Biodiversity Conservation Act 2016

The NSW *Biodiversity Conservation Act 2016* (BC Act), with associated regulations and maps, repealed the *Threatened Species Conservation Act 1995* on the 25th of August 2017. The BC Act is now the key piece of legislation protecting threatened species, populations and ecological communities within NSW.

There are a number of Endangered Ecological Communities (EEC) mapped on the Delta Coal sites (ELA 2016). These include;

- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions;
- Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions; and

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• Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion.

Refer to Maps 1, 2 and 3 for mapped EECs. The Mannering Colliery does not contain any EECs.

One aim of the BC Act is to eliminate or manage certain Key Threatening Processes (KTPs) that threaten the survival or evolutionary development of threatened species, populations and ecological communities.

KTPs listed by the BC Act are identified as having significant impacts on the conservation of native flora and fauna. There are currently thirty-seven (37) KTPs listed under the BC Act including:

- Invasion and establishment of exotic vines and scramblers.
- ii. Invasion, establishment and spread of Lantana camara.
- iii. Invasion of native plant communities by *Chrysanthemoides monilifera* (Bitou Bush and Boneseed).
- iv. Invasion of native plant communities by exotic perennial grasses.
- v. Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.

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2 METHODS

2.1 Desktop Research

A preliminary desktop study was conducted to assess the previously mapped weed locations (Kleinfelder 2016) and existing plant community types using the Wyong ELA 2016 PCT (ELA, 2016) mapping.

2.2 Site Survey

A site survey was conducted over two (2) days on the 15th and 16th October 2019. Weather conditions were clear with maximum temperatures of approximately 25°C on the 15th and 24°C on the 16th. See Maps 1, 2 and 3 for survey effort.

A general weed survey was conducted using random meanders. Edges of bushland, creek lines, disturbed areas and any other areas likely to contain weeds were targeted as were areas where weeds were previously identified in the 2016 Weed Action Plan.

• The identification of native and exotic plant species according to *Field Guide to the Native Plants of Sydney* (Robinson, 2003), Flora of NSW, Volumes 1-4 (Harden 1992, 1993, 2000, 2002), *Weeds of the south-east: an identification guide for Australia* (Richardson et al, 2006) and PlantNET (2019), with reference to recent taxonomic changes;

Any "weed infestations" found during survey were recorded using a hand held GPS. Weed infestations are defined as:

- Areas where weeds make up >80% percentage foliage cover.
- Weeds of national significance
- Priority weeds and other weeds of regional concern as listed in the Greater Sydney Regional Strategic Weed Management Plan

Any WoNS and/or any priority weeds for the Greater Sydney Region which were identified on site, are listed in Appendix A which includes their biosecurity status under the *Biosecurity Act* 2015.

2.3 Weed Density Mapping

Weed density maps were developed for each zone. All weeds present were considered when determining the weed densities for each area.

GPS locations were mapped to provide clear locations for WoNS, significant weed infestation and Priority Weeds.

2.4 Priorities

The priorities of targeted weed work detailed in Section 4 - Management Zones, were determined by the species listing and the landholder's obligations under the *Biosecurity Act 2015* and the Greater Sydney Regional Strategic Weed Management Plan. Species listed as WoNS are considered a high priority. Other weeds that were deemed to have the potential to significantly impact biodiversity were also included as Priority Weeds.

Priority areas were determined by the resilience and condition of existing bushland and the location of weed infestations. Infestation or small outbreaks of weeds in high quality, undisturbed or resilient bushland are considered a high priority to conserve the existing biodiversity values and to prevent further spread which could become more costly to address in the future. Infestations along property boundaries, creek lines and waterways are considered high priority as weeds are more susceptible to spread onto neighbouring properties downstream or across boundary edges.

2.5 Limitations

The diurnal field survey was conducted over two (2) days during October 2019. Random meanders were conducted across the site and targeted searches for weeds along creek line, bushland edges and disturbed areas where weeds are likely to occur. Some areas were not searched due to access issues and time constraints. The central zones mainly consist of infrastructure and planted species and were not surveyed for this report.

When reviewing maps please note that the hand-held GPS equipment used is only accurate to 3 metres.

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3 RESULTS

The weed survey identified thirty-six (36) weed species under the *Biosecurity Act 2015*. These are listed in Appendix A along with the land holder's obligations under the Act. Of these, five (5) are WoNS. These are:

- Asparagus Fern (Asparagus aethiopicus)
- Bitou Bush (Chrysanthemoides monilifera subsp rotundata)
- Lantana (Lantana camara)
- Blackberry (Rubus fruticosus aggregate)
- Fireweed (Senecio madagascariensis)

Bitou Bush, Lantana and Fireweed are also listed as State Priority Weeds. Six (6) weeds are listed as Priority Weeds under the Greater Sydney Regional Strategic Weed Management Plan. These include Giant Reed (*Arundo donax*), Pampas Grass (*Cortaderia jubata*) and the above mentioned WoNS.

Weeds are mostly contained to disturbed areas, bushland edges, tracks and riparian areas across all three (3) sites. There are some small outbreaks within large resilient bushland areas which have been prioritised within this Plan. Many of these have been treated as part of primary bush regeneration efforts and require follow up treatment of new shoots.

Two (2) areas with two (2) to three (3) individual orchids of the genus Microtis were identified. One (1) area is located in the eastern of the eastern zone of Chain Valley Colliery and another along the disturbed edges of the eastern zone at Mannering Colliery. These have been mapped in Map 7 and Map 11.

The current condition, locations of weed infestation and weed densities have been discussed in detail within Section 4 - Management Zones.

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4 MANAGEMENT ZONES

TEC have based the management zones on those created for the 2016 Weed Action Plan (Kleinfelder, 2016). The boundaries have been adjusted slightly to follow existing structural boundaries such as roads, tracks, clearings, easements and fences to allow for clearer delineation of management zones during on ground works.

The Central Zone of both the Chain Valley Colliery and Mannering Park Colliery are entirely disturbed and contain the site infrastructure. The zones are mostly void of native vegetation except for remnant canopy trees and planted native and ornamental species, as such these zones were not included in the weed survey.

4.1 Chain Valley Colliery

The Chain Valley Colliery site is made up of the following EECs:

- Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions; and
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

See Map 1 for EEC locations.

Chain Valley Colliery contains high quality resilient bushland in most zones. Managing weed outbreaks in these areas is a high priority to prevent degradation and further encroachment on bushland areas. Most weed outbreaks occur in the disturbed areas including cleared easements, easement edges, along tracks, creek lines and dam edges. These outbreaks are small and in their early stages of growth and therefore should be targeted before they progress any further. Bush regeneration efforts targeting Lantana and Pampas Grass (*Cortaderia selloana*) are evident throughout the site but now require follow up treatment. The following maps and tables provide further details on each management zone including priority weeds and management issues.



Figure 1. Eastern Zone of Chain Valley Colliery along creek line.

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Figure 2. Treated Lantana and Blackberry in Northern Zone of Chain Valley Colliery near cottages.



Figure 3. Fishbone Fern and Crofton Weed in Western Zone Area B of Chain Valley Colliery along drainage area.

4.1.1 Chain Valley Colliery - Northern Zone

Table 1. Chain Valley Colliery – Northern Zone Area Descriptions

Description	This zone is approximately 8.2 ha and includes cleared powerline easements and modified areas surrounding the cottages and bushland.
	Area A – <5% weed cover
	The most resilient area of the zone with low weed densities. Some weed encroachments on the edges of the bushland. A small area of treated Lantana and Blackberry is located to the south-east of this zone.
	Area B – 5-25% weed cover
	Highest weed densities are found along the edge of the bushland and species present include Blackberry, Asparagus Fern, Fishbone Fern (Nephrolepis cordifolia), Monstera deliciosa and Senna pendula var. glabrata.
	Area C – 25-50% weed cover
	Dense area of Blackberry, Lantana, Ochna serrulata, Wild Tobacco (<i>Solanum mauritianum</i>) and herbaceous weeds. Evidence of Blackberry and Pampas Grass being treated. Appears to have been the focus area of Bush Regeneration efforts.
	Area D – 5-25% weed cover
	Mostly ornamental exotic plant species in front of houses.
	Area E – 5-25% weed cover
	Dense patch of Monstera deliciosa.
	Area F - 5-25% weed cover
	Patch of Camphor Laurel (<i>Cinnamomum camphora</i>) and Coral trees (<i>Erythrina x sykesii</i>) including several saplings.
	Area G - 5-25% weed cover
	Bushland strip between powerline easements containing scattered small outbreaks of weeds including Senna pendula var. glabrata and Lantana.
	Area H – 5-25% weed cover
	Powerline easement with scattered Fireweed and Purple Top (Verbena bonariensis).
Priority Weeds	Lantana, Blackberry, Pampas Grass and Asparagus Fern
Priority Areas	Area A and B has the most resilience and is connected to larger tracts of bushland. Weeds should be controlled to prevent further spread.
Key Management Issues	 Follow up treatment of Lantana, Blackberry, Senna pendula var. glabrata in Areas A and C. Primary treatment of Asparagus Fern particularly along edges in Area B. Primary treatment of Senna pendula var. glabrata and Monstera deliciosa, and untreated areas of Lantana and Pampas Grass.
Notes	Access to this zone via dirt road from near CVC site entry. Key required. Caution to be taken driving around cottages due to rubbish and debris hidden by long grass.

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4.1.2 Chain Valley Colliery – Western Zone

Table 2. Chain Valley Colliery – Western Zone Area Descriptions

Description	This zone is approximate 6.4 ha of highly resilient bushland with predominantly low weed densities. Evidence throughout of bush regeneration efforts.
	Area A – <5% weed cover
	Highly resilient bushland with a very low weed density. Scattered outbreaks of Blackberry and Lantana on the side of the road that runs along the north-west boundary. All identified scattered Lantana thickets in the south-east part of the area have been treated. Some juvenile Lantana coming up in these treated areas.
	Area B – 5-25% weed cover
	Damp drainage areas in some places have encourage weed growth. Lantana, Crofton Weed, Asparagus Fern, Fishbone Fern and herbaceous weed species scattered throughout this zones (see Figure 3). All identified Lantana patches have been treated. Some juvenile Lantana coming up in these treated areas. Pampas Grass and some Fishbone Fern has been treated but requiring follow up treatment.
Priority Weeds	Lantana, Blackberry, Pampas Grass, Asparagus Fern and Crofton Weed.
Priority Areas	Both Area A and B. The surrounding bushland is highly resilient and further weed outbreaks should be prevented.
Key Management Issues	 Follow up treatment of Lantana and Pampas Grass. Primary treatment of Crofton Weed and Fishbone Fern. Hand weeding and spraying. Priority zone. Edges and tracks should be monitored regularly.
Notes	Access to the track along the north-west boundary of this zone via dirt road from near CVC site entry. Key required.

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Map No: 5

Chain Valley Colliery Site:

Delta Coal Client: Date: November 2019

Project No: 11483 Author: G Barron

- Road

Management Zones

Weed Density

< 5%

5 - 25%

25 - 50%

Key Points

- Asparagus Fern
- Blackberry & Fireweed
- Crofton Weed
- Crofton Weed & Lantana camara
- Lantana camara
- Lantana camara treated

Pampas Grass & Lantana

- camara treated and Asparagus Fern & Crofton Weed
- Senna pendula var. glabrata

80 Meters



Data Source: Total Earth Care Nearmap



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4.1.3 Chain Valley Colliery – Southern Zone

Table 3. Chain Valley Colliery – Southern Zone Area Descriptions

This zone is approximate 7.2 ha of highly resilient and mostly undisturbed bushland with predominantly low weed densities. Area A – 5-25% weed cover Scattered small outbreaks of Senna pendula var. glabrata, Blackberry, Bush, Ochna and Lantana, Lantana has been treated but some small shoundary of the bush and powerline easement. Area B – <5% weed cover Highly resilient bushland. Some Pinus radiata saplings coming up adjact the track that runs along the southern part of the area. Area C – 5-25% weed cover Powerline easement containing scattered Pinus radiata saplings, herbackweeds and Oleander. Area D – <5% weed cover Resilient bushland with scattered Pinus radiata saplings along easement.	Bitou oots are stern ent to
Scattered small outbreaks of <i>Senna pendula var. glabrata</i> , Blackberry, E Bush, Ochna and Lantana, Lantana has been treated but some small sh coming up. Most weeds are along the track edge to the north and the eaboundary of the bush and powerline easement. Area B – <5% weed cover Highly resilient bushland. Some <i>Pinus radiata</i> saplings coming up adjact the track that runs along the southern part of the area. Area C – 5-25% weed cover Powerline easement containing scattered <i>Pinus radiata</i> saplings, herbackweeds and Oleander. Area D – <5% weed cover Resilient bushland with scattered <i>Pinus radiata</i> saplings along easement	oots are stern
Bush, Ochna and Lantana, Lantana has been treated but some small sh coming up. Most weeds are along the track edge to the north and the earlier boundary of the bush and powerline easement. Area B - <5% weed cover Highly resilient bushland. Some <i>Pinus radiata</i> saplings coming up adjact the track that runs along the southern part of the area. Area C - 5-25% weed cover Powerline easement containing scattered <i>Pinus radiata</i> saplings, herbackweeds and Oleander. Area D - <5% weed cover Resilient bushland with scattered <i>Pinus radiata</i> saplings along easement	oots are stern
Highly resilient bushland. Some <i>Pinus radiata</i> saplings coming up adjace the track that runs along the southern part of the area. Area C – 5-25% weed cover Powerline easement containing scattered <i>Pinus radiata</i> saplings, herbac weeds and Oleander. Area D – <5% weed cover Resilient bushland with scattered <i>Pinus radiata</i> saplings along easement	
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weeds and Oleander. Area D - <5% weed cover Resilient bushland with scattered <i>Pinus radiata</i> saplings along easement	eous
Resilient bushland with scattered Pinus radiata saplings along easemen	
A = -0-0/	t edge.
Area E – 5-25% weed cover	
Mostly managed lawn along driveway. Scattered <i>Pinus radiata</i> saplings, Lovegrass (<i>Eragrostis curvula</i>) and Oleander (<i>Nerium oleander</i>) on busl edges.	
Area F – 25-50% weed cover	
Disturbed bushland edges with scattered small outbreaks of Bitou Bush Lantana, Pampas Grass, Banana Trees and African Love Grass. Most F Grass in this area has been treated.	
Priority Weeds Lantana, Pampas Grass, Bitou Bush and Pinus radiata saplings	
Priority Areas Area B is highly resilient and has very few weed outbreaks. All other are this management zone should be managed to prevent further spread of into Area B.	
 Follow up treatment of Pampas Grass Follow up and primary treatment of Lantana. Small shoots can be pulled. Primary treatment of Bitou Bush. Most can be hand pulled. Primary treatment of Pinus radiata saplings particularly along the in Area B. This is a highly resilient area and invasion of Pines in area should be prevented. High priority zone. Monitor tracks for any weed out breaks. 	e track
Notes Access to the track within this zone is via a locked gate or through power easement.	rline

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4.1.4 Chain Valley Colliery – Eastern Zone

Table 4. Chain Valley Colliery – Eastern Zone Area Descriptions

Description

This zone is approximate 11.17 ha of bushland cleared powerline easements and sediment ponds. These ponds consistently discharge across the bushland in Area H and into the lake to the north-east.

Area A - <5% weed cover

Small occurrences of Caster Oil and Lantana on dam walls. Scattered occurrences of *Senna pendula var. glabrata* and Narrow-leafed Cotton Bush (*Gomphocarpus fruticosus*) in the easements to the north.

Area B - 5-25% weed cover

Small amounts of scattered Whiskey Grass (*Andropogon virginicus*), Pampas Grass and Bitou Bush on easement edges and damp areas.

Area C - <5% weed cover

Small amounts of scattered Whiskey Grass, Pampas Grass, Bitou Bush and other herbaceous weeds on easement edges.

Area D - 5-25% weed cover

Encroachments of weeds from the track to the south of the area and the easement edges. Scattered small outbreaks of Asparagus Fern, *Senna pendula var. glabrata*, Lantana, African Love Grass, Blackberry Nightshade and Bitou Bush. A small Lantana thicket has been treated.

Area E - 5-25% weed cover

Dense areas of Pampas Grass in this area and across property boundary. Scattered occurrences of Crofton Weed, Lantana and Bitou Bush.

Area F - 5-25% weed cover

Cleared powerline easement containing scattered Whiskey Grass, Cotton Bush, Fireweed and herbaceous weeds. Small lantana thicket and Pampas Grass under powerline pylon.

Area G - 25-50% weed cover

Dense stand of Wild Tobacco. Asparagus Fern starting to come up. Scattered small occurrences of Bitou Bush, Lantana, Ginger Lily, Ochna, Inkweed, Crofton and Senna pendula var. glabrata. Large stands of Lantana have been treated. Coral trees, Fishbone Fern, Monstera deliciosa, Senna pendula var. glabrata and Ginger Lily along creek line in southern corner.

Area H - <5% weed cover

Parts of this area have been recently burnt and are coming up with early successional native species such as *Dodonaea triquetra*. Track edges southeast of the dam have scattered small occurrences of Bitou Bush, Asparagus Fern, Lantana, Crofton Weed and Fireweed. Some sporadic occurrences of Lantana, Bitou Bush and *Senna pendula var. glabrata* along the edges of the easement in the north of this area.

Priority Weeds

Lantana, Asparagus Fern, Bitou Bush, Pampas Grass and *Senna pendula var. glabrata*.

Priority Areas

Area G along creek line should be targeted to prevent weed propagules travelling downstream.

Area H is mostly resilient bushland that has been mapped as two EECs (see Map 1).

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Prioritise treating weeds in the southern half of this zone. Follow up treatment of Lantana. Small shoots can be hand pulled. Primary treatment of Bitou Bush, Asparagus Fern, Senna pendula var. glabrata and Pampas Grass along track and easement edges. Notes Vehicle access via the tracks near the sediment ponds and via the track through the south-west corner of the zone.

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4.2 Mannering Colliery

Mannering Colliery has more disturbed areas and fewer large tracts of undisturbed bushland then the Chain Valley Colliery. However, the site is surrounded by bushland and therefore it is imperative that weeds are prevented from spreading into neighbouring resilient areas. Most outbreaks are small and should be targeted before they progress any further. Bush regeneration efforts targeting Lantana and Pampas Grass are evident throughout the site but now require follow up treatment. This site does not contain any EECs.

The following maps and tables provide further details on each management zone including priority weeds, priority areas and management issues.



Figure 4. Resilient bushland in Eastern Zone Area D of Mannering Colliery.

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Figure 5. Bamboo and Crofton Weed in Western Zone Area F of Mannering Colliery.



Figure 6. Crofton Weed and Juncus acutus in wetland area of Northern Zone Area B of Mannering Colliery.

4.2.1 Mannering Colliery – Northern Zone

Table 5. Mannering Colliery - Northern Zone Area Descriptions

Description

This zone is approximate 4.24 ha and consists of four (4) dams, access tracks and some patches of disturbed bushland. Water is discharged from the ponds across Area A, B and G.

Area A - 5-25% weed cover

Pinus radiata saplings, Whiskey Grass and Fireweed along track edges. Treated *Acacia saligna*. Dense stands of *Juncus acutus* in low lying areas.

Area B - 50-75% weed cover

Dense area of weeds including Lantana, Bitou Bush, Crofton Weed, Pampas Grass, Senna and *Juncus acutus*. Lantana and some Pampas Grass has been treated.

Area C - 25-50% weed cover

High density of herbaceous weeds. *Acacia saligna* present, most of which has been treated. *Juncus acutus* present. Pampas Grass present most of which has been treated. Whiskey Grass along track edges.

Area D - 25-50% weed cover

High density of herbaceous weeds across disturbed area.

Area E - 5-25% weed cover

Hydrocotyl is scattered along the dam edges and Typha within the dam.

Area F - 5-25% weed cover

Typha within the dam.

Area G - 5-25% weed cover

The edges of Area G contains *Pinus radiata* saplings. Within the low lying damp wetland areas Large stands of Lantana and Pampas Grass have been treated.

Area H - <5% weed cover

Limited access due to fencing. Scattered Crofton Weed, Lantana, Bitou Bush, Camphor Laurel trees and mature and sapling *Pinus radiata*.

A Resource Regulator identified Coolatai Grass (*Hyparrhenia hirta*) present on the western wall of the largest dam. EMM consultants confirmed the species ID.

Area I - <5% weed cover

Mostly disturbed and cleared areas. Herbaceous weeds, Whiskey Grass and Fireweed along track edges.

Area J - 50-75% weed cover

Dense and scattered stands of Bitou Bush, Lantana, Crofton and Senna. Lantana has been treated but new young shoots are coming up. Large and sapling *Pinus radiata* present. Scattered herbaceous weeds including *Bidens pilosa*, Fleabane (*Conyza sp.*) and Purple Top.

Priority Weeds

Lantana, Bitou Bush, Pampas Grass, Crofton Weed, Fireweed, Senna, *Pinus radiata, Juncus acutus, Coolatai Grass* and Senna

Priority Areas

Area J to follow up from primary weed treatment in this area.

Area B to follow up primary treatment of Lantana and Pampas Grass and prevent propagules form spreading downstream.

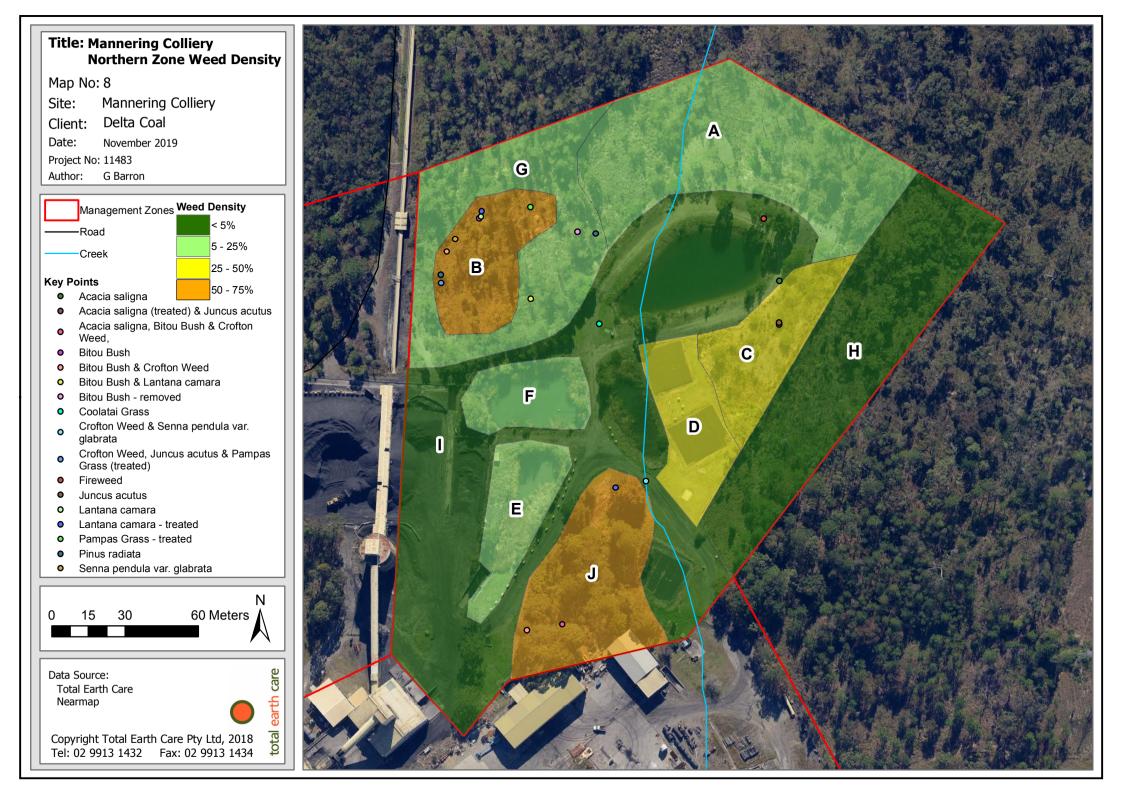
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Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft

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Key Follow up treatment of Lantana. Young, small shoots can be hand Management pulled. Follow up treatment for Pampas Grass and Crofton Weed using cut/paint, hand removal and spraying. Primary treatment of Juncus acutus Hand pull Fireweed opportunistically. Prioritise areas A, E, G and J. Easy vehicle access to most areas. No obvious access to Area H due to fence. **Notes**

Weed Action Plan Page 23 of 45 Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft

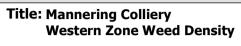


4.2.2 Mannering Colliery – Western Zone

Table 6. Mannering Colliery – Western Zone Area Descriptions

Description	This zone is approximately 4.12 ha including cleared powerline easements, a dam, and disturbed patches of remnant bushland some of which connect to greater bushland extents.
	Area A – 5-25% weed cover
	Scattered herbaceous weeds and exotic grasses. Small scattered patches of Asparagus Fern.
	Area B – 5-25% weed cover
	Powerline easements mostly consisting of exotic grasses, some Lantana patches, <i>Senna pendula var. glabrata</i> and Fireweed, particularly closer to the dam edges.
	Area C – 5-25% weed cover
	Small scattered outbreaks of Crofton Weed, Pampas Grass, Bitou Bush, Whiskey Grass and African Love Grass throughout this area.
	Area D – 25-50% weed cover
	Scattered outbreaks of Lantana, Crofton Weed, Bitou Bush, Whiskey Grass and herbaceous weeds. Lantana thickets have been treated. New shoots are coming requiring treatment.
	Area E - <5% weed cover
	Isolated patch of vegetation containing a small thicket of Lantana.
	Area F – 25-50% weed cover
	Lantana, Crofton Weed, Bitou Bush, and a large outbreak of Bamboo are dominating this area.
	Area G – 5-25% weed cover
	A fence divides this area from the rest of the western zone. A large area of Lantana is located in the northern part of this area.
Priority Weeds	Asparagus Fern, Lantana, Senna, Crofton Weed, Bitou Bush and Bamboo.
Priority Areas	Areas C, F and G are a priority within this zone due to their proximity to remnant bushland and potential for WoNS and Priority Weeds under the Biosecurity Act to spread.
Key Management Issues	 Follow up and primary treatment of Lantana. Primary treatment of Bamboo, Crofton Weed, Asparagus Fern. Opportunistic hand pulling of Fireweed.
Notes	Easy vehicle access to most areas. Area G is separated from the rest of the zone by a fence so vehicle access is limited. On foot access is possible by following the fence from the main driveway entrance to the south.

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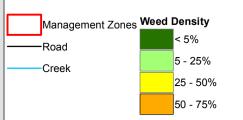


Map No: 9

Site: Mannering Colliery

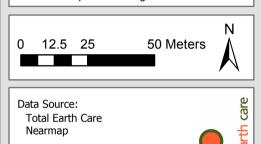
Client: Delta Coal
Date: November 2019

Project No: 11483 Author: G Barron



Key Points

- African Lovegrass & Bitou Bush
- Asparagus Fern
- Bamboo
- Bamboo, Lantana camara & Pampas
- Bitou Bush
- Bitou Bush & Lantana camara
- Crofton Weed
- Crofton Weed & Pampas Grass
- Crofton Weed, Fireweed, Lantana camara
 & Senna pendula var. glabrata
- Crofton Weed, Lantana camara & Senna pendula var. glabrata
- Lantana camara
- Lantana camara treated
- Pinus radiata
- Senna pendula var. glabrata



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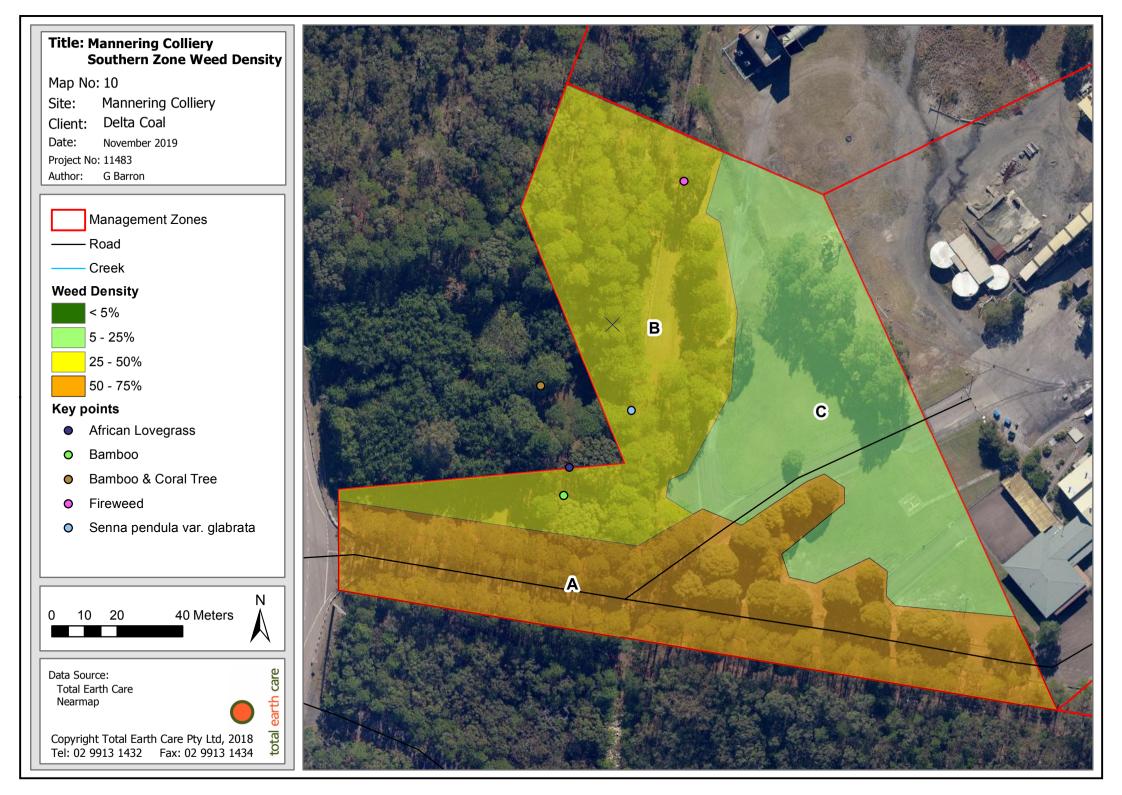


4.2.3 Mannering Colliery – Southern Zone

Table 7. Mannering Colliery – Southern Zone Area Descriptions

Description	This zone is approximately 2.02 ha. It is mostly dominated by mature <i>Pinus radiata</i> and Bamboo. This zone is a low priority due to the lack of remnant bushland and the extent of the pine forest.
	Area A – 50-75% weed cover
	Mature and sapling <i>Pinus radiata</i> lining the driveways.
	Area B – 25-50% weed cover
	High densities of mature <i>Pinus radiata</i> and Bamboo on western side of fence. Other exotic ornamental species including Oleander and Agave. Camphor Laurel trees on western side of fence. Whiskey Grass and Fireweed across managed lawn. Low priority area as dominated by <i>Pinus radiata</i> .
	Area C – 5-25% weed cover
	Mostly herbaceous weeds and exotic grasses.
Priority Weeds	Bamboo, Fireweed, Camphor Laurel trees.
Priority Areas	All areas within this zone are low priority. Other zones of the Mannering Colliery are to be prioritised over this one.
Key Management Issues	Primary treatment of Fireweed and <i>Pinus radiata</i> saplings in Area C
Notes	Fence divides Area B. Western side of Area B can be accessed from southern end near driveway.

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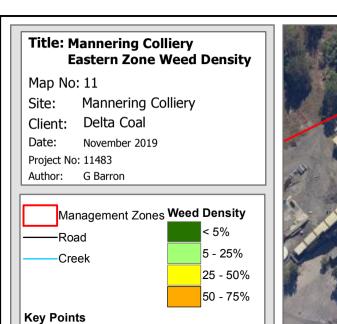


4.2.4 Mannering Colliery – Eastern Zone

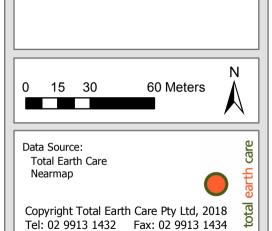
Table 8. Mannering Colliery – Eastern Zone Area Descriptions

Description	This zone is approximately 3.29 ha. This zone contains a carpark, cleared stockpile areas and dam, all bordered by bushland. The bushland is contiguous with adjacent bushland beyond the property boundary to the south. Weeds are generally confined to the bushland edges and disturbed areas.						
	Area A - 5-25% weed cover						
	Mostly planted ornamental exotics and some natives. Herbaceous weeds, exotic grasses and Fireweed across lawn.						
	Area B – 25-50% weed cover						
	Scattered herbaceous weeds, exotic and weedy grasses around edges of disturbed area.						
	Area C - 5-25% weed cover						
	Small area of weed encroachment including Crofton Weed. Evidence of treated Pampas Grass. Small outbreaks of Crofton Weed and Lantana present.						
	Area D - <5% weed cover						
	Mostly weed free bushland with some <i>Pinus radiata</i> saplings and African Lovegrass in the south-west corner of the area.						
	Area E – 25-50% weed cover						
	Dominated by mature and sapling Pinus radiata.						
Priority Weeds	Crofton Weed, Lantana, Pampas Grass, <i>Pinus radiata</i> and Fireweed.						
Priority Areas	Area C and D. These areas are highly resilient and connected to bushland to the south.						
Key Management Issues	 Follow up treatment of Pampas Grass. Primary treatment of Lantana and Crofton Weed. 						
Notes	Site easily accessible.						

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- Acacia saligna
- African Lovegrass
- African Lovegrass & Senna pendula var. glabrata
- Bitou Bush
- Crofton Weed
- Fireweed
- Lantana camara
- Orchid Microtis sp.
- Pampas Grass
- Pinus radiata
- Senna pendula var. glabrata





4.3 Summerland Point Ventilation Shaft

The Summerland Point Ventilation Shaft site is made up of the following EECs:

- Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions; and
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregions.

See Map 3 for EEC locations.

The site contains an unsealed road that provides access to a cleared area where the ventilation shaft infrastructure sits. The areas surrounding the ventilation shaft have been cleared and contain most of the weed species identified on the site. The site is surrounded by highly resilient bushland. Areas along the unsealed road have also been subject to some weed invasion.



Figure 7. Giant Reed within bushland at the Summerland Ventilation Shaft site. .

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Figure 8. Unsealed road and easement within the Summerland Ventilation Shaft site.



Figure 9. Vegetation adjacent to road on the Summerland Ventilation Shaft site.

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Table 9. Summerland Point Ventilation Shaft – Area Descriptions

Description	This zone is approximately 3.73 ha. This zone contains an unsealed road, a cleared area for the ventilation shaft infrastructure and remnant adjacent bushland. Weeds are generally confined to the bushland edges and disturbed areas.
	Area A – 5-25% weed cover
	Mostly bushland and road edges effected by weeds. Lantana thickets have been treated but required follow up treatment. Scattered small shoots of Lantana and Bitou Bush andherbaceous weeds.
Priority Weeds	Lantana, Giant Reed, Bitou Bush
Priority areas	Entire site – small weeds outbreaks on edges of highly resilient bushland must be targeted to prevent further spread.
Key Management Issues	 Follow up treatment of Lantana and Bitou Bush. Small shoots can be hand pulled. Primary treatment of a small area of Giant Reed. Monitor bushland edges and road edges for new outbreaks.
Notes	Easy vehicle access. Key required.
	Red-bellied black snake observed on site.

Weed Action Plan Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft Page 33 of **45**

Title: Summerland Point Ventilation **Shaft Weed Density**

Map No: 12

Site: Summerland Point Ventilation Shaft

Delta Coal Client: November 2019 Date:

Project No: 11483 Author: G Barron



Road

Creek

Weed Density



Key Points

- Arundo donax & Lantana camara
- Bitou Bush
- Bitou Bush removed
- Crofton Weed
- Fireweed
- Lantana camara
- Lantana camara & Senna pendula var. glabrata
- Lantana camara (treated) & Senna pendula var. glabrata
- Lantana camara treated
- Senna pendula var. glabrata



Data Source: Total Earth Care SIX Maps



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Tel: 02 9913 1432 Fax: 02 9913 1434



5 WEED MANAGEMENT

Species specific recommended weeding techniques including recommended herbicides and ratios are included Appendix B.

Weed recruitment and outbreaks are often triggered by disturbance or clearing. Weed management is a form of disturbance that can trigger additional recruitment of weeds as areas are cleared. Therefore secondary treatment is essential to successful weeding and bush regeneration methods.

All weeding management actions on these sites must be carried out by trained bush regenerators. Bush Regeneration contractors must comply with the *Pesticides Act 1999 and the Pesticides Regulation 2017.*

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7 MONITORING GUIDELINES

Monitoring is required to assess the outcomes of the weed management work and help determine if management strategies should be amended. Monitoring should be completed every six (6) months by a qualified ecologist or bush regeneration supervisor using the following methods:

- Assessment of weed control works, native regeneration and revegetation success via permanent repeatable photographic monitoring points; and
- Mapping of weed density per zone to assess the progress of the work. The mapping included in this report can assist in the development of baseline data.

Monitoring reports must include:

- Details of the work carried out including weed management techniques and herbicide used;
- Photo monitoring points baseline and follow up photos; and
- · Recommendations for corrective measures and/or specific vegetation management required.

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Final

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Appendix A. Weed Species listed as a Biosecurity Risk

Table 10. Categories of Management under the Greater Sydney Regional Strategic Weed Management Plan 2017-2022 under the NSW Biosecurity Act 2015

Category	Management Action
Prevention (Prevent)	To prevent the weed species arriving and establishing in the Region.
Eradication (Eliminate)	To permanently remove the species and its propagules from the Region, OR to destroy infestations to reduce the extent of the weed in the region with the aim of local eradication.
Containment (Minimise)	To prevent the ongoing spread of the species in all or part of the Region.
Asset Protection (Manage)	To prevent the spread of weeds to key sites/ assets of high economic, environmental and social value, or to reduce their impact on these sites if spread.
GBD (General Biosecurity Duty)	All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable."
RRM	
(Regional Recommended Measure)	Specific details for each species included in table.
PoD (Prohibition on Dealings)	Must not be imported into the State or sold.
B Zone (Biosecurity Zone)	Specific details for each species included in table.
PM (Prohibited Matter)	A person who deals with prohibited matter or a carrier of prohibited matter is guilty of an offence. A person who becomes aware of or suspects the presence of prohibited matter must immediately notify the Department of Primary Industries.

Weed Action Plan Page 38 of **45**

Table 11. Weeds under the Biosecurity Act recorded within the subject site listed as State or Regional Priority Weeds in the Greater Sydney Regional Strategic Weed Management Plan 2017-2022

Common Name	Botanical Name	WONS	State Priority Weed-Mgmt. Actions	Regional Priority Weeds- Mgmt. Actions	Other Regional Weeds-Asset/value at risk	Duties for Priority Weeds of Greater Sydney
Golden Wreath Wattle	Acacia saligna				Environment	
Crofton Weed	Ageratina adenophora				Environment, Agriculture	
Scarlet Pimpernel	Anagallis arvensis				J	
Whisky Grass	Andropogon virginicus				Environment	
Giant Reed	Arundo donax			Asset Protection		RRM; Land managers should mitigate the risk of new weeds being introduced to their land. The plant should not be bought, sold, grown, carried or released into the environment.
Asparagus Fern	Asparagus aethiopicus	Yes				PoD
Cobblers Pegs	Bidens pilosa					
Buffalo Grass	Bouteloua dactyloides					
Bitou Bush	Chrysanthemoides monilifera subsp rotundata	Yes	Containment			PoD, B Zone; The Bitou Bush Biosecurity Zone is established for all land within the State except land within 10 kilometres of the mean high water mark of the Pacific Ocean between Cape Byron in the north and Point Perpendicular in the south.
Camphor Laurel	Cinnamomum camphora				Environment, Agriculture, Human health	

Final

Common Name	Botanical Name	WONS	State Priority Weed-Mgmt. Actions	Regional Priority Weeds- Mgmt. Actions	Other Regional Weeds-Asset/value at risk	Duties for Priority Weeds of Greater Sydney
Spear Thistle	Cirsium vulgare					
Fleabane	Conyza bonariensis					
Pampas Grass	Cortaderia jubata			Asset Protection		RRM: Land managers mitigate the risk of the plant being introduced to their land. Land managers prevent spread from their land where feasible. Land managers reduce the impact on priority assets. The plant should not be bought, sold, grown, carried or released into the environment. This Regional Recommended Measure applies to Cortaderia jubata (pink pampas grass)
Panic Veldgrass	Ehrharta erecta					
African Lovegrass	Eragrostis curvula				Environment	
Coral Tree, Common Coral Tree	Erythrina x sykesii				Environment	
Fennel	Foeniculum vulgare					
Narrow-Leaf Cotton Bush / Swan Plant	Gomphocarpus fruticosus					
Ginger Lily	Hedychium gardnerianum				Environment	
Pennywort	Hydrocotyle bonariensis					
Coolatai Grass	Hyparrhenia hirta				Environment, Agriculture	
Spiny Rush, Spike Rush, Sharp Rush	Juncus acutus				Environment	

Common Name	Botanical Name	WONS	State Priority Weed-Mgmt. Actions	Regional Priority Weeds- Mgmt. Actions	Other Regional Weeds-Asset/value at risk	Duties for Priority Weeds of Greater Sydney
Lantana	Lantana camara	Yes	Asset Protection			PoD
Fishbone Fern	Nephrolepis cordifolia				Environment	
Ochna	Ochna serrulata				Environment	
Bamboo, Black Bamboo, Rhizomatous Bamboo,	Phyllostachys nigra				Environment	
Inkweed	Phytolacca octandra					
Radiata Pine, Pine Wildings	Pinus radiata				Environment	
Plantain	Plantago lanceolata					
Castor Oil Plant	Ricinus communis					
Blackberry	Rubus fruticosus aggregate	Yes				PoD; All species in the Rubus fruiticosus species aggregate have this requirement, except for the varietals Black Satin, Chehalem, Chester Thornless, Dirksen Thornless, Loch Ness, Murrindindi, Silvan, Smooth Stem, and Thornfree
Fireweed	Senecio madagascariensis	Yes	Asset Protection			PoD
Senna / Cassia	Senna pendula				Environment	
Paddy's Lucerne	Sida rhombifolia					
Tobacco Bush/ Wild Tobacco	Solanum mauritianum				Environment, Agriculture	

Common Name	Botanical Name	WONS	State Priority Weed-Mgmt. Actions	Regional Priority Weeds- Mgmt. Actions	Other Regional Weeds-Asset/value at risk	Duties for Priority Weeds of Greater Sydney
Blackberry Night Shade	Solanum nigrum					
Purpletop	Verbena bonarensis					

Appendix B. Species Specific Weeding Techniques

Common Name	Botanical Name	Weeding Technique	Recommended Timing for Treatment	Herbicide Application	Herbicide Group	Ratio
Golden Wreath Wattle	Acacia saligna	Chainsaw and paint with neat Glyphosate.	All year round	Glyphosate 360g/L	M	Neat
Crofton Weed	Ageratina adenophora	Hand removal, brush cut and foliar sprayed with Glyphosate	All year round	Glyphosate 360g/L	M	1/100
Scarlet Pimpernel	Anagallis arvensis	Hand removal, spot spraying with Glyphosate.	All year round	Glyphosate 360g/L	M	1/100
Whisky Grass	Andropogon virginicus	Remove seed and crown out with knife or spot spray	Prior to flowering in March to May	Glyphosate 360g/L	M	1/100
Giant Reed	Arundo donax	Cut and paint with neat Glyphosate.	All year round	Glyphosate 360g/L	М	Neat
Asparagus Fern	Asparagus aethiopicus	Small single specimens to be crowned or Sprayed with Glyphosate/metsulfuron methyl	All year round	Glyphosate 360g/L & Metsulfuron-Methyl 600 g/kg	M & B	1/100 & 1g/10L
Cobblers Pegs	Bidens pilosa	Foliar spraying using Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Buffalo Grass	Bouteloua dactyloides	Hand removal, brush cut and foliar sprayed with Glyphosate	All year round	Glyphosate 360g/L	M	1/100
Bitou Bush	Chrysanthemoides monilifera subsp rotundata	Small single specimens hand pulled or larger shrubs cut and painted with neat Glyphosate	All year round	Glyphosate 360g/L	M	Neat
Camphor Laurel	Cinnamomum camphora	Scrape and paint or drill and fill with neat Glyphosate	All year round	Glyphosate 360g/L	M	Neat
Spear Thistle	Cirsium vulgare	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	М	1/100
Fleabane	Conyza bonariensis	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Pampas Grass	Cortaderia jubata	Foliar spraying or cut/paint with Glyphosate or hand removed.	Prior to flowering in March to May	Glyphosate 360g/L	М	1/100 & Neat
Panic Veldgrass	Ehrharta erecta	Foliar spraying with Glyphosate	All year round	Glyphosate 360g/L	М	1/100

Common Name	Botanical Name	Weeding Technique	Recommended Timing for Treatment	Herbicide Application	Herbicide Group	Ratio
African Lovegrass	Eragrostis curvula	Hand pulled or brush cut and foliar sprayed with Glyphosate	All year round	Glyphosate 360g/L	M	1/100
Coral Tree, Common Coral Tree	Erythrina x sykesii	<80mm cut & painted; >80mm will be drilled/frilled with neat Glyphosate	All year round	Glyphosate 360g/L	M	Neat
Fennel	Foeniculum vulgare	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Narrow-Leaf Cotton Bush / Swan Plant	Gomphocarpus fruticosus	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100 & Neat
Ginger Lily	Hedychium gardnerianum	Physical removal. Large stands cut and painted with Glyphosate/Metsulfuron-Methyl.	All year round	Glyphosate 360g/L & Metsulfuron-Methyl 600 g/kg	M & B	Neat
Pennywort	Hydrocotyle bonariensis	Hand pulled or spot sprayed with Dicamba	All year round			
Coolatai Grass	Hyparrhenia hirta	Hand pulled or brush cut and foliar sprayed with Glyphosate. Up to three applications of Glyphosate in the same growing season will be required.	All year round	Glyphosate 360g/L	M	200ml/10l
Spiny Rush, Spike Rush, Sharp Rush	Juncus acutus	Juvenile single specimens to be dug out. Large infestations foliar spraying with Glyphosate.	All year round	Glyphosate 360g/L	M	1/100
Lantana	Lantana camara	Cut and paint, sprayed or splattered with Glyphosate. Hand pull small shoots.	All year round	Glyphosate 360g/L	M	Neat
Fishbone Fern	Nephrolepis cordifolia	Hand removal. Brush cut then sprayed with Glyphosate.	All year round	Glyphosate 360g/L	M	1/100
Ochna	Ochna serrulata	Double side scrape and paint all stems to 75% coverage.	All year round	Glyphosate 360g/L	M	Neat
Bamboo, Black Bamboo, Rhizomatous Bamboo,	Phyllostachys nigra	Chainsaw/cut close to base. Allow new shoots to return. Cut and paint new shoots with neat Glyphosate.	All year round	Glyphosate 360g/L	M	Neat
Inkweed	Phytolacca octandra	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Radiata Pine, Pine Wildings	Pinus radiata	<80mm cut & painted; >80mm will be drilled/frilled with neat Glyphosate	All year round	Glyphosate 360g/L	M	Neat

Common Name	Botanical Name	Weeding Technique	Recommended Timing for Treatment	Herbicide Application	Herbicide Group	Ratio
Plantain	Plantago lanceolata	Foliar spraying with Glyphosate	All year round	Glyphosate 360g/L	M	1/100
Castor Oil Plant	Ricinus communis	Hand pulled and cut & painted with neat Glyphosate	All year round	Glyphosate 360g/L	M	Neat
Blackberry	Rubus fruticosus aggregate	Brush cut, crowned and scraped & painted with neat Glyphosate	Between flowering and fruiting from November to January	Glyphosate 360g/L	M	Neat
Fireweed	Senecio madagascariensis	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Senna / Cassia	Senna pendula	Small individuals hand removed, larger plants cut and painted with neat Glyphosate	All year round	Glyphosate 360g/L	M	Neat
Paddy's Lucerne	Sida rhombifolia	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Tobacco Bush/ Wild Tobacco	Solanum mauritianum	Cut & paint with Glyphosate	All year round	Glyphosate 360g/L	M	Neat
Blackberry Night Shade	Solanum nigrum	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Purpletop	Verbena bonarensis	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100



total earth care



Weed Action Plan - Addendum

Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft

Total Earth Care Pty Ltd August 2020



Weed Action Plan - Addendum

Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft

August 2020

Quality Control	© Total Earth Care Pty Ltd 2020		
Revision/Version No.	Addendum 1	Date of revision	28 August 2020
Prepared by:	G Teear		
Approved by	G Barron, W Thurston		
Prepared for:	Delta Coal		
TEC Job No.	C11483/J4925		

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1 INTRODUCTION

1.1 Background

Total Earth Care (TEC) previously prepared the Weed Action Plan (WAP) in January 2020 for the three (3) Delta Coal sites: Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft. This Addendum is developed to incorporate an additional area on the Lake Macquarie foreshore at the Chain Valley Colliery in the WAP. Delta Coal was granted a licence by the Minister for Water, Property & Housing on 11th June 2020 under Section 2.20 of the Crown Land Management Act 2016 for the use of the licensed area for *Environmental Rehabilitation – Vegetation Management*.

This Addendum provides guidance for managing the weeds within the license's foreshore area. Current weed densities of the licence's area are provided as well as the relevant management actions.

1.2 Subject Sites and Study Area

The "Study Area" for this Addendum includes the licensed area of Crown Land (Lot 2, DP1198253) that abuts the Chain Valley Colliery site managed by Delta Coal. This will be referred to as the "Foreshore Zone". The area included in the license extends along the foreshore of the neighbouring Delta Electricity site to the north-west, but this area was not part of the scope of this project. Please see the Map 1 below which indicates the boundaries of the Study Area. The site falls within the Local Land Services Greater Sydney Region, bordering on the Hunter Region.

2 METHODS

2.1 Desktop Research

A preliminary desktop study was conducted to assess the previously mapped weed locations (Kleinfelder 2016) and existing plant community types using the Wyong ELA 2016 PCT (ELA, 2016) mapping.

2.2 Site Survey

A site survey was conducted over one (1) day on the 4th August 2020. Weather conditions were clear with maximum temperatures of approximately 18°C. See Map 1 for survey effort. Survey methodology followed that outlined in the WAP 2020.

3 RESULTS

The weed survey identified twenty-five (25) weed species under the *Biosecurity Act 2015*. These are listed in Appendix A along with the landholder's obligations under the Act. Of these, four (4) are listed as Weeds of National Significance (WoNS). These are:

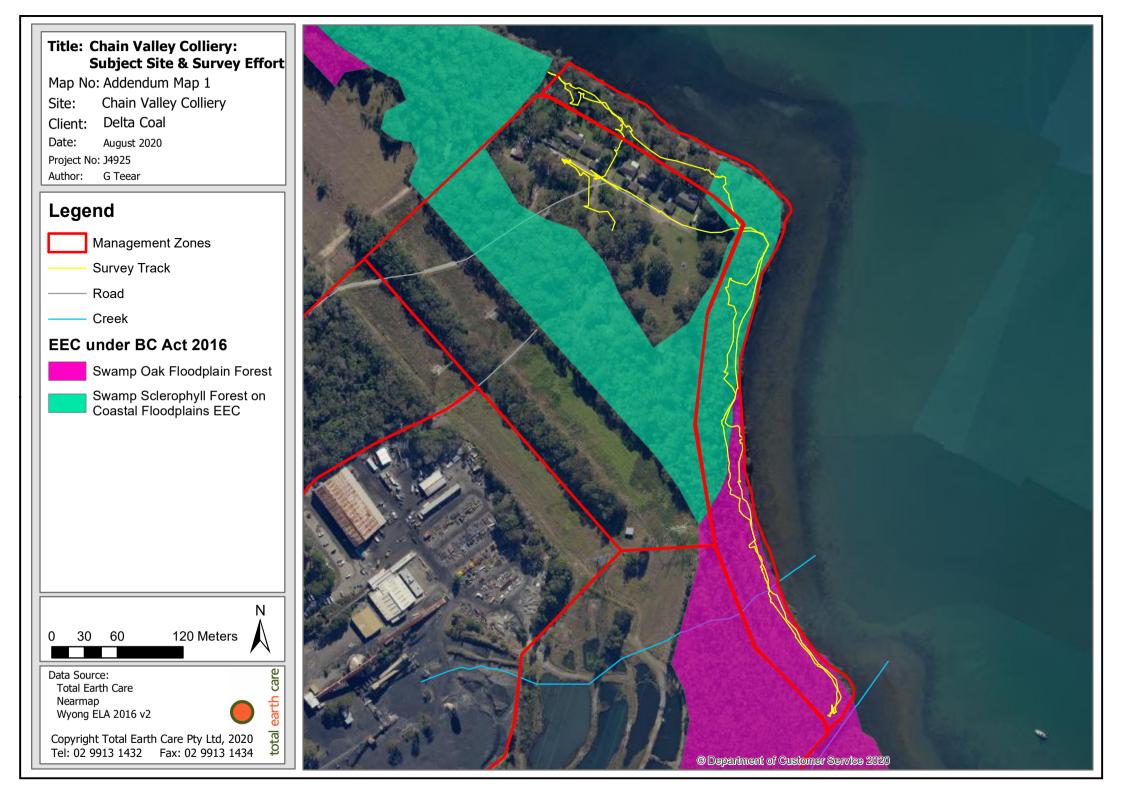
- Asparagus Fern (Asparagus aethiopicus);
- Bitou Bush (Chrysanthemoides monilifera subsp rotundata);
- Lantana (Lantana camara); and
- Fireweed (Senecio madagascariensis).

Bitou Bush, Lantana and Fireweed are also listed as State Priority Weeds. The above listed weeds are also listed as Priority Weeds under the Greater Sydney Regional Strategic Weed Management Plan.

Weeds are mostly encroaching from the lot boundaries of the land, which is managed by Delta Coal. There are some small outbreaks within large resilient bushland areas which have been prioritised within this Plan.

Approximately six (6) *Dendrobium teretifolium*, an epiphytic orchid, were recorded at the southern end of this zone attached to the trunks of Casuarinas. These have been mapped in Map 2 of this Addendum.

The current condition, locations of weed infestations and weed densities have been discussed in detail within Section 4 - Management Zones.



4 MANAGEMENT ZONE

The Foreshore Area is the Crown Land foreshore of the southern end of Lake Macquarie. The Foreshore area forms an additional management zone to those outlined in the WAP 2020. A detailed description of the zone and the weed presence is included in Table 1.

4.1.1 Chain Valley Colliery - Foreshore Area

Table 1. Chain Valley Colliery - Foreshore Area Description

	,,			
Description	This zone is approximately 2.7 ha and runs along the foreshore of Lake Macquarie abutting the north-east boundary of the Chain Valley Colliery.			
	Area A – <5% weed cover			
	The most resilient area of this zone with low weed densities. Scattered occurrences of Bitou Bush (<i>Chrysanthemoides monilifera</i>) and Asparagus Fern (<i>Asparagus aethiopicus</i>), mostly along the lake edge. Approximately six (6) <i>Dendrobium teretifolium</i> , an epiphytic orchid, were recorded at the southern end of this zone attached to the trunks of Casuarinas.			
	Area B – 50 – 75% weed cover			
	Area with the highest weed density within this zone, which this mostly within the ground and shrub layer. Weed occurrences in this area mostly consist of <i>Lantana camara</i> , <i>Ochna serrulata</i> , Wild Tobacco (<i>Solanum mauritianum</i>), Bitou Bush (<i>Chrysanthemoides monilifera</i>), <i>Tradescantia fluminensis</i> and Asparagus Fern (<i>Asparagus aethiopicus</i>). The areas of densest weeds are along the western boundary of Area B.			
	Area C – 50 – 75% weed cover			
	Weeds are mostly within the ground layer which consists of exotic grasses, Watsonia (Watsonia meriana var. bulbillifera), Fireweed (Senecio madagascariensis), Asparagus Fern (Asparagus aethiopicus) and herbaceous weeds. Scattered occurrences and small patches of Senna pendula var. glabrata, Fishbone Fern (Nephrolepis cordifolia), Ochna serrulata, Coolatai Grass (Hyparrhenia hirta), Lantana camara, Rhodes Grass (Chloris gayana) and Crofton Weed (Ageratina adenophora) occur along the front of the cottages. Other ornamental exotic plant species are present here, most likely as plantings installed by previous residents of the cottages.			
	Area D – 5-25% weed cover			
	Scattered occurrences of <i>Lantana camara</i> , <i>Ochna serrulata</i> , and Asparagus Fern (<i>Asparagus aethiopicus</i>).			
Priority Weeds	Lantana camara, Bitou Bush (Chrysanthemoides monilifera), Fireweed (Senecio madagascariensis) and Asparagus Fern (Asparagus aethiopicus).			
Priority Areas	Area A and B has the most resilience. Weeds should be controlled to prevent further spread. Working from the lake edge towards the Chain Valley Colliery lot boundaries will help in containing weeds within the Delta Coal's land and follow best practice of working from areas of highest resilience to lowest.			
Key Management Issues	 Targeted treatment of Bitou Bush (Chrysanthemoides monilifera) and Asparagus Fern (Asparagus aethiopicus) particularly along lake edges in Areas A and B. Primary and targeted treatment of Senna pendula var. glabrata, Fishbone Fern (Nephrolepis cordifolia), Ochna serrulata, Coolatai Grass (Hyparrhenia hirta), Lantana camara, Rhodes Grass (Chloris gayana) and Crofton Weed (Ageratina adenophora). 			
Notes	Access to this zone via dirt road from near the Chain Valley Colliery site entry. Key required. Caution to be taken driving around cottages due to rubbish and debris hidden by long grass.			



Figure 1. Area C showing the small patch of Coolatai Grass present.

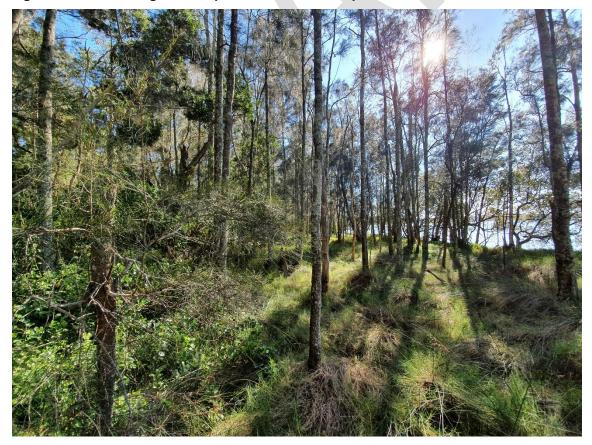
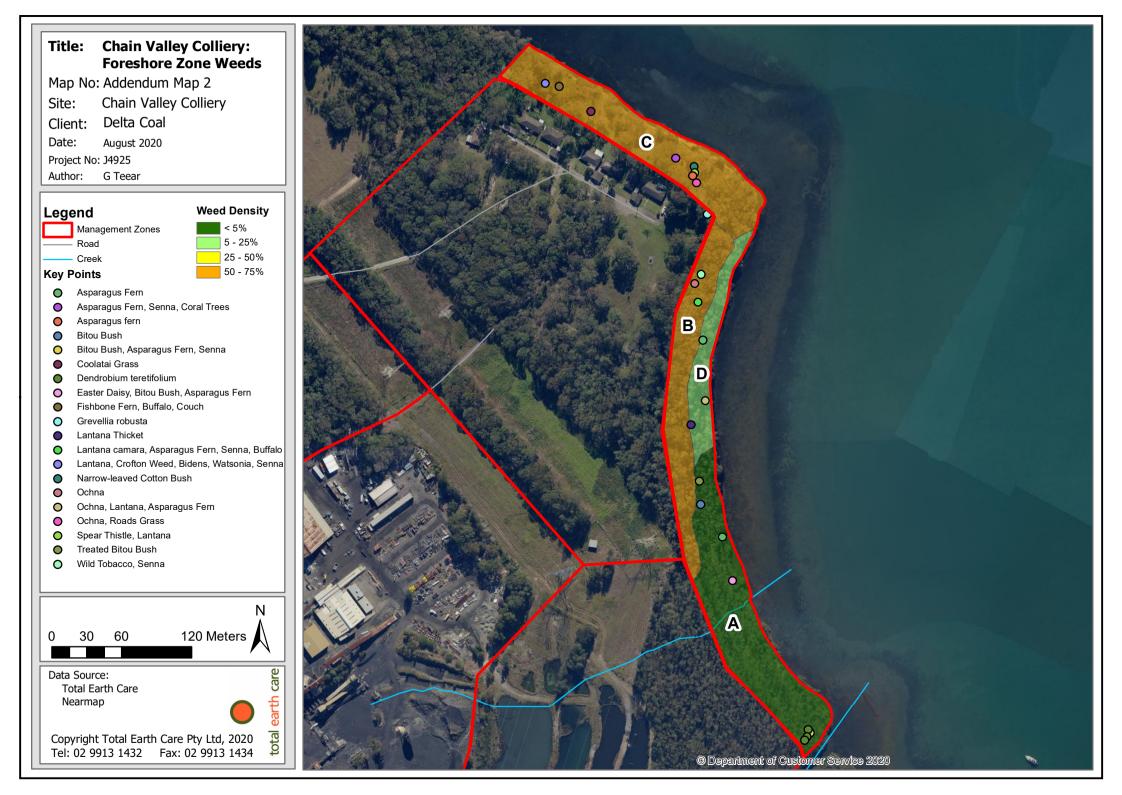


Figure 2. Boundary of Area B and D.



5 MONITORING GUIDELINES

Monitoring is required to assess the outcomes of the weed management work and help determine if management strategies should be amended. Monitoring should be completed every six (6) months by a qualified ecologist or bush regeneration supervisor using the following methods:

- Assessment of weed control works, native regeneration and revegetation success via permanent repeatable photographic monitoring points; and
- Mapping of weed density per zone to assess the progress of the work. The mapping included in this report can assist in the development of baseline data.

Monitoring reports must include:

- Details of the work carried out including weed management techniques and herbicide used;
- Photo monitoring points baseline and follow up photos; and
- Recommendations for corrective measures and/or specific vegetation management required.



Appendix A. Weed Species listed as a Biosecurity Risk

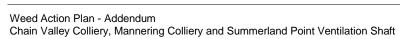
Table 2. Categories of Management under the Greater Sydney Regional Strategic Weed Management Plan 2017-2022 under the NSW Biosecurity Act 2015

Category	Management Action					
Prevention (Prevent)	To prevent the weed species arriving and establishing in the Region.					
Eradication (Eliminate)	To permanently remove the species and its propagules from the Region, OR to destroy infestations to reduce the extent of the weed in the region with the aim of local eradication.					
Containment (Minimise)	To prevent the ongoing spread of the species in all or part of the Region.					
Asset Protection (Manage)	To prevent the spread of weeds to key sites/ assets of high economic, environmental and social value, or to reduce their impact on these sites if spread.					
GBD (General Biosecurity Duty)	All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable."					
RRM (Regional Recommended Measure)	Specific details for each species included in table.					
PoD						
(Prohibition on Dealings)	Must not be imported into the State or sold.					
B Zone	Specific details for each species included in table					
(Biosecurity Zone)	Specific details for each species included in table.					
PM A person who deals with prohibited matter or a carrier of prohibited is guilty of an offence. A person who becomes aware of or suspect presence of prohibited matter must immediately notify the Department Primary Industries.						

Table 3. Weeds recorded within the subject site with respective categories listed in the Greater Sydney Regional Strategic Weed Management Plan 2017-2022

Common Name	Botanical Name	WONS	State Priority Weed-Mgmt. Actions	Regional Priority Weeds- Mgmt. Actions	Other Regional Weeds-Asset/value at risk	Duties for Priority Weeds of Greater Sydney
Crofton Weed	Ageratina adenophora				Environment, Agriculture	
Whisky Grass	Andropogon virginicus				Environment	
Asparagus Fern	Asparagus aethiopicus	Yes				PoD
Cobblers Pegs	Bidens pilosa					
Buffalo Grass	Bouteloua dactyloides					
Bitou Bush	Chrysanthemoides monilifera subsp rotundata	Yes	Containment			PoD, B Zone; The Bitou Bush Biosecurity Zone is established for all land within the State except land within 10 kilometres of the mean high water mark of the Pacific Ocean between Cape Byron in the north and Point Perpendicular in the south.
Spear Thistle	Cirsium vulgare					
Fleabane	Conyza bonariensis					
Panic Veldgrass	Ehrharta erecta					
African Lovegrass	Eragrostis curvula				Environment	
Coral Tree, Common Coral Tree	Erythrina x sykesii				Environment	
Narrow-Leaf Cotton Bush / Swan Plant	Gomphocarpus fruticosus					
Pennywort	Hydrocotyle bonariensis					

Common Name	Botanical Name	WONS	State Priority Weed-Mgmt. Actions	Regional Priority Weeds- Mgmt. Actions	Other Regional Weeds-Asset/value at risk	Duties for Priority Weeds of Greater Sydney
Coolatai Grass	Hyparrhenia hirta				Environment, Agriculture	
Lantana	Lantana camara	Yes	Asset Protection			PoD
Fishbone Fern	Nephrolepis cordifolia				Environment	
Ochna	Ochna serrulata				Environment	
Fireweed	Senecio madagascariensis	Yes	Asset Protection			PoD
Senna / Cassia	Senna pendula				Environment	
Paddy's Lucerne	Sida rhombifolia					
Tobacco Bush/ Wild Tobacco	Solanum mauritianum				Environment, Agriculture	
Blackberry Night Shade	Solanum nigrum				_	
Purpletop	Verbena bonarensis					



Appendix B. Species Specific Weeding Techniques

Common Name	Botanical Name	Weeding Technique	Recommended Timing for Treatment	Herbicide Application	Herbicide Group	Ratio
Crofton Weed	Ageratina adenophora	Hand removal, brush cut and foliar sprayed with Glyphosate	All year round	Glyphosate 360g/L	М	1/100
Whisky Grass	Andropogon virginicus	Remove seed and crown out with knife or spot spray	Prior to flowering in March to May	Glyphosate 360g/L	M	1/100
Asparagus Fern	Asparagus aethiopicus	Small single specimens to be crowned or Sprayed with Glyphosate/metsulfuron methyl	All year round	Glyphosate 360g/L & Metsulfuron-Methyl 600 g/kg	M & B	1/100 & 1g/10L
Cobblers Pegs	Bidens pilosa	Foliar spraying using Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Buffalo Grass	Bouteloua dactyloides	Hand removal, brush cut and foliar sprayed with Glyphosate	All year round	Glyphosate 360g/L	M	1/100
Bitou Bush	Chrysanthemoides monilifera subsp rotundata	Small single specimens hand pulled or larger shrubs cut and painted with neat Glyphosate	All year round	Glyphosate 360g/L	М	Neat
Spear Thistle	Cirsium vulgare	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	М	1/100
Fleabane	Conyza bonariensis	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Panic Veldgrass	Ehrharta erecta	Foliar spraying with Glyphosate	All year round	Glyphosate 360g/L	M	1/100
African Lovegrass	Eragrostis curvula	Hand pulled or brush cut and foliar sprayed with Glyphosate	All year round	Glyphosate 360g/L	М	1/100
Coral Tree, Common Coral Tree	Erythrina x sykesii	<80mm cut & painted; >80mm will be drilled/frilled with neat Glyphosate	All year round	Glyphosate 360g/L	М	Neat
Narrow-Leaf Cotton Bush / Swan Plant	Gomphocarpus fruticosus	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100 & Neat
Pennywort	Hydrocotyle bonariensis	Hand pulled or spot sprayed with Dicamba	All year round			
Coolatai Grass	Hyparrhenia hirta	Hand pulled or brush cut and foliar sprayed with Glyphosate. Up to three applications of Glyphosate in the same growing season will be required.	All year round	Glyphosate 360g/L	M	200ml/10l

Common Name	Botanical Name	Weeding Technique	Recommended Timing for Treatment	Herbicide Application	Herbicide Group	Ratio
Lantana	Lantana camara	Cut and paint, sprayed or splattered with Glyphosate. Hand pull small shoots.	All year round	Glyphosate 360g/L	M	Neat
Fishbone Fern	Nephrolepis cordifolia	Hand removal. Brush cut then sprayed with Glyphosate.	All year round	Glyphosate 360g/L	M	1/100
Ochna	Ochna serrulata	Double side scrape and paint all stems to 75% coverage.	All year round	Glyphosate 360g/L	M	Neat
Fireweed	Senecio madagascariensis	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Senna / Cassia	Senna pendula	Small individuals hand removed, larger plants cut and painted with neat Glyphosate	All year round	Glyphosate 360g/L	M	Neat
Paddy's Lucerne	Sida rhombifolia	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Tobacco Bush/ Wild Tobacco	Solanum mauritianum	Cut & paint with Glyphosate	All year round	Glyphosate 360g/L	M	Neat
Blackberry Night Shade	Solanum nigrum	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Purpletop	Verbena bonarensis	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100





total earth care



Weed Action Plan - Addendum

Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft

Total Earth Care Pty Ltd August 2020



Weed Action Plan - Addendum

Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft

August 2020

Quality Control	© Total Earth Care Pty Ltd 2020						
Revision/Version No.	Addendum 1	Date of revision	28 August 2020				
Prepared by:	G Teear						
Approved by	G Barron, W Thurstor	G Barron, W Thurston					
Prepared for:	Delta Coal						
TEC Job No.	C11483/J4925						

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1 INTRODUCTION

1.1 Background

Total Earth Care (TEC) previously prepared the Weed Action Plan (WAP) in January 2020 for the three (3) Delta Coal sites: Chain Valley Colliery, Mannering Colliery and Summerland Point Ventilation Shaft. This Addendum is developed to incorporate an additional area on the Lake Macquarie foreshore at the Chain Valley Colliery in the WAP. Delta Coal was granted a licence by the Minister for Water, Property & Housing on 11th June 2020 under Section 2.20 of the Crown Land Management Act 2016 for the use of the licensed area for *Environmental Rehabilitation – Vegetation Management*.

This Addendum provides guidance for managing the weeds within the license's foreshore area. Current weed densities of the licence's area are provided as well as the relevant management actions.

1.2 Subject Sites and Study Area

The "Study Area" for this Addendum includes the licensed area of Crown Land (Lot 2, DP1198253) that abuts the Chain Valley Colliery site managed by Delta Coal. This will be referred to as the "Foreshore Zone". The area included in the license extends along the foreshore of the neighbouring Delta Electricity site to the north-west, but this area was not part of the scope of this project. Please see the Map 1 below which indicates the boundaries of the Study Area. The site falls within the Local Land Services Greater Sydney Region, bordering on the Hunter Region.

2 METHODS

2.1 Desktop Research

A preliminary desktop study was conducted to assess the previously mapped weed locations (Kleinfelder 2016) and existing plant community types using the Wyong ELA 2016 PCT (ELA, 2016) mapping.

2.2 Site Survey

A site survey was conducted over one (1) day on the 4th August 2020. Weather conditions were clear with maximum temperatures of approximately 18°C. See Map 1 for survey effort. Survey methodology followed that outlined in the WAP 2020.

3 RESULTS

The weed survey identified twenty-five (25) weed species under the *Biosecurity Act 2015*. These are listed in Appendix A along with the landholder's obligations under the Act. Of these, four (4) are listed as Weeds of National Significance (WoNS). These are:

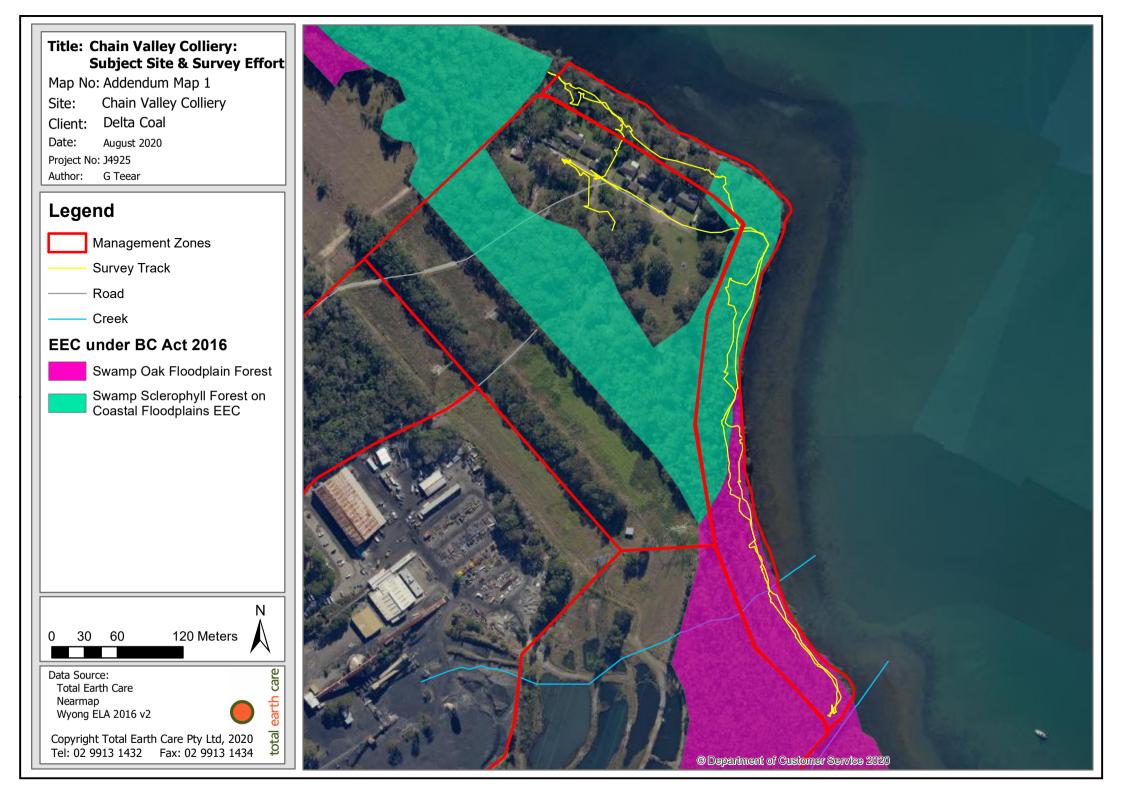
- Asparagus Fern (Asparagus aethiopicus);
- Bitou Bush (Chrysanthemoides monilifera subsp rotundata);
- Lantana (Lantana camara); and
- Fireweed (Senecio madagascariensis).

Bitou Bush, Lantana and Fireweed are also listed as State Priority Weeds. The above listed weeds are also listed as Priority Weeds under the Greater Sydney Regional Strategic Weed Management Plan.

Weeds are mostly encroaching from the lot boundaries of the land, which is managed by Delta Coal. There are some small outbreaks within large resilient bushland areas which have been prioritised within this Plan.

Approximately six (6) *Dendrobium teretifolium*, an epiphytic orchid, were recorded at the southern end of this zone attached to the trunks of Casuarinas. These have been mapped in Map 2 of this Addendum.

The current condition, locations of weed infestations and weed densities have been discussed in detail within Section 4 - Management Zones.



4 MANAGEMENT ZONE

The Foreshore Area is the Crown Land foreshore of the southern end of Lake Macquarie. The Foreshore area forms an additional management zone to those outlined in the WAP 2020. A detailed description of the zone and the weed presence is included in Table 1.

4.1.1 Chain Valley Colliery - Foreshore Area

Table 1. Chain Valley Colliery - Foreshore Area Description

	,,
Description	This zone is approximately 2.7 ha and runs along the foreshore of Lake Macquarie abutting the north-east boundary of the Chain Valley Colliery.
	Area A – <5% weed cover
	The most resilient area of this zone with low weed densities. Scattered occurrences of Bitou Bush (<i>Chrysanthemoides monilifera</i>) and Asparagus Fern (<i>Asparagus aethiopicus</i>), mostly along the lake edge. Approximately six (6) <i>Dendrobium teretifolium</i> , an epiphytic orchid, were recorded at the southern end of this zone attached to the trunks of Casuarinas.
	Area B – 50 – 75% weed cover
	Area with the highest weed density within this zone, which this mostly within the ground and shrub layer. Weed occurrences in this area mostly consist of <i>Lantana camara</i> , <i>Ochna serrulata</i> , Wild Tobacco (<i>Solanum mauritianum</i>), Bitou Bush (<i>Chrysanthemoides monilifera</i>), <i>Tradescantia fluminensis</i> and Asparagus Fern (<i>Asparagus aethiopicus</i>). The areas of densest weeds are along the western boundary of Area B.
	Area C – 50 – 75% weed cover
	Weeds are mostly within the ground layer which consists of exotic grasses, Watsonia (Watsonia meriana var. bulbillifera), Fireweed (Senecio madagascariensis), Asparagus Fern (Asparagus aethiopicus) and herbaceous weeds. Scattered occurrences and small patches of Senna pendula var. glabrata, Fishbone Fern (Nephrolepis cordifolia), Ochna serrulata, Coolatai Grass (Hyparrhenia hirta), Lantana camara, Rhodes Grass (Chloris gayana) and Crofton Weed (Ageratina adenophora) occur along the front of the cottages. Other ornamental exotic plant species are present here, most likely as plantings installed by previous residents of the cottages.
	Area D – 5-25% weed cover
	Scattered occurrences of <i>Lantana camara</i> , <i>Ochna serrulata</i> , and Asparagus Fern (<i>Asparagus aethiopicus</i>).
Priority Weeds	Lantana camara, Bitou Bush (Chrysanthemoides monilifera), Fireweed (Senecio madagascariensis) and Asparagus Fern (Asparagus aethiopicus).
Priority Areas	Area A and B has the most resilience. Weeds should be controlled to prevent further spread. Working from the lake edge towards the Chain Valley Colliery lot boundaries will help in containing weeds within the Delta Coal's land and follow best practice of working from areas of highest resilience to lowest.
Key Management Issues	 Targeted treatment of Bitou Bush (Chrysanthemoides monilifera) and Asparagus Fern (Asparagus aethiopicus) particularly along lake edges in Areas A and B. Primary and targeted treatment of Senna pendula var. glabrata, Fishbone Fern (Nephrolepis cordifolia), Ochna serrulata, Coolatai Grass (Hyparrhenia hirta), Lantana camara, Rhodes Grass (Chloris gayana) and Crofton Weed (Ageratina adenophora).
Notes	Access to this zone via dirt road from near the Chain Valley Colliery site entry. Key required. Caution to be taken driving around cottages due to rubbish and debris hidden by long grass.



Figure 1. Area C showing the small patch of Coolatai Grass present.

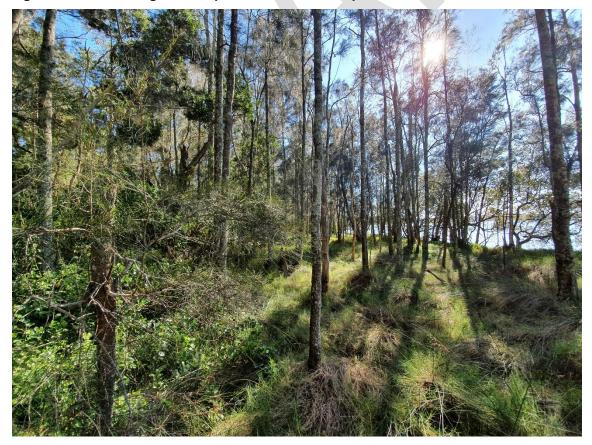
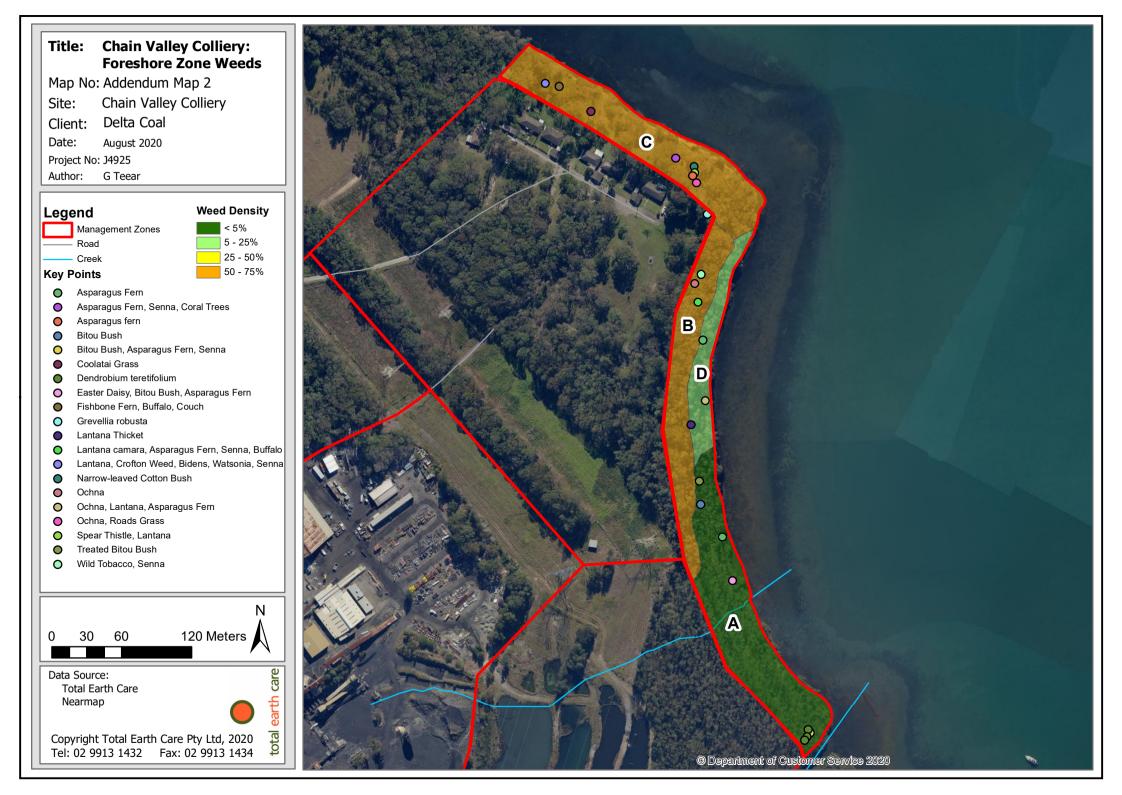


Figure 2. Boundary of Area B and D.



5 MONITORING GUIDELINES

Monitoring is required to assess the outcomes of the weed management work and help determine if management strategies should be amended. Monitoring should be completed every six (6) months by a qualified ecologist or bush regeneration supervisor using the following methods:

- Assessment of weed control works, native regeneration and revegetation success via permanent repeatable photographic monitoring points; and
- Mapping of weed density per zone to assess the progress of the work. The mapping included in this report can assist in the development of baseline data.

Monitoring reports must include:

- Details of the work carried out including weed management techniques and herbicide used;
- Photo monitoring points baseline and follow up photos; and
- Recommendations for corrective measures and/or specific vegetation management required.



Appendix A. Weed Species listed as a Biosecurity Risk

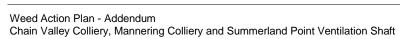
Table 2. Categories of Management under the Greater Sydney Regional Strategic Weed Management Plan 2017-2022 under the NSW Biosecurity Act 2015

Category	Management Action					
Prevention (Prevent)	To prevent the weed species arriving and establishing in the Region.					
Eradication (Eliminate)	To permanently remove the species and its propagules from the Region, OR to destroy infestations to reduce the extent of the weed in the region with the aim of local eradication.					
Containment (Minimise)	To prevent the ongoing spread of the species in all or part of the Region.					
Asset Protection (Manage)	To prevent the spread of weeds to key sites/ assets of high economic, environmental and social value, or to reduce their impact on these sites if spread.					
GBD (General Biosecurity Duty)	All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable."					
RRM (Regional Recommended Measure)	Specific details for each species included in table.					
PoD						
(Prohibition on Dealings)	Must not be imported into the State or sold.					
B Zone	Specific details for each species included in table					
(Biosecurity Zone)	Specific details for each species included in table.					
PM A person who deals with prohibited matter or a carrier of prohibited is guilty of an offence. A person who becomes aware of or suspect presence of prohibited matter must immediately notify the Department Primary Industries.						

Table 3. Weeds recorded within the subject site with respective categories listed in the Greater Sydney Regional Strategic Weed Management Plan 2017-2022

Common Name	Botanical Name	WONS	State Priority Weed-Mgmt. Actions	Regional Priority Weeds- Mgmt. Actions	Other Regional Weeds-Asset/value at risk	Duties for Priority Weeds of Greater Sydney
Crofton Weed	Ageratina adenophora				Environment, Agriculture	
Whisky Grass	Andropogon virginicus				Environment	
Asparagus Fern	Asparagus aethiopicus	Yes				PoD
Cobblers Pegs	Bidens pilosa					
Buffalo Grass	Bouteloua dactyloides					
Bitou Bush	Chrysanthemoides monilifera subsp rotundata	Yes	Containment			PoD, B Zone; The Bitou Bush Biosecurity Zone is established for all land within the State except land within 10 kilometres of the mean high water mark of the Pacific Ocean between Cape Byron in the north and Point Perpendicular in the south.
Spear Thistle	Cirsium vulgare					
Fleabane	Conyza bonariensis					
Panic Veldgrass	Ehrharta erecta					
African Lovegrass	Eragrostis curvula				Environment	
Coral Tree, Common Coral Tree	Erythrina x sykesii				Environment	
Narrow-Leaf Cotton Bush / Swan Plant	Gomphocarpus fruticosus					
Pennywort	Hydrocotyle bonariensis					

Common Name	Botanical Name	WONS	State Priority Weed-Mgmt. Actions	Regional Priority Weeds- Mgmt. Actions	Other Regional Weeds-Asset/value at risk	Duties for Priority Weeds of Greater Sydney
Coolatai Grass	Hyparrhenia hirta				Environment, Agriculture	
Lantana	Lantana camara	Yes	Asset Protection			PoD
Fishbone Fern	Nephrolepis cordifolia				Environment	
Ochna	Ochna serrulata				Environment	
Fireweed	Senecio madagascariensis	Yes	Asset Protection			PoD
Senna / Cassia	Senna pendula				Environment	
Paddy's Lucerne	Sida rhombifolia					
Tobacco Bush/ Wild Tobacco	Solanum mauritianum				Environment, Agriculture	
Blackberry Night Shade	Solanum nigrum				_	
Purpletop	Verbena bonarensis					



Appendix B. Species Specific Weeding Techniques

Common Name	Botanical Name	Weeding Technique	Recommended Timing for Treatment	Herbicide Application	Herbicide Group	Ratio
Crofton Weed	Ageratina adenophora	Hand removal, brush cut and foliar sprayed with Glyphosate	All year round	Glyphosate 360g/L	М	1/100
Whisky Grass	Andropogon virginicus	Remove seed and crown out with knife or spot spray	Prior to flowering in March to May	Glyphosate 360g/L	M	1/100
Asparagus Fern	Asparagus aethiopicus	Small single specimens to be crowned or Sprayed with Glyphosate/metsulfuron methyl	All year round	Glyphosate 360g/L & Metsulfuron-Methyl 600 g/kg	M & B	1/100 & 1g/10L
Cobblers Pegs	Bidens pilosa	Foliar spraying using Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
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Spear Thistle	Cirsium vulgare	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	М	1/100
Fleabane	Conyza bonariensis	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Panic Veldgrass	Ehrharta erecta	Foliar spraying with Glyphosate	All year round	Glyphosate 360g/L	M	1/100
African Lovegrass	Eragrostis curvula	Hand pulled or brush cut and foliar sprayed with Glyphosate	All year round	Glyphosate 360g/L	М	1/100
Coral Tree, Common Coral Tree	Erythrina x sykesii	<80mm cut & painted; >80mm will be drilled/frilled with neat Glyphosate	All year round	Glyphosate 360g/L	М	Neat
Narrow-Leaf Cotton Bush / Swan Plant	Gomphocarpus fruticosus	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100 & Neat
Pennywort	Hydrocotyle bonariensis	Hand pulled or spot sprayed with Dicamba	All year round			
Coolatai Grass	Hyparrhenia hirta	Hand pulled or brush cut and foliar sprayed with Glyphosate. Up to three applications of Glyphosate in the same growing season will be required.	All year round	Glyphosate 360g/L	M	200ml/10l

Common Name	Botanical Name	Weeding Technique	Recommended Timing for Treatment	Herbicide Application	Herbicide Group	Ratio
Lantana	Lantana camara	Cut and paint, sprayed or splattered with Glyphosate. Hand pull small shoots.	All year round	Glyphosate 360g/L	M	Neat
Fishbone Fern	Nephrolepis cordifolia	Hand removal. Brush cut then sprayed with Glyphosate.	All year round	Glyphosate 360g/L	M	1/100
Ochna	Ochna serrulata	Double side scrape and paint all stems to 75% coverage.	All year round	Glyphosate 360g/L	M	Neat
Fireweed	Senecio madagascariensis	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Senna / Cassia	Senna pendula	Small individuals hand removed, larger plants cut and painted with neat Glyphosate	All year round	Glyphosate 360g/L	M	Neat
Paddy's Lucerne	Sida rhombifolia	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Tobacco Bush/ Wild Tobacco	Solanum mauritianum	Cut & paint with Glyphosate	All year round	Glyphosate 360g/L	M	Neat
Blackberry Night Shade	Solanum nigrum	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100
Purpletop	Verbena bonarensis	Foliar spraying with Glyphosate, hand pulled and brush cut	All year round	Glyphosate 360g/L	M	1/100





Appendix 8: Noise Monitoring Results

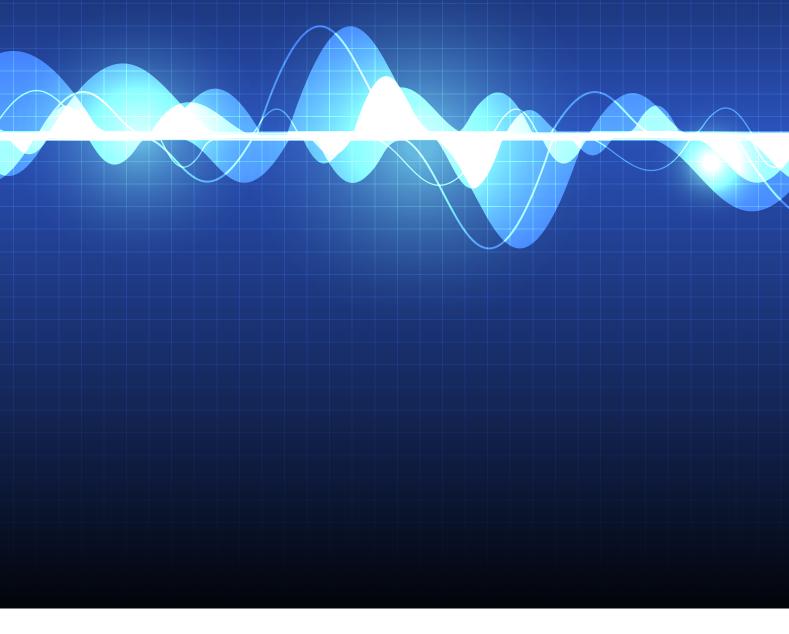
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Chain Valley Colliery

Quarterly attended noise monitoring

Quarter - 202

Prepared for Great Southern Energy Pty Ltd (trading as Delta Coal)
April 2022







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Ground Floor, 20 Chandos Street St Leonards NSW 2065 T 02 9493 9500

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PERTH

Level 6, 191 St Georges Terrace
Perth WA 6000

CANBERRA

PO Box 9148 Deakin ACT 2600



Chain Valley Colliery

Quarterly attended noise monitoring - Quarter 1 2022

Prepared for Great Southern Energy Pty Ltd (trading as Delta Coal) April 2022

EMM Newcastle Level 3, 175 Scott Street Newcastle NSW 2300

T 02 4907 4800

E info@emmconsulting.com.au

www.emmconsulting.com.au

Chain Valley Colliery

Quarterly attended noise monitoring - Quarter 1 2022

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14 April 2022	
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Prepared by	Approved by
alle de la company de la compa	Ms
Teanuanua Villierme	Katie Teyhan
Senior Acoustic Consultant	Associate
14 April 2022	14 April 2022

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1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to undertake operator-attended noise surveys on behalf of Great Southern Energy Pty Ltd (Delta Coal).

The purpose of the noise monitoring was to address requirements of the approved Chain Valley Colliery Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent SSD-5465 (DC) and Environment Protection License (EPL) 1770.

Compliance noise monitoring is required to occur on a quarterly basis for Chain Valley Colliery (CVC or the site). This report presents the results and findings for the first quarter (Q1) of 2022 from attended noise monitoring conducted on 14, 15 and 18 March 2022.

The following material was referenced as part of this assessment:

- NSW Department of Planning, Industry and Environment (DPIE), Development Consent SSD-5465, as modified (Modification 4) July 2021 (current as of the monitoring date 14 March 2022);
- NSW Environment Protection Authority (EPA), Environment Protection License 1770, as varied on 24 February 2022 (current as of the monitoring date 14 March 2022);
- Chain Valley Colliery Noise Management Plan (currently approved NMP), approved by NSW Department of Planning and Environment on 12 March 2014;
- Chain Valley Colliery and Mannering Colliery Noise Management Plan (revised NMP DPIE approval pending), updated following Chain Valley Colliery Modification 3 (Mod 3) approval;
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

It is of note that Delta Coal is currently in the process of updating the NMP to reflect changes associated with Modification 3 (Mod 3) of the DC which was approved by the DPIE in June 2020. Modification 4 (Mod 4) of the DC was subsequently approved by DPIE in July 2021, however no changes to the CVC noise requirements resulted from the Mod 4 approval. Delta Coal have submitted a revised NMP to DPIE for approval to reflect any changes to, or additional, operational noise conditions. The revised NMP incorporates noise management for both Delta Coal's CVC and Mannering Colliery (MC).

The CVC noise monitoring locations and associated noise limits in the revised NMP are generally consistent with those provided in the approved NMP. The CVC noise limits in the revised NMP have not changed from the approved NMP; however, the revised NMP provides two additional noise monitoring locations and associated noise limits for CVC, consistent with those provided in the EPL. For the purpose of this assessment, the CVC noise monitoring requirements in the revised NMP have been adopted for the monitoring undertaken on 14, 15 and 18 March 2022. These are discussed further in Section 2 and Section 3.

A glossary of acoustic terms relevant to this report is provided in Appendix A.

2 Noise limits

2.1 Operational and sleep disturbance noise limits

Chain Valley Colliery noise limits are provided in Table 1, Condition 7 of Schedule 3 of the DC and Conditions L5.1 and L5.2 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix B and Appendix C, respectively. Assessment locations and relevant noise limits are summarised in Table 2.1.

Table 2.1 Noise limits

Assessment location	Day L _{Aeq,15min} , dB	Evening L _{Aeq,15min} , dB	Night L _{Aeq,15min} , dB	Night L _{A1,1min} , dB
R8 (EPL Point 9)	38	38	38	45
R11 (EPL Point 12)	49	49	49	54
R12 (EPL Point 13)	49	49	49	53
R13 (EPL Point 14)	43	43	43	49
R15 (EPL Point 16)	36	36	36	45
R19 (EPL Point 20)	37	37	37	45
R22 (EPL Point 23)	46	46	46	46
All other privately-owned land	35	35	35	45

Appendix 8 of the DC states meteorological conditions under which noise limits do not apply as follows:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 m above ground level; or
- temperature inversion conditions greater than 3°C/100 m.

Condition L5.4 of the EPL states meteorological conditions under which noise limits do not apply as follows:

- wind speeds greater than 3 m/s at 10 m above ground level;
- stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 m above ground level;
- stability category G temperature inversion conditions; or
- as defined under the NPfl.

The last point refers to 'very noise-enhancing' conditions which are considered outside the 'standard' or 'noise-enhancing' meteorological conditions defined in Table D1 of Fact Sheet D of the NPfl. Table D1 of the NPfl is reproduced in Table 2.2.

Table 2.2 Standard and noise-enhancing meteorological conditions

Meteorological conditions	Meteorological parameters		
Standard meteorological conditions	Day/evening/night: stability categories A-D with wind speed up to 0.5 m/s at 10 m above ground level.		
Noise-enhancing meteorological conditions	Day/evening: stability categories A-D with wind light winds (up to 3 m/s at 10 m above ground level).		
	Night: stability categories A-D with light winds (up to 3 m/s at 10 m above ground level) and/or stability category F with winds up to 2 m/s at 10 m above ground level.		

Source: NPfl (EPA 2017)

Further, Fact Sheet E of the NPfI (point 6 of Section E1) provides additional guidance on monitoring the performance of a site against 'suitable' noise limits placed in the consent/environment protection licence. Noise limits are based on 'achievable' noise levels under the 'standard' and/or 'noise-enhancing' meteorological conditions (refer to Table 2.2). Where meteorological conditions are considered 'very noise-enhancing', a positive adjustment of 5 dB applies to noise limits for 'standard' or 'noise-enhancing' meteorological conditions.

In accordance with the NPfI and for consistency between the DC and EPL, where 'very noise-enhancing' meteorological conditions were present during a noise survey, a positive adjustment of 5 dB has been applied to the noise limits stated in the DC and EPL (refer to Table 2.1). This approach means that noise limits will always be applicable, with or without a positive adjustment of 5 dB, depending on whether meteorological conditions are 'very noise-enhancing' or not.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1min}$. The INP application notes (EPA 2017) state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1min}$ or L_{Amax} metrics, with the L_{Amax} resulting in a more conservative assessment of site noise emissions.

The DC and EPL state that all modifying factor adjustments must be applied as appropriate to the measured site noise levels before comparison to the relevant noise limits, where applicable. Fact Sheet C of the NPfl outlines the method for assessing the presence of noise with annoying characteristics and applying the relevant modifying factor adjustment(s) to measured site noise at a residential receiver.

2.1 CVC long term goals

Long-term goals for CVC are provided in Condition 8(d) of Schedule 3 of the DC, which states:

8. The Applicant must:

(d) use its best endeavours to achieve the long-term noise goals in Table 2, where reasonable and feasible, and report on progress towards achieving these goals in each Annual Review;

The long-term goals for CVC in Table 2 of the DC are summarised in Table 2.3 for the relevant assessment locations.

Table 2.3 CVC long-term goals

Assessment location	Day	Evening	Night
	L _{Aeq,15min} , dB	L _{Aeq,15min} , dB	L _{Aeq,15min} , dB
R11 (EPL Point 12)	41	41	41
R12 (EPL Point 13)	41	41	41
R13 (EPL Point 14)	41	41	41
R22 (EPL Point 23)	40	40	40

As stated in Appendix 9 of the DC, Delta Coal is committed to the progressive implementation of feasible measures to target long-term noise goals which are designed to reduce noise emissions from CVC. For the purpose of this compliance noise monitoring assessment, site $L_{Aeq,15min}$ noise contributions have also been compared to the long-term goals.

2.2 Low frequency noise criteria

Condition 5 in Appendix 8 of the DC and L5.9 of the EPL state that noise generated by Chain Valley Colliery is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing certain characteristics of a noise source such as low frequency noise.

Fact sheet C of the NPfI provides guidelines for applying modifying factor adjustments to account for low frequency noise emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced noise spectrum and potential increased annoyance at a residential receiver.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the low frequency noise threshold values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 2.4.

Table 2.4 One-third octave low frequency noise threshold levels

One-third octave Lzeg 15min threshold levels

			_cq)										
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB (Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

The following modifying factor corrections for low frequency noise are to be applied to the site $L_{Aeq,15min}$ noise contribution where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 2.4 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or
- where any of the one-third octave noise levels in Table 2.4 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dB positive adjustment applies for the daytime period.

Hence, where possible throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the sound analyser (L_{Ceq} - L_{Aeq}). Where this was found to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 2.4 to identify the relevant modifying factor adjustments (if applicable). This method for the application of modifying adjustments for low frequency noise has been applied to this assessment as presented in Section 4.

It is of note that the NPfI states that low frequency noise modifying factor adjustments only apply under the standard or noise-enhancing meteorological conditions as per Fact Sheet D of the NPfI.

3 Assessment methodology

3.1 Attended noise monitoring

To quantify noise emissions from CVC, attended noise monitoring surveys were completed at representative locations, in accordance with the revised NMP.

Attended noise monitoring locations as per the revised NMP, and their coordinates are listed in Table 3.1 and are shown in Figure 3.1.

Table 3.1 Attended noise monitoring locations

Attended noise	Assessment location	Description	Coordinates (MGA56)		
monitoring location			Easting	Northing	
ATN001	R8 (EPL Point 9)	Griffith Street, Mannering Park	363990	6330529	
ATN002	R11 (EPL Point 12)	Lakeshore Avenue, Kingfisher Shores	365218	6329388	
ATN003	R15 (EPL Point 16)	Short Street, Macquarie Shores	365165	6328323	
ATN004	R14	Lloyd Avenue, Chain Valley Bay	365949	6328530	
ATN005	R17	Teragalin Drive, Chain Valley Bay	366560	6328590	
ATN006	R19 (EPL Point 20)	Sunset Parade, Chain Valley Bay	366305	6329321	
ATN007 ¹	R22 (EPL Point 23)	Cams Boulevard, Chain Valley Bay	366425	6331135	
R12	R12 (EPL Point 13)	Lakeshore Avenue, Kingfisher Shores	365185	6329352	
R13	R13 (EPL Point 14)	Karoola Avenue, Kingfisher Shores	365391	6329169	

Notes: 1. Due to access issues, noise monitoring for ATN007 was conducted at an intermediate location within the site boundary and site noise contributions were calculated back to R22 (EPL Point 23).

Condition M4.1 of the EPL specifies additional noise monitoring requirements to determine compliance, including the following:

- locations of monitoring EPL points listed in Table 3.1;
- frequency of monitoring quarterly and at least two months between monitoring periods;
- periods of monitoring:
 - for three out of four quarterly periods each day, evening and night periods for a minimum of 15 minutes. Night period monitoring must be undertaken between the hours of 1 am and 4 am; and
 - for one out of four quarterly periods day period monitoring must be undertaken for a minimum of 1.5 hours (six 15-minute periods); evening period monitoring must be undertaken for a minimum of 30 minutes (two 15-minute periods); night period monitoring must be undertaken for a minimum of 1 hour (four 15-minute periods).
- days of monitoring each quarterly monitoring must be undertaken on a different day of the week excluding Saturday, Sundays and public holidays.

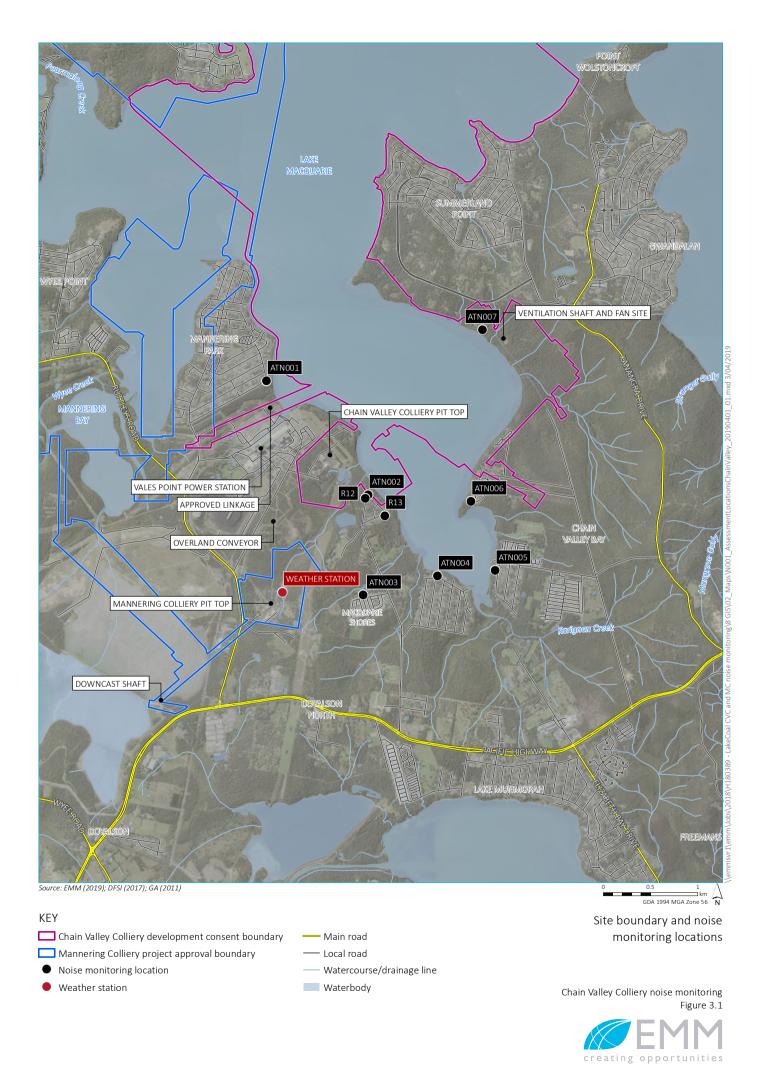
In accordance with the preceding, this round of quarterly attended noise monitoring (Q1 2022) was undertaken on Monday 14, Wednesday 15 and Friday 18 March 2022 which is more than two months since the last quarterly round of monitoring (Q4 2021) conducted on Monday 6 and Wednesday 8 December 2021.

As per the revised NMP, attended noise monitoring is scheduled considering the occurrence of regular operations at CVC. Noise monitoring avoids scheduled down-time or maintenance. Regular operations were occurring during this round of noise monitoring.

3.2 Instrumentation

Two Brüel & Kjær (B&K) 2250 Type 1 sound analysers (s/n 2759405 and s/n 3029363) were used to conduct 15-minute attended measurements and record one-third octave frequency and statistical noise indices. The sound analysers were calibrated before and on completion of the survey using a Svantek Type SV 36 calibrator (s/n 79952). Instrumentation calibration certificates are provided in Appendix D.

Where possible throughout each survey, the operator has quantified the contribution of site noise and other significant noise sources. This was done by matching audible sounds with the response of the sound analyser (where applicable) and/or via post-analysis of data (eg low-pass filtering).



3.3 Determination of stability category

For the purpose of this assessment and as required by the DC, EPL and revised NMP, stability categories were determined for each 15-minute attended monitoring period. The stability category data for the monitoring period as well as the average wind data (speed and direction) were obtained from MC's meteorological station located to the south of the site (refer to Figure 3.1).

The stability categories and associated ranges in temperature lapse rates are presented in Table 3.2.

 Table 3.2
 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)	
Α	ΔT < -1.9	
В	-1.9 ≤ ΔT < -1.7	
C	-1.7 ≤ ΔT < -1.5	
D	-1.5 ≤ ΔT < -0.5	
E	-0.5 ≤ ΔT < 1.5	
F	1.5 ≤ ΔT < 4.0	
G	ΔT ≥ 4.0	

Source: NPfl (EPA 2017).

4 Review of data and discussion

Noise contribution from CVC was determined for each survey using in-field observations and post-analysis of data as required (eg removing higher frequencies that are not mine related). Attended noise monitoring was completed on 14, 15 and 18 March 2022. Monitoring surveys occurred at all monitoring locations for 15 minutes during the day, evening and night periods as per the EPL. Results for this Q1 2022 attended noise monitoring are summarised in Table 4.1.

The meteorological data for the monitoring period was sourced from Mannering Colliery's meteorological station to determine if a positive adjustment of 5 dB to the noise limits was applicable due to 'very noise-enhancing' meteorological conditions as per the NPfl. Meteorological conditions were 'standard' or 'noise-enhancing' at the time of the monitoring and, in accordance with the revised NMP, the standard noise limits shown in Table 2.1 applied for all 27 measurements.

Site noise was inaudible during 24 of the 27 measurements. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is at least 10 dB below the measured background (L_{A90}) level. For all of the measurements where site noise was inaudible, the measured L_{A90} noise levels were no more than 10 dB above the relevant $L_{Aeq,15min}$ limits. Hence, site $L_{Aeq,15min}$ noise contributions were likely below the relevant limits during these measurements.

At the one noise monitoring location where site noise was audible; ATN007 (day, evening and night), CVC noise contributions satisfied the relevant noise limits.

With regard to LFN modifying factor adjustments, these have not been applied to locations where CVC was deemed to be inaudible. Measured site noise levels exceeded the relevant LFN threshold levels during the evening and night-time measurements at ATN007. Therefore, in accordance with the NPfI, a 2 dB positive adjustment was applied to the estimated site L_{Aeq,15min} noise contributions for these measurements (as shown in Table 4.1).

Site $L_{Aeq,15min}$ noise contributions were also compared to the long-term noise goals (refer to Table 2.3) for the relevant locations (ie R11, R12, R13 and R22). Site $L_{Aeq,15min}$ noise contributions satisfied the relevant long-term goals at R11 (ATN002), R12 and R13 during the day, evening and night periods. However, during the daytime measurement at R22 (ATN007), site $L_{Aeq,15min}$ noise contribution exceeded the relevant long-term goal by 1 dB. During the evening and night-time measurements at R22 (ATN007), site $L_{Aeq,15min}$ noise contributions (inclusive of the 2 dB positive adjustment for LFN) exceeded the relevant long-term goals by 4 dB.

Table 4.1 Chain Valley Colliery attended noise monitoring results – Q1 2022

					Total r	noise lev	els, dB			Site cor	ntributio	ons, dB	Noise I	imits, dB		Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L_{Ceq}	LFN mod. factor ¹	L_{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	conditions ³ Very noise- enhancing?		
ATN001	18/3	16:07 (Day)	42	44	55	50	68	80	68	Nil	IA	N/A	38	N/A	1.7 m/s @ 114° SC A No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and birds consistently audible. Nearby residents frequently audible. Car passby and distant traffic occasionally audible. Dog barking occasionally audible.
ATN001	18/3	19:09 (Eve.)	43	44	54	49	64	80	65	Nil	IA	N/A	38	N/A	0.4 m/s @ 155° SC E No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and birds consistently audible. Nearby residents frequently audible. Car passby and distant traffic occasionally audible.
ATN001	18/3	2:57 (Night)	43	44	51	45	59	77	69	Nil	IA	IA	38	45	0.3 m/s @ 220° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Electrical line buzzing noise consistently audible. Traffic passbys.
ATN002	18/3	13:51 (Day)	33	36	43	42	55	63	60	Nil	IA	N/A	49	N/A	1.4 m/s @ 121° SC A No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and birds consistently audible. Wind in trees frequently audible. Car passby, local and distant traffic occasionally audible. Dog barking occasionally audible. Aircraft noise audible on one occasion.
ATN002	14/3	20:59 (Eve.)	34	37	41	44	45	48	59	Nil	IA	N/A	49	N/A	0.9 m/s @ 146° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Local and distant traffic occasionally audible.
ATN002	15/3	2:05 (Night)	34	36	38	39	41	54	64	Nil	IA	IA	49	54	0.5 m/s @ 193° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible.

Table 4.1 Chain Valley Colliery attended noise monitoring results – Q1 2022

					Total n	oise lev	els, dB			Site cor	ntributio	ons, dB	Noise l	imits, dB		Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L_{Ceq}	LFN mod. factor ¹	L_Aeq	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	conditions ³ Very noise- enhancing?		
ATN003	18/3	14:15 (Day)	31	35	46	48	53	76	57	Nil	IA	N/A	36	N/A	1.4 m/s @ 117° SC A No	Nil	CVC inaudible. Insects and birds consistently audible. Local and distant traffic frequently audible. Wind in trees and aircraft noise occasionally audible.
ATN003	14/3	20:22 (Eve.)	42	46	49	51	52	55	53	Nil	IA	N/A	36	N/A	0.9 m/s @ 148° SC F No	Nil	CVC inaudible. Insects consistently audible. Nearby residents and distant dog barking occasionally audible.
ATN003	15/3	1:45 (Night)	37	39	41	43	44	65	60	Nil	IA	IA	36	45	0.5 m/s @ 80° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible.
ATN004	18/3	16:52 (Day)	30	35	42	44	52	65	54	Nil	IA	N/A	35	N/A	1.8 m/s @ 90° SC A No	Nil	CVC inaudible. Insects and birds consistently audible. Distant traffic and wind in foliage frequently audible. Nearby residents and dog barking occasionally audible.
ATN004	18/3	18:44 (Eve.)	30	37	47	50	56	65	56	Nil	IA	N/A	35	N/A	0.5 m/s @ 91° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and birds consistently audible. Nearby residents, aircraft noise, local and distant traffic occasionally audible.
ATN004	14/3	23:06 (Night)	32	38	42	43	51	61	51	Nil	IA	IA	35	45	0.8 m/s @ 152° SC F No	Nil	CVC inaudible. Insects consistently audible. Distant traffic occasionally audible. Aircraft flying above on one occasion.
ATN005	18/3	17:15 (Day)	31	38	47	50	57	62	62	Nil	IA	N/A	35	N/A	1.4 m/s @ 138° SC A No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and birds consistently audible. Nearby residents, wind in foliage, distant and local traffic occasionally audible.

Table 4.1 Chain Valley Colliery attended noise monitoring results – Q1 2022

					Total r	noise lev	els, dB			Site co	ntributio	ns, dB	Noise I	imits, dB		Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L_{Ceq}	LFN mod. factor ¹	L_{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	conditions ³ Very noise- enhancing?		
ATN005	18/3	18:20 (Eve.)	33	39	48	51	56	69	58	Nil	IA	N/A	35	N/A	1.3 m/s @ 107° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and birds consistently audible. Boat engine audible (5 minutes). Nearby residents frequently audible. Distant traffic, dog barking and aircraft noise occasionally audible.
ATN005	14/3	23:32 (Night)	29	38	44	47	49	65	46	Nil	IA	IA	35	45	0.8 m/s @ 139° SC F No	Nil	CVC inaudible. Insects consistently audible. Distant traffic occasionally audible.
ATN006	18/3	17:35 (Day)	32	35	48	49	61	73	58	Nil	IA	N/A	37	N/A	1.7 m/s @ 121° SC A No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and birds consistently audible. Distant traffic frequently audible.
ATN006	18/3	18:00 (Eve.)	32	35	44	42	55	68	57	Nil	IA	N/A	37	N/A	1.1 m/s @ 105° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and birds consistently audible. Distant traffic frequently audible. Nearby residents occasionally audible.
ATN006	18/3	3:45 (Night)	33	34	36	38	39	49	60	Nil	IA	IA	37	45	0.3 m/s @ 250° SC F No	Nil	CVC inaudible. VPPS consistently audible. Insects consistently audible.
ATN007 ⁴	18/3	15:02 (Day)	47	48	49	50	52	61	70	Nil	41	N/A	46	N/A	1.5 m/s @ 135° SC A No	Nil	CVC vent fans consistently audible. Insects and birds consistently audible. Wind in trees occasionally audible. Aircraft noise audible on one occasion.
ATN007 ⁴	14/3	21:47 (Eve.)	47	49	49	50	50	51	70	2 dB	44 (42+2)	N/A	46	N/A	0.9 m/s @ 152° SC F No	Nil	CVC vent fans consistently audible. Insects consistently audible.

Table 4.1 Chain Valley Colliery attended noise monitoring results – Q1 2022

		a)			Total n	oise lev	els, dB			Site co	ntributio	ons, dB	Noise I	imits, dB	Meteorological conditions ³	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L _{Ceq}	LFN mod. factor ¹	L_{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN007 ⁴	15/3	1:00 (Night)	47	48	49	49	50	52	70	2 dB	44 (42+2)	42	46	46	1.4 m/s @ 77° SC F No	Nil	CVC vent fans consistently audible. Insects consistently audible. Wind in trees occasionally audible.
R12	14/3	13:51 (Day)	33	36	43	42	55	63	60	Nil	IA	N/A	49	N/A	1.4 m/s @ 121° SC A No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and birds consistently audible. Wind in trees frequently audible. Car passby, local and distant traffic occasionally audible. Dog barking occasionally audible. Aircraft noise audible on one occasion.
R12	15/3	20:59 (Eve.)	34	37	41	44	45	48	59	Nil	IA	N/A	49	N/A	0.9 m/s @ 146° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Local and distant traffic occasionally audible.
R12	18/3	2:05 (Night)	34	36	38	39	41	54	64	Nil	IA	IA	49	53	0.5 m/s @ 193° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible.
R13	18/3	16:32 (Day)	29	33	49	50	59	73	59	Nil	IA	N/A	43	N/A	1.9 m/s @ 98° SC A No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and birds consistently audible. Nearby residents frequently audible. Car passby and distant traffic occasionally audible.
R13	14/3	21:16 (Eve.)	33	36	38	41	42	51	51	Nil	IA	N/A	43	N/A	1.1 m/s @ 90° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in trees occasionally audible.

Table 4.1 Chain Valley Colliery attended noise monitoring results – Q1 2022

					Total n	oise lev	els, dB			Site con	tributio	ons, dB	Noise I	imits, dB		Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L _{Ceq}	LFN mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	conditions ³ Very noise- enhancing?		
R13	18/3	3:20 (Night)	35	37	40	41	44	61	60	Nil	IA	IA	43	49	0.1 m/s @ 187° SC F No		CVC inaudible. VPPS consistently audible. Insects consistently audible. Distant traffic and dog barking occasionally audible. Aircraft flying above on one occasion.

Notes

- 1. Modifying factor adjustment for low frequency noise in accordance with Fact sheet C of the NPfI (refer to Section 2.2).
- 2. For assessment purposes the recorded L_{Amax} has been used as a conservative estimate of the L_{A1,1min}.
- 3. Meteorological data including wind speed, wind direction and stability category (SC) were taken as an average over 15 minutes from Mannering Colliery's weather station (Refer to Section 3.3).
- 4. Due to access issues, noise monitoring for ATN007 was conducted at an intermediate location. Total noise levels shown were measured at the alternative location and site contributions were calculated back to R22/EPL Point 23.

5. IA = inaudible, N/A = not applicable.

5 Conclusion

EMM has completed a review of mine noise from Chain Valley Colliery within the surrounding community based on attended measurements conducted on 14, 15 and 18 March 2022.

The meteorological data for the monitoring period was sourced from Mannering Colliery's meteorological station to determine if the standard noise limits applied as per the revised NMP or if a positive adjustment of 5 dB to the noise limits was applicable due to 'very noise-enhancing' meteorological conditions in accordance with the NPfl. Meteorological conditions were 'standard' or 'noise-enhancing' at the time of the monitoring and, in accordance with the revised NMP, the standard noise limits applied for all measurements.

The assessment of noise contributions from site included consideration of modifying factors for annoying noise characteristics, where relevant, and in accordance with the NPfI. A modifying factor for LFN was applicable at ATN007 during the evening and night-time measurements. Therefore, in accordance with the NPfI, a 2 dB positive adjustment was applied to the estimated site $L_{Aeq,15min}$ noise contribution for these measurements before comparison to the relevant noise limits.

CVC L_{Aeq,15min} and L_{Amax} noise contributions for this round (Q1 2022) of noise monitoring satisfied the relevant noise limits at all monitoring locations as outlined in the DC, EPL and revised NMP.

CVC L_{Aeq,15min} noise contributions were also compared to the long-term noise goals applicable at R11, R12, R13 and R22. CVC L_{Aeq,15min} noise contributions satisfied the relevant long-term goals during all measurements at R11, R12 and R13. However, during the daytime measurements at R22 (ATN007), site L_{Aeq,15min} noise contributions exceeded the relevant long-term goals by 1 dB, and during the evening and night-time measurements at R22 (ATN007), site L_{Aeq,15min} noise contributions (inclusive of the 2 dB positive adjustment for LFN) exceeded the relevant long-term goals by 4 dB.

References

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Appendix A

Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table A.1.

Table A.1Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L _{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
L _{A1,1min}	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L _{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.
L _{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L _{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15min}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L _{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L _{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L _{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15min}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table A.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure A.1.

E220003 | RP2 | v2 A.2

Table A.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud

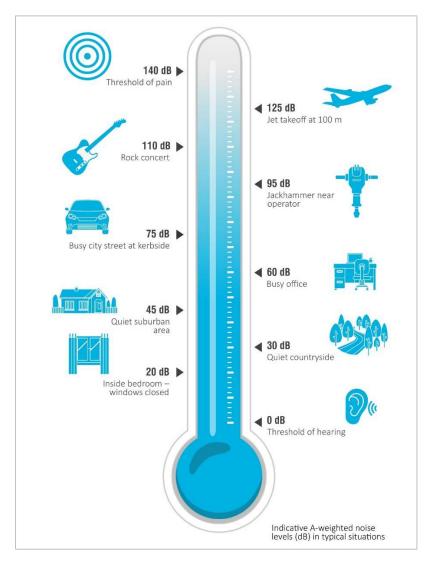


Figure A.1 Common noise levels

E220003 | RP2 | v2 A.3

Appendix B

Project approval extract

- 4. Prior to 31 March 2014, and every 12 months thereafter for each calendar year in which coal haulage from the site is undertaken utilising public roads, unless the Planning Secretary directs otherwise, the Applicant must commission a suitably qualified person, whose appointment has been approved by the Planning Secretary at least one month prior to undertaking the audit, to conduct an Independent Traffic Audit of the development. This audit must:
 - (a) be undertaken without prior notice to the Applicant, and in consultation with TfNSW, NCC, CC Council and the CCC;
 - (b) assess the impact of the development on the performance and safety of the road network, including a review of:
 - haulage records;
 - accident records on the haulage route, infringements relating to the code of conduct and any incidents involving haulage vehicles;
 - · community complaints register; and
 - (c) assess the effectiveness of the Road Transport Protocol; and, if necessary, recommend measures to reduce or mitigate any adverse (or potentially adverse) impacts.
- 5. Within 1 month of receiving the audit report, or as otherwise agreed by the Planning Secretary, the Applicant must submit a copy of the report to the Planning Secretary, with a detailed response to any of the recommendations contained in the audit report, including a timetable for the implementation of any measures proposed to address the recommendations in the audit report.

A summary of the audit report must be included in the Annual Review.

Alternative Coal Transport Options

- 6. Prior to 31 December 2014, and every three years thereafter, the Applicant must prepare and submit to the Planning Secretary for approval, a study of the reasonable and feasible options to reduce or eliminate the use of public roads to transport coal from the development, unless otherwise agreed by the Planning Secretary. The assessment must include:
 - (a) an analysis of the capital, construction and operating costs of the alternative transport options; and
 - (b) quantified social and environmental impacts associated with road and rail transport.

NOISE

Noise Impact Assessment Criteria

7. The Applicant must ensure that the noise generated by the development at any residence on privatelyowned land does not exceed the criteria for the location in Table 1 nearest to that residence.

Table 1: Noise Criteria dB(A)

Location	Day	Evening	Night					
Location	L _{Aeq(15 min)}	L _{Aeq(15 min)}	L Aeq(15 min)	L _{A1(1 min)}				
R8	38	38	38	45				
R11	49	49	49	54				
R12	49	49	49	53				
R13	43	43	43	49				
R15	36	36	36	45				
R19	37	37	37	45				
R22	46	46	46	46				
all other privately-owned land	35	35	35	45				

Notes:

- To interpret the locations referred to in Table 1, see Appendix 6 and the EIS; and
- Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 8 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has a written agreement with the relevant landowner to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Operating Conditions

- 8. The Applicant must:
 - implement best management practice, including all reasonable and feasible noise mitigation measures, to minimise the construction, operational and transport noise generated by the development;
 - regularly assess the noise monitoring and meteorological data and relocate, modify, and/or stop operations on site to ensure compliance with the relevant conditions of this consent;
 - (c) minimise the noise impacts of the development during meteorological conditions under which the noise limits in this consent do not apply (see Appendix 8);
 - (d) use its best endeavours to achieve the long-term noise goals in Table 2, where reasonable and feasible, and report on progress towards achieving these goals in each Annual Review;
 - (e) carry out a comprehensive noise audit of the development in conjunction with each independent environmental audit; and
 - (f) prepare an action plan to implement any additional reasonable and feasible onsite noise mitigation measures identified by each audit:

to the satisfaction of the Planning Secretary.

Table 2: Long-term Noise Goals dB(A)

Location	Day	Evening	Night		
Location	L _{Aeq(15 min)}	L _{Aeq(15 min)}	L _{Aeq(15 min)}		
R11 – R13	41	41	41		
R22	40	40	40		

Notes:

- To interpret the locations referred to in Table 2, see Appendix 6 and the EIS; and
- Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 8 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

Noise Management Plan

- The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
 - (a) be prepared in consultation with the EPA and submitted to the Planning Secretary for approval within 4 months of the date of this consent, unless otherwise agreed by the Planning Secretary;
 - (b) describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this consent;
 - (c) describe the proposed noise management system in detail including the mitigation measures that would be implemented to minimise noise during construction and operations, including on and off site road noise generated by vehicles associated with the development; and
 - (d) include a monitoring program that:
 - uses attended monitoring to evaluate the compliance of the development against the noise criteria in this consent;
 - evaluates and reports on:
 - the effectiveness of the on-site noise management system; and
 - compliance against the noise operating conditions; and
 - defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.

AIR QUALITY

Odour

10. The Applicant must ensure that no offensive odours are emitted from the site, as defined under the POEO

APPENDIX 6 NOISE RECEIVER LOCATIONS

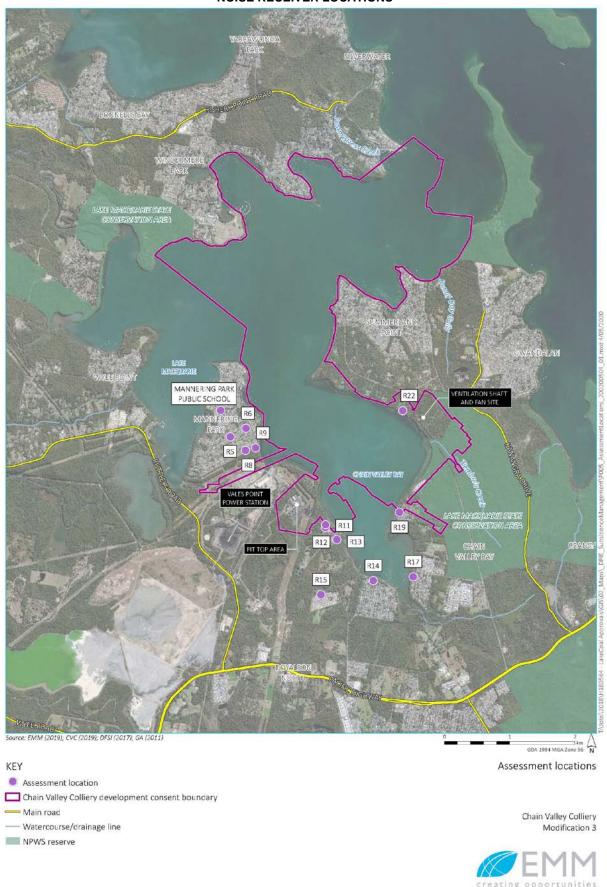


Figure 1: Noise Receiver Locations

APPENDIX 8 NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

- 1. The noise criteria in Table 1 of the conditions are to apply under all meteorological conditions except the following:
 - (a) during periods of rain or hail;
 - (b) average wind speed at microphone height exceeds 5 m/s;
 - (c) wind speeds greater than 3 m/s measured at 10 m above ground level; or
 - (d) temperature inversion conditions greater than 3°C/100 m.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions must be that recorded by the meteorological station described in condition 14 of schedule 3.

Compliance Monitoring

- 3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this consent.
- 4. This monitoring must be carried out at least 4 times in each calendar year (ie at least once every 3 months), unless the Planning Secretary directs otherwise.
- 5. Unless otherwise agreed with the Planning Secretary, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
 - (a) monitoring locations for the collection of representative noise data;
 - (b) meteorological conditions during which collection of noise data is not appropriate;
 - (c) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
 - (d) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

- results of this monitoring program will be reviewed by a suitably qualified expert and used to determine the appropriateness of the existing irrigation area to receive this effluent:
- develop a program to monitor creek line channel stability and the health of riparian vegetation within Swindles Creek. Monitoring will be undertaken in accordance with Section 8.5.2 of the Surface Water Impact Assessment (EIS Appendix E) and incorporated into the Colliery's WMP or Biodiversity Management Plan; and
- record monitoring data in accordance with the Colliery's WMP and EPL 1770.
 Monitoring data will be interpreted as it is received to ensure appropriate operational guidance on monitoring water quality within desired parameters.

 Results of water quality monitoring will be reported in the Annual Review and made available to the CCC, as well as CC Council and LMCC.

Noise

Management and monitoring of noise will continue to be undertaken in accordance with the Colliery's NMP, which will be reviewed and updated as required to include the commitments made below. Great Southern Energy Pty Limited will:

- continue attended compliance monitoring on site which will be used to identify potential hot spots and primary noise sources;
- continue real-time noise monitoring alerts to site personnel to enable implementation of any required rapid noise management initiatives;
- manage potential non-compliance through a noise complaint handling and response system, including the identification of responsible sources to enable targeted remedial action;
- assess if further noise mitigation options for the ventilation fans are reasonable and feasible following the receipt of attenuation proposals; and
- discuss potential management measures or agreement options with the landowner at 275 Cams Boulevard, following receipt of proposals from acoustics specialists.

In addition to the above, Great Southern Energy Pty Limited is committed to the progressive implementation of feasible measures to target long-term noise goals which are designed to reduce noise emissions from the Colliery. Long-term options for investigation include:

- modification to belt/movement alarms;
- investigation of surface conveyer and coal preparation equipment, to determine if noise reductions are possible;
- identifying sound attenuation options for the surface bulldozer and front-end loader;
- strategic placement of acoustic barriers;
- attenuation for the surface screener/shaker;
- installation of quiet rollers for surface conveyor belts:
- · acoustic treatments around compressors; and
- the use of a conveyor stacker for product coal stockpiling.

Air Quality and greenhouse gases

Management and monitoring of air quality and greenhouse gases will continue to be undertaken in accordance with the Colliery's AQGHGMP, which will be reviewed and updated as required to include the commitments made below Great Southern Energy Pty Limited will:

- investigate the use of a stacker to replace hauling between current conveyor system and stockpiles;
- undertake GHG monitoring comprising measurement of carbon dioxide and methane at the ventilation shaft and fan sites; and
- record and report annual diesel, oil, grease, acetylene and electricity use to fulfil National Greenhouse and Energy Reporting Scheme requirements.

Traffic and transport

Management and monitoring of traffic and transport will continue to be undertaken in accordance with the Colliery's RTP. In addition, Great Southern Energy Pty Limited will continue to investigate alternative options for transporting export coal to the Port of Newcastle, specifically the preferred rail transport option, requiring the construction of a private haul road to the VPPS coal unloading facility and associated infrastructure upgrades. In addition, Great Southern Energy Pty Limited will investigate options to reduce peak hour traffic would be investigated including potentially limiting the peak hourly volumes of the Colliery truck traffic which would be permitted to travel via this intersection should the Colliery not be using rail transport for export coal by five years from the granting of development consent. Alternatively, a pro-rata financial contribution to the cost of installing traffic signals at the southbound intersection of the F3 and Sparks Road interchange could be made commensurate with the percentage of Colliery generated traffic using the intersection.

Subsidence

Management and monitoring of subsidence will continue to be undertaken in accordance with the Colliery's SMP or Extraction Plans, which will be reviewed and

Appendix C

EPL extract



Licence - 1770

1	Discharge to waters Discharge quality and volume monitoring	Discharge to waters Discharge quality and volume monitoring	Discharge to waters and monitoring from final settlement pond, gravity fed discharge pipe as identified in plan titled "Delta Coal Chain Valley Colliery, Surface EPA Premises Plan, DRG No: C1S0165_2" 10 August 2021 and saved as EPA Document DOC21/691135.
27	Discharge to waters Discharge quality and volume monitoring	Discharge to waters Discharge quality and volume monitoring	Discharge to waters via dam spillway from final settlement pond adjacent to EPA Point 1 as identified in plan titled "Delta Coal Chain Valley Colliery, Surface EPA Premises Plan, DRG No: C1S0165_2" 10 August 2021 and saved as EPA Document DOC21/691135.

P1.4 The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.

Noise/Weather

EPA identi- fication no.	Type of monitoring point	Location description
9	Noise monitoring	Noise monitoring site R8 as defined in Development Consent SSD-5465 (MOD 3), located at 109 Griffith Street, MANNERING PARK, 2259
12	Noise monitoring	Noise monitoring site R11 as defined in Development Consent SSD-5465 (MOD 3), located at 35 Lakeshore Avenue, CHAIN VALLEY BAY, 2259
13	Noise monitoring	Noise monitoring site R12 as defined in Development Consent SSD-5465 (MOD 3), located at 20 Lakeshore Avenue, Kingfisher Shores, CHAIN VALLEY BAY, 2259
14	Noise monitoring	Noise monitoring site R13 as defined in Development Consent SSD-5465 (MOD 3), located at 33 Karoola Avenue, Kingfisher Shores, CHAIN VALLEY BAY, 2259
16	Noise monitoring	Noise monitoring site R15 as defined in Development Consent SSD-5465 (MOD 3), located at Short Street, Macquarie Shores, CHAIN VALLEY BAY, 2259
20	Noise monitoring	Noise monitoring site R19 as defined in Development Consent SSD-5465 (MOD 3), located at 2 Sunset Parade, CHAIN VALLEY BAY, 2259



Licence - 1770

23	Noise monitoring	Noise monitoring site R22 as defined in Development Consent SSD-5465 (MOD 3), located at 275a Cams Boulevard, CHAIN VALLEY BAY, 2259
26	Meteorological Station	Mannering Colliery Meteorological Station, Ruttleys Road, Doyalson 2259.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

- L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.
- L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.
- L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.
- L2.4 Water and/or Land Concentration Limits

POINT 1,27

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Faecal Coliforms	colony forming units per 100 millilitres				200
рН	рН				6.5-8.5
Total suspended solids	milligrams per litre				50



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L3 Volume and mass limits

- L3.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of:
 - a) liquids discharged to water; or;
 - b) solids or liquids applied to the area;

must not exceed the volume/mass limit specified for that discharge point or area.

Point	Unit of Measure	Volume/Mass Limit
1	kilolitres per day	12161
27	kilolitres per day	12161

L3.2 The volumetric daily discharge limit for the premises is the combined discharge measured at EPA discharge points 1 and 27 and must not exceed 12161 kilolitres per day.

L4 Waste

L4.1 The licensee must not cause, permit or allow any waste to be received at the premises, except the wastes expressly referred to in the column titled "Waste" and meeting the definition, if any, in the column titled "Description" in the table below.

Any waste received at the premises must only be used for the activities referred to in relation to that waste in the column titled "Activity" in the table below.

Any waste received at the premises is subject to those limits or conditions, if any, referred to in relation to that waste contained in the column titled "Other Limits" in the table below.

This condition does not limit any other conditions in this licence.

Code	Waste	Description	Activity	Other Limits
NA	General or Specific exempted waste	Waste that meets all the conditions of a resource exemption under Clause 92 of the Protection of the Environment Operations (Waste) Regulation 2014.	As specified in each particular resource recovery exemption	NA

L5 Noise limits

L5.1 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 12

•	Measurement frequency	Noise level dB(A)
parameter		



Licence - 1770

Day	Day-LAeq (15 minute)	-	49
Evening	Evening-LAeq (15 minute)	-	49
Night	Night-LAeq (15 minute)	-	49
Night	Night-LA1 (1 minute)	-	54

POINT 13

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	49
Evening	Evening-LAeq (15 minute)	-	49
Night	Night-LAeq (15 minute)	-	49
Night	Night-LA1 (1 minute)	-	53

POINT 14

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	43
Evening	Evening-LAeq (15 minute)	-	43
Night	Night-LAeq (15 minute)	-	43
Night	Night-LA1 (1 minute)	-	49

POINT 16

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	36
Evening	Evening-LAeq (15 minute)	-	36
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	45

POINT 20

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	37
Evening	Evening-LAeq (15 minute)	-	37
Night	Night-LAeq (15 minute)	-	37



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Night	Night-LA1 (1 minute)	-	45

POINT 23

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	46
Evening	Evening-LAeq (15 minute)	-	46
Night	Night-LAeq (15 minute)	-	46
Night	Night-LA1 (1 minute)	-	46

POINT 9

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	38
Night	Night-LA1 (1 minute)	-	45

- L5.2 The licensee must ensure that noise generated on the premises does not exceed:
 - a) 35 LAeq(15min) during the day, evening or night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1; and
 - b) 45 LA1(1min) during the night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1.

Note: The licensee may provide to the EPA written evidence of any agreement with a landholder which is subject to the above noise limits. The written evidence may be submitted with a licence variation to remove the landholder from the above tables.

- L5.3 For the purpose of condition L5.1 and condition L5.2:
 - (a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays;
 - (b) Evening is defined as the period 6pm to 10pm, and
 - (c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.
- L5.4 The noise limits set out in condition L5.1 and condition L5.2 apply under all meterorological conditions except for any one of the following:



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- (a) Wind speeds greater than 3 metres/second at 10 metres above ground level; or
- (b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at
- 10 metres above ground level; or
- (c) Stability category G temperature inversion conditions.
- (d) Or as defined under the NSW EPA Noise Policy for Industry 2017.
- L5.5 For the purpose of condition L5.4:
 - (a) the meteorological data to be used for determining meteorological conditions is the data recorded at the meteorological station identified in this licence as EPA Identification Point 26.
 - (b) Stability category temperature inversion conditions are to be determined in accordance with the NSW EPA Noise Policy for Industry 2017.
- Note: The weather station must be designed, commissioned and operated in a manner to obtain the necessary parameters required under the above condition.
- L5.6 For the purpose of determining the noise generated at the premises the licensee must use a Class 1 or Class 2 noise monitoring device as defined by AS IEC61672.1 and AS IEC61672.2-2004, or other noise monitoring equipment accepted by the EPA in writing.
- L5.7 To determine compliance:
 - 1. With the L_{Aeq(15 min)} noise limits in condition L5.1 and condition L5.2, the licensee must locate noise monitoring equipment;
 - (a) within 30 metres of a dwelling facade (but not closer than 3 metres) where any dwelling on the property is situated more then 30 metres from the property boundary that is closest to the premises;
 - (b) approximately on the boundary where any dwelling is situated 30 metres or less from the property boundary that is closest to the premises, or, where applicable,
 - (c) within approximately 50 metres if the boundary of a national park or nature reserve.
 - 2. With the LA1(1 minute) noise limits in condition L5.1 and L5.2, the noise monitoring equipment must be located within 1 metre of a dwelling facade.
 - 3. With the noise limits in condition L5.1 and condition L5.2, the noise monitoring equipment must be located;
 - (a) at the most affected point at a location where there is no dwelling at the location, or
 - (b) at the most affected point within an area at a location prescribed by conditions L5.7 1(a) or L5.7 1(b).
- L5.8 A non-compliance of condition L5.1 or condition L5.2 will still occur where noise generated from the premises in excess of the appropriate limit is measured;
 - a) at a location other than an area prescribed by conditions L5.7 1(a) and L5.7 1(b), and /or
 - b) at a point other than the most affected point at a location.
- L5.9 For the purposes of determining the noise generated at the premises all applicable modification factors as described in the NSW EPA Noise Policy for Industry 2017 must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

Environment Protection Authority - NSW Licence version date: 24-Feb-2022



Licence - 1770

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

M4 Environmental monitoring

Requirement to monitor noise

- M4.1 To determine compliance with condition L5.1, attended noise monitoring must be undertaken in accordance with conditions L5.7 and L5.8, and
 - (a) at each one of the locations listed in condition L5.1;
 - (b) occur quarterly within the reporting period of the Environment Protection Licence with at least 2 months between monitoring periods;
 - (c) occur during each day, evening and night period as defined in the NSW Industrial Noise Policy (EPA 2000) for a minimum of 15 minutes for three of the quarters;
 - (d) the night time 15 minute attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am;
 - (e) the night time LA1 (1 min) attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am;
 - (f) one quarterly monitoring must occur during each day, evening and night period as defined in the NSW EPA Noise Policy for Industry 2017 for a minimum of 1.5 hours during the day; 30 minutes during the evening; and 1 hours during the night, and
 - (g) each quarterly monitoring must be undertaken on a different day(s) of the week not including Saturdays, Sundays and public holidays; and
 - (h) these monitoring conditions take effect in the 2015 Reporting period.

Note: The intention of this condition is that quarterly monitoring be undertaken at each sensitive receiver. That at each sensitive receiver monitoring is undertaken over a range of different days excluding weekends and public holidays during the reporting period so as to be representative of operating hours. That night time 15 minute attended monitoring and the LA1 (1min) monitoring for three of the quarters be undertaken at worst case being the most stable atmospheric conditions and when noise would be most intrusive to sleep. All of the sensitive receivers do not have to be monitored on the same day, evening and night for sub condition f.

M4.2 For the Annual Reporting Period ending March 2015 the EPA will accept all monitoring required by the current Department of Planning and Environment consent (usually quarterly monitoring for noise as dB(A) Leq15minutes) for compliance with noise monitoring requirements in this licence, as a single report attached to the Annual Return for the premises.

M5 Weather monitoring

M5.1 At the point(s) identified below, the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1 of the table below, using the corresponding sampling method, units of measure, averaging period and sampling frequency, specified opposite in the Columns 2, 3, 4 and 5 respectively.

Appendix D

Calibration certificates



CERTIFICATE NO: C30591

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Syantek

Type No: SV-36 Serial No: 79952

Owner: EMM Consulting Pty Ltd

L3, 175 Scott Street Newcastle, NSW 2300

Tests Performed: Measured Output Pressure level, Frequency & Distortion

Comments: See Details overleaf All Test Passed

Pre- Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
NA	N	94.12 dB	999.99 Hz	1.58 %
NA	N	114.05 dB	999.99 Hz	1.12 %
ertainty		±0.11 dB	±0.05%	±0.20 %
	Adj NA NA	Adj Y/N NA N NA N	Adj Y/N (dB re 20 μPa) NA N 94.12 dB NA N 114.05 dB	Adj Y/N (dB re 20 μPa) (Hz) NA N 94.12 dB 999.99 Hz NA N 114.05 dB 999.99 Hz

Uncertainty (at 95% c.l.) k=2

CONDITION OF TEST:

Ambient Pressure 1007 hPa ±1 hPa Date of Receipt: 16/09/2021 Date of Calibration: 16/09/2021 Temperature 21 °C ±1° C **Relative Humidity** 43 % ±5% Date of Issue: 16/09/2021

Acu-Vib Test AVP02 (Calibrators)

Procedure: Test Method: AS IEC 60942 - 2017

CHECKED BY: .

AUTHORISED SIGNATURE:

Accredited for compliance with ISO/IEC 17025 - Calibration Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or

other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.



Accredited Lab No. 9262 Acoustic and Vibration Measurements

Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 21 (02) 9680 8133 www.acu-vib.com.au

Page 1 of 2 Calibration Certificate AVCERT02.1 Rev.2.0 14.04.2021



The Calibration Laboratory Skodsborgvej 307, DK-2850 Nærum, Denmark





CERTIFICATE OF CALIBRATION

No: CDK2007931

Page 1 of 12

CALIBRATION OF

Sound Level Meter:

Brüel & Kjær Type 2250

No: 3029363 Id: -

Microphone:

Brüel & Kjær Type 4189

No: 3260501

PreAmplifier:

Brüel & Kjær Type ZC-0032

No: 30109

Supplied Calibrator:

None

Software version:

BZ7222 Version 4.7.6

Pattern Approval:

Instruction manual:

BE1712-22

CUSTOMER

EMM Consulting Ground Floor, Suite 1 20 Chandos Street 2065 St Leonards

New South Wales, Australia

CALIBRATION CONDITIONS

Preconditioning:

4 hours at $23^{\circ}C \pm 3^{\circ}C$

Environment conditions:

See actual values in sections.

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 has been calibrated in accordance with the requirements as specified in IEC 61672-1:2013 class 1. Procedures from IEC 61672-3:2013 were used to perform the periodic tests. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 8.2 - DB: 8.20) by using procedure B&K proc 2250, 4189 (IEC 61672:2013).

RESULTS

Calibration Mode: Calibration as received.

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor k = 2 providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2020-11-26

Date of issue: 2020-11-26

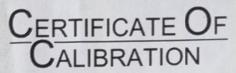
Lene Petersen

Calibration Technician

Erik Bruus Approved Signatory

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500 A



CERTIFICATE No: SLM31670

EQUIPMENT TESTED: Sound Level Meter

Manufacturer: B&K

Type No: 2250

Mic. Type: 4189

Pre-Amp. Type: ZC0032

Filter Type: 1/3 Octave

Owner: EMM Consulting

Level 3, 175 Scott Street Newcastle, NSW 2300

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Temperature

Ambient Pressure

Relative Humidity

992 hPa ±1 hPa

26 °C ±1° C

48 % ±5%

Date of Receipt: 02/02/2022

Serial No: 2759405

Serial No: 2983733

Test No: F031671

Serial No: 22666

Date of Calibration: 02/02/2022

Date of Issue: 03/02/2022

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY:

AUTHORISED SIGNATURE:

Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

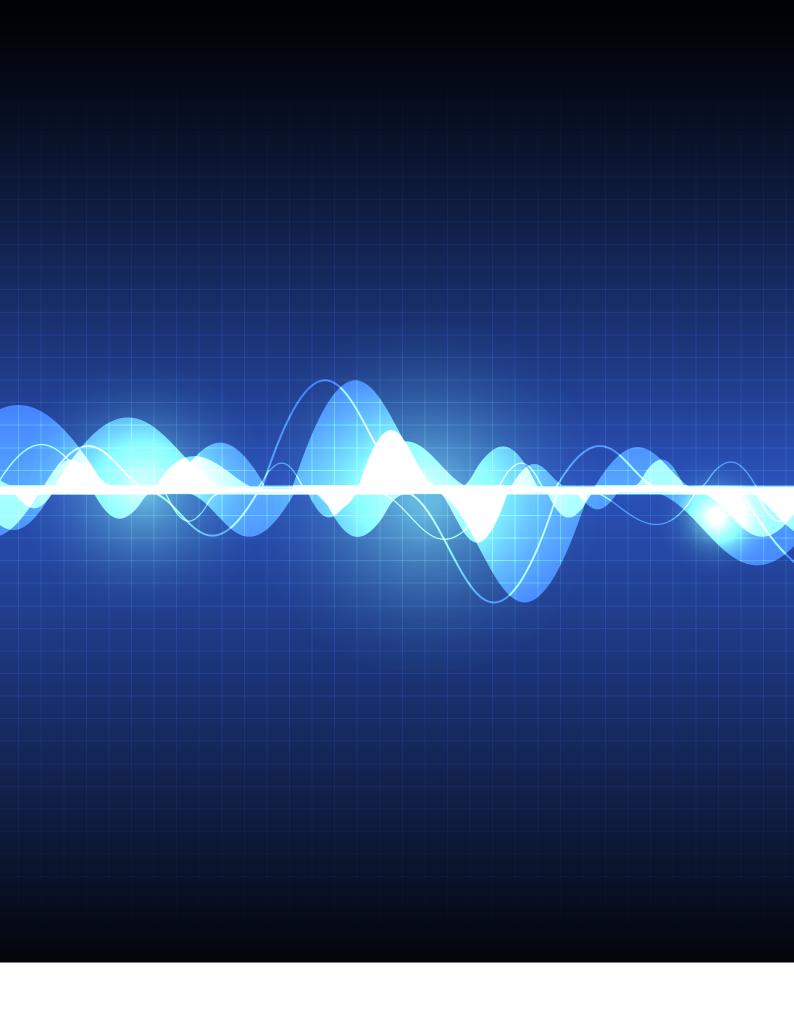


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Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS

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Page 1 of 2 Calibration Certificate AVCERT10.14 Rev.2.0 14/04/2021



Chain Valley Colliery

Quarterly attended noise monitoring Quarter 2 - 2022

Prepared for Great Southern Energy Pty Ltd (trading as Delta Coal) July 2022





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PO Box 9148 Deakin ACT 2600



Chain Valley Colliery

Quarterly attended noise monitoring - Quarter 2 2022

Prepared for Great Southern Energy Pty Ltd (trading as Delta Coal) July 2022

EMM Newcastle Level 3, 175 Scott Street Newcastle NSW 2300

T 02 4907 4800

E info@emmconsulting.com.au

www.emmconsulting.com.au

Chain Valley Colliery

31 July 2022

Quarterly attended noise monitoring - Quarter 2 2022

Report Number	
E220003 RP2	
Client	
Great Southern Energy Pty Ltd (trading as Delta Coal)	
Date	
31 July 2022	
Version	
v2 Final	
Prepared by	Approved by
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Teanuanua Villierme	Katie Teyhan
Senior Acoustic Consultant	Associate

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

31 July 2022

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1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to undertake operator-attended noise surveys on behalf of Great Southern Energy Pty Ltd (Delta Coal).

The purpose of the noise monitoring was to address requirements of the approved Chain Valley Colliery Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent SSD-5465 (DC) and Environment Protection License (EPL) 1770.

Compliance noise monitoring is required to occur on a quarterly basis for Chain Valley Colliery (CVC or the site). This report presents the results and findings for the second quarter (Q2) of 2022 from attended noise monitoring conducted on 20 and 22 June 2022.

The following material was referenced as part of this assessment:

- NSW Department of Planning, Industry and Environment (DPIE), Development Consent SSD-5465, as modified (Modification 4) July 2021 (current as of the monitoring date 20 June 2022);
- NSW Environment Protection Authority (EPA), Environment Protection License 1770, as varied on 24 February 2022 (current as of the monitoring date 20 June 2022);
- Chain Valley Colliery and Mannering Colliery Noise Management Plan (NMP) (approved 19 April 2022) updated following CVC Modification 4 (Mod 4) approval;
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

A glossary of acoustic terms relevant to this report is provided in Appendix A.

2 Noise limits

2.1 Operational and sleep disturbance noise limits

Noise limits for CVC are provided in Table 1, Condition 7 of Schedule 3 of the DC and Conditions L5.1 and L5.2 of the EPL. Extracts of the relevant sections of the DC and EPL pertaining to noise are provided in Appendix B and Appendix C, respectively. Assessment locations and relevant noise limits are summarised in Table 2.1.

Table 2.1 Noise limits

Assessment location	Day L _{Aeq,15min} , dB	Evening L _{Aeq,15min} , dB	Night L _{Aeq,15min} , dB	Night L _{A1,1min} , dB
R8 (EPL Point 9)	38	38	38	45
R11 (EPL Point 12)	49	49	49	54
R12 (EPL Point 13)	49	49	49	53
R13 (EPL Point 14)	43	43	43	49
R15 (EPL Point 16)	36	36	36	45
R19 (EPL Point 20)	37	37	37	45
R22 (EPL Point 23)	46	46	46	46
All other privately-owned land	35	35	35	45

Appendix 8 of the DC states meteorological conditions under which noise limits do not apply as follows:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 m above ground level; or
- temperature inversion conditions greater than 3°C/100 m.

Condition L5.4 of the EPL states meteorological conditions under which noise limits do not apply as follows:

- wind speeds greater than 3 m/s at 10 m above ground level;
- stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 m above ground level;
- stability category G temperature inversion conditions; or
- as defined under the NPfl.

The last point refers to 'very noise-enhancing' conditions which are considered outside the 'standard' or 'noise-enhancing' meteorological conditions defined in Table D1 of Fact Sheet D of the NPfl. Table D1 of the NPfl is reproduced in Table 2.2.

Table 2.2 Standard and noise-enhancing meteorological conditions

Meteorological conditions	Meteorological parameters
Standard meteorological conditions	Day/evening/night: stability categories A-D with wind speed up to 0.5 m/s at 10 m above ground level.
Noise-enhancing meteorological conditions	Day/evening: stability categories A-D with wind light winds (up to 3 m/s at 10 m above ground level).
	Night: stability categories A-D with light winds (up to 3 m/s at 10 m above ground level) and/or stability category F with winds up to 2 m/s at 10 m above ground level.

Source: NPfI (EPA 2017)

Further, Fact Sheet E of the NPfI (point 6 of Section E1) provides additional guidance on monitoring the performance of a site against 'suitable' noise limits placed in the consent/environment protection licence. Noise limits are based on 'achievable' noise levels under the 'standard' and/or 'noise-enhancing' meteorological conditions (refer to Table 2.2). Where meteorological conditions are considered 'very noise-enhancing', a positive adjustment of 5 dB applies to noise limits for 'standard' or 'noise-enhancing' meteorological conditions.

In accordance with the NPfI and for consistency between the DC and EPL, where 'very noise-enhancing' meteorological conditions were present during a noise survey, a positive adjustment of 5 dB has been applied to the noise limits stated in the DC and EPL (refer to Table 2.1). This approach means that noise limits will always be applicable, with or without a positive adjustment of 5 dB, depending on whether meteorological conditions are 'very noise-enhancing' or not.

For this assessment, the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1min}$. The INP application notes (EPA 2017) state that the EPA accepts sleep disturbance analysis based on either the $L_{A1,1min}$ or L_{Amax} metrics, with the L_{Amax} resulting in a more conservative assessment of site noise emissions.

The DC and EPL state that all modifying factor adjustments must be applied as appropriate to the measured site noise levels before comparison to the relevant noise limits, where applicable. Fact Sheet C of the NPfl outlines the method for assessing the presence of noise with annoying characteristics and applying the relevant modifying factor adjustment(s) to measured site noise at a residential receiver.

2.1 CVC long term goals

Long-term goals for CVC are provided in Condition 8(d) of Schedule 3 of the DC, which states:

8. The Applicant must:

(d) use its best endeavours to achieve the long-term noise goals in Table 2, where reasonable and feasible, and report on progress towards achieving these goals in each Annual Review;

The long-term goals for CVC in Table 2 of the DC are summarised in Table 2.3 for the relevant assessment locations.

Table 2.3 CVC long-term goals

Assessment location	Day	Evening	Night
	L _{Aeq,15min} , dB	L _{Aeq,15min} , dB	L _{Aeq,15min} , dB
R11 (EPL Point 12)	41	41	41

Table 2.3 CVC long-term goals

Assessment location	Day	Evening	Night
	L _{Aeq,15min} , dB	L _{Aeq,15min} , dB	L _{Aeq,15min} , dB
R12 (EPL Point 13)	41	41	41
R13 (EPL Point 14)	41	41	41
R22 (EPL Point 23)	40	40	40

As stated in Appendix 9 of the DC, Delta Coal is committed to the progressive implementation of feasible measures to target long-term noise goals which are designed to reduce noise emissions from CVC. For the purpose of this compliance noise monitoring assessment, site $L_{Aeq,15min}$ noise contributions have also been compared to the long-term goals in Section 4, where relevant.

2.2 Low frequency noise criteria

Condition 5 in Appendix 8 of the DC and L5.9 of the EPL state that noise generated by CVC is to be measured in accordance with the relevant requirements of the INP. The INP application notes state that modifying factor adjustments outlined in Fact Sheet C of the NPfI are to be used when assessing certain characteristics of a noise source such as low frequency noise (LFN).

Fact sheet C of the NPfI provides guidelines for applying modifying factor adjustments to account for LFN emissions. The NPfI specifies that a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels identifies the potential for an unbalanced noise spectrum and potential increased annoyance at a residential receiver.

Where a difference of 15 dB or more between site 'C-weighted' and site 'A-weighted' noise emission levels is identified, the one-third octave noise levels recorded should be compared to the LFN threshold values in Table C2 of the NPfI (EPA 2017), which has been reproduced in Table 2.4.

Table 2.4 One-third octave LFN threshold levels

One third ectave I

	One-till	ru octave	LZeq,15min	tillesiloi	u ieveis								
Frequency (Hz)	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB (Z)	92	89	86	77	69	61	54	50	50	48	48	46	44

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The following modifying factor adjustments for LFN are to be applied to the site $L_{Aeq,15min}$ noise contribution where the site 'C-weighted' and site 'A-weighted' noise emission level is 15 dB or more and:

- where any of the one-third octave noise levels in Table 2.4 are exceeded by up to and including 5 dB and cannot be mitigated, a 2 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period; or
- where any of the one-third octave noise levels in Table 2.4 are exceeded by more than 5 dB and cannot be mitigated, a 5 dB positive adjustment to measured/predicted A-weighted levels applies for the evening/night period and a 2 dB positive adjustment applies for the daytime period.

Hence, where possible throughout each survey the operator has estimated the difference between site 'C-weighted' and site 'A-weighted' noise emission levels by matching audible sounds with the response of the sound analyser (L_{Ceq} - L_{Aeq}). Where this was found to be 15 dB or greater, the measured one-third octave frequencies have been compared to the values in Table 2.4 to identify the relevant modifying factor adjustments (if applicable). This method for the application of modifying factor adjustments for LFN has been applied to this assessment as presented in Section 4.

It is of note that the NPfI states that LFN modifying factor adjustments only apply under the standard or noise-enhancing meteorological conditions as per Fact Sheet D of the NPfI.

3 Assessment methodology

3.1 Attended noise monitoring

To quantify noise emissions from CVC, attended noise monitoring surveys were completed at representative locations, in accordance with the NMP.

Attended noise monitoring locations as per the NMP, and their coordinates are listed in Table 3.1 and are shown in Figure 3.1.

Table 3.1 Attended noise monitoring locations

Attended noise	Assessment location	Description	Coordinates (MGA56)				
monitoring location			Easting	Northing			
ATN001	R8 (EPL Point 9)	Griffith Street, Mannering Park	363990	6330529			
ATN002	R11 (EPL Point 12)	Lakeshore Avenue, Kingfisher Shores	365218	6329388			
ATN003	R15 (EPL Point 16)	Short Street, Macquarie Shores	365165	6328323			
ATN004	R14	Lloyd Avenue, Chain Valley Bay	365949	6328530			
ATN005	R17	Teragalin Drive, Chain Valley Bay	366560	6328590			
ATN006	R19 (EPL Point 20)	Sunset Parade, Chain Valley Bay	366305	6329321			
ATN0071	R22 (EPL Point 23)	Cams Boulevard, Chain Valley Bay	366425	6331135			
R12	R12 (EPL Point 13)	Lakeshore Avenue, Kingfisher Shores	365185	6329352			
R13	R13 (EPL Point 14)	Karoola Avenue, Kingfisher Shores	365391	6329169			

Notes: 1. Due to access issues, noise monitoring for ATN007 was conducted at an intermediate location within the site boundary and site noise contributions were calculated back to R22 (EPL Point 23).

Condition M4.1 of the EPL specifies additional noise monitoring requirements to determine compliance, including the following:

- locations of monitoring EPL points listed in Table 3.1;
- frequency of monitoring quarterly and at least two months between monitoring periods;
- periods of monitoring:
 - for three out of four quarterly periods each day, evening and night periods for a minimum of 15 minutes. Night period monitoring must be undertaken between the hours of 1 am and 4 am; and
 - for one out of four quarterly periods day period monitoring must be undertaken for a minimum of 1.5 hours (six 15-minute periods); evening period monitoring must be undertaken for a minimum of 30 minutes (two 15-minute periods); night period monitoring must be undertaken for a minimum of 1 hour (four 15-minute periods).
- days of monitoring each quarterly monitoring must be undertaken on a different day of the week excluding Saturday, Sundays and public holidays.

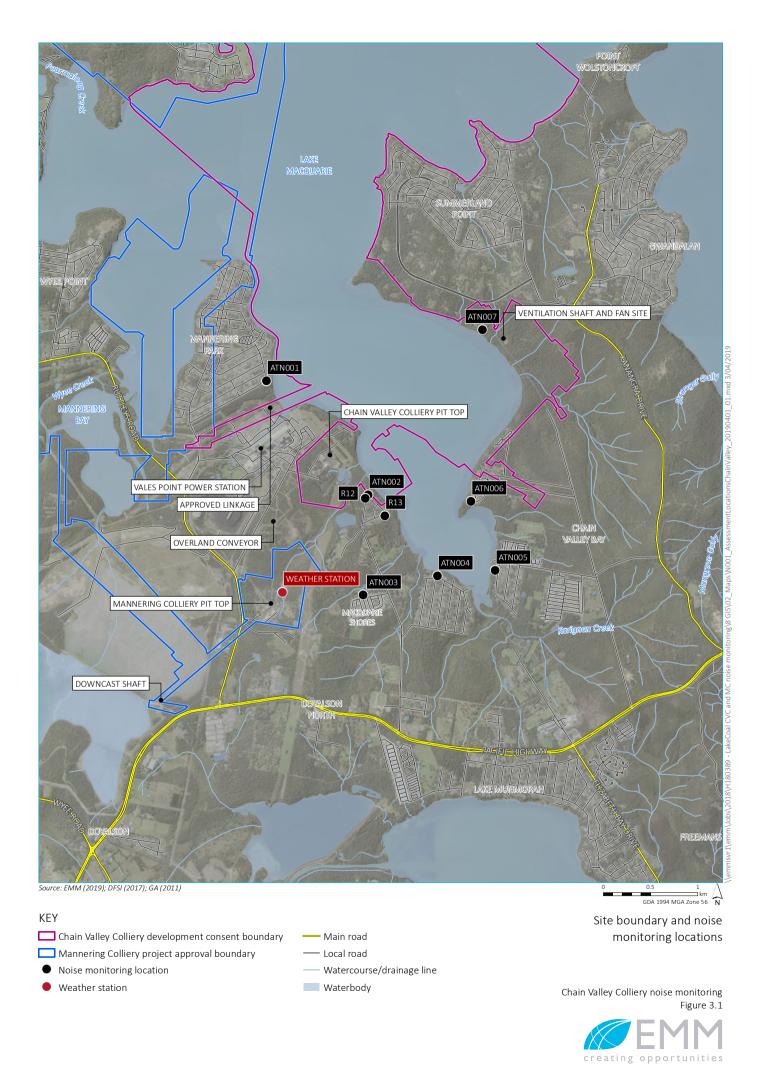
In accordance with the preceding, this round of quarterly attended noise monitoring (Q2 2022) was undertaken on Monday 20 and Wednesday 22 June 2022 which is more than two months since the last quarterly round of monitoring (Q1 2022) conducted on Monday 14, Wednesday 15 and Friday 18 March 2022.

As per the NMP, attended noise monitoring is scheduled considering the occurrence of regular operations at CVC. Noise monitoring avoids scheduled down-time or maintenance. Regular operations were occurring during this round (Q2 2022) of noise monitoring.

3.2 Instrumentation

Two Brüel & Kjær (B&K) 2250 Type 1 sound analysers (s/n 2759405 and s/n 3029363) were used to conduct 15-minute attended measurements and record one-third octave frequency and statistical noise indices. The sound analysers were calibrated before and on completion of the survey using a Svantek Type SV 36 calibrator (s/n 79952). Instrumentation calibration certificates are provided in Appendix D.

Where possible throughout each survey, the operator has quantified the contribution of site noise and other significant noise sources. This was done by matching audible sounds with the response of the sound analyser (where applicable) and/or via post-analysis of data (eg low-pass filtering).



3.3 Determination of stability category

For the purpose of this assessment and as required by the DC, EPL and NMP, stability categories were determined for each 15-minute attended monitoring period. The stability category data for the monitoring period as well as the average wind data (speed and direction) were obtained from MC's meteorological station located to the south of the site (refer to Figure 3.1).

The stability categories and associated ranges in temperature lapse rates are presented in Table 3.2.

 Table 3.2
 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)	
Α	ΔT < -1.9	
В	-1.9 ≤ ∆T < -1.7	
C	-1.7 ≤ ∆T < -1.5	
D	-1.5 ≤ ΔT < -0.5	
E	-0.5 ≤ ΔT < 1.5	
F	1.5 ≤ ∆T < 4.0	
G	ΔT ≥ 4.0	

Source: NPfl (EPA 2017).

4 Review of data and discussion

Noise contribution from CVC was determined for each survey using in-field observations and post-analysis of data as required (eg removing higher frequencies that are not mine related). Attended noise monitoring was completed on 20 and 22 June 2022. Monitoring surveys occurred at all monitoring locations for 15 minutes during the day, evening and night periods as per the EPL. Results for this Q2 2022 attended noise monitoring are summarised in Table 4.1.

The meteorological data for the monitoring period was sourced from Mannering Colliery's meteorological station to determine if a positive adjustment of 5 dB to the noise limits was applicable due to 'very noise-enhancing' meteorological conditions as per the NPfl. Meteorological conditions were 'standard' or 'noise-enhancing' at the time of the monitoring and, in accordance with the NMP, the standard noise limits shown in Table 2.1 applied for all 28 measurements.

Site noise was inaudible during 25 of the 28 measurements. Typically, when a particular source is not audible above local ambient noise levels, the likely contribution of that source is at least 10 dB below the measured background (L_{A90}) level. For most of the measurements where site noise was inaudible, the measured L_{A90} noise levels were no more than 10 dB above the relevant $L_{Aeq,15min}$ limits. The exception was during the daytime measurement at ATN005 (R17). Field observations made at the time of this measurement indicate that noise from nearby construction works (unrelated to Delta Coal) was consistently audible and contributed to the measured $L_{A90,15min}$ at ATN005 (R17). Hence, site $L_{Aeq,15min}$ noise contributions likely satisfied the relevant limits during all of the measurements where site noise was inaudible.

At the one noise monitoring location where site noise was audible; ATN007 (R22), CVC noise contributions satisfied the relevant noise limits during the day, evening and night periods.

With regard to LFN modifying factor adjustments, these have not been applied to locations where CVC was deemed to be inaudible. Measured site noise levels exceeded the relevant LFN threshold levels during the evening and night-time measurements at ATN007 (R22). Therefore, in accordance with the NPfl, a 2 dB positive adjustment was applied to the estimated site $L_{Aeq.15min}$ noise contributions for these measurements (as shown in Table 4.1).

Site $L_{Aeq,15min}$ noise contributions were also compared to the long-term noise goals (refer to Table 2.3) for the relevant locations (ie R11, R12, R13 and R22). Site $L_{Aeq,15min}$ noise contributions measured at ATN002 (R11), R12 and R13 satisfied the relevant long-term goals during the day, evening and night periods. During the daytime measurement at ATN007 (R22), site $L_{Aeq,15min}$ noise contribution exceeded the relevant long-term goal by 2 dB. During the evening and night-time measurements at ATN007 (R22), site $L_{Aeq,15min}$ noise contributions (inclusive of the 2 dB positive adjustment for LFN) exceeded the relevant long-term goals by 4 and 5 dB respectively.

Table 4.1 CVC attended noise monitoring results – Q2 2022

					Total n	oise lev	els, dB			Site cor	Site contributions, dB			imits, dB	Meteorological	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L_{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L_{Ceq}	LFN mod. factor ¹	L_{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	conditions ³ Very noise- enhancing?		
ATN001	22/6	14:37 (Day)	44	46	50	47	60	74	73	Nil	IA	N/A	38	N/A	2.4 m/s @ 267° SC B No	Nil	CVC inaudible. VPPS hum consistently audible. Wind in foliage, distant and local traffic frequently audible. Bird noise and resident noise occasionally audible.
ATN001	22/6	19:47 (Eve.)	41	42	47	44	51	75	66	Nil	IA	N/A	38	N/A	0.3 m/s @ 138° SC F No	Nil	CVC inaudible. VPPS hum, insects and frogs consistently audible. Distant and local traffic occasionally audible.
ATN001	22/6	2:02 (Night)	45	46	47	47	48	63	69	Nil	IA	IA	38	45	0.9 m/s @ 248° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects just audible.
ATN002	22/6	15:41 (Day)	32	35	47	47	60	66	62	Nil	IA	N/A	49	N/A	1.6 m/s @ 272° SC B No	Nil	CVC inaudible. VPPS hum, insects, frogs and bird noise consistently audible. Distant traffic and resident noise occasionally audible.
ATN002	20/6	20:48 (Eve.)	39	40	42	42	44	52	65	Nil	IA	N/A	49	N/A	0.4 m/s @ 183° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Overland conveyor unrelated to Delta Coal barely audible. Distant traffic, nearby resident and dog barking occasionally audible.
ATN002	22/6	2:24 (Night)	42	44	45	46	47	49	69	Nil	IA	IA	49	54	1.5 m/s @ 244° SC F No	Nil	CVC inaudible. VPPS hum consistently audible.

Table 4.1 CVC attended noise monitoring results – Q2 2022

				Total r	noise lev	els, dB			Site cor	ntributio	ons, dB	Noise I	imits, dB	conditions ³	Comments		
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L _{Ceq}	LFN mod. factor ¹	L_Aeq	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	conditions ³ Very noise- enhancing?		
ATN003	22/6	15:02 (Day)	38	41	58	51	70	84	71	Nil	IA	N/A	36	N/A	1.3 m/s @ 278° SC A No	Nil	CVC inaudible. VPPS hum and bird noise consistently audible. Traffic passbys frequently audible. Dogs barking occasionally audible.
ATN003	20/6	21:30 (Eve.)	38	39	40	42	43	49	63	Nil	IA	N/A	36	N/A	0.4 m/s @ 327° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Overland conveyor unrelated to Delta Coal barely audible to inaudible. Insects/frogs consistently audible. Distant traffic frequently audible.
ATN003	20/6	23:30 (Night)	39	40	41	42	45	49	64	Nil	IA	IA	36	45	0.2 m/s @ 297° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects/frogs consistently audible. Distant traffic frequently audible.
ATN003	22/6	3:00 (Night)	38	39	41	42	45	55	62	Nil	IA	IA	36	45	1.9 m/s @ 240° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Mannering Colliery and overland conveyor unrelated to Delta Coal consistently audible. Insects/frogs consistently audible. Distant traffic occasionally audible.
ATN004	22/6	16:00 (Day)	35	38	47	51	56	66	61	Nil	IA	N/A	35	N/A	1.0 m/s @ 267° SC C No	Nil	CVC inaudible. VPPS hum and bird noise consistently audible. Distant and local traffic frequently audible. Resident noise occasionally audible.
ATN004	22/6	19:22 (Eve.)	36	37	40	41	46	57	61	Nil	IA	N/A	35	N/A	0.2 m/s @ 170° SC F No	Nil	CVC inaudible. VPPS hum, insects and frogs consistently audible. Distant traffic frequently audible. Dogs barking occasionally audible.
ATN004	20/6	22:48 (Night)	34	37	38	39	41	61	58	Nil	IA	IA	35	45	0.2 m/s @ 285° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Distant traffic and dog barking occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q2 2022

	a)				Total r	noise lev	els, dB			Site co	ntributio	ns, dB	Noise li	imits, dB	Meteorological	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L_{Ceq}	LFN mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	conditions ³ Very noise- enhancing?		
ATN005	22/6	16:25 (Day)	42	51	66	68	78	85	76	Nil	IA	N/A	35	N/A	0.5 m/s @ 196° SC A No	Nil	CVC inaudible. Noise from nearby construction works consistently audible. Bird noise and nearby children frequently audible. Traffic passbys occasionally audible.
ATN005	22/6	18:30 (Eve.)	34	37	52	52	63	78	64	Nil	IA	N/A	35	N/A	0.5 m/s @ 288° SC F No	Nil	CVC inaudible. VPPS hum, insects and frogs consistently audible. Distant traffic frequently audible. Bird noise occasionally audible.
ATN005	20/6	22:00 (Night)	37	39	40	42	44	61	62	Nil	IA	IA	35	45	0.2 m/s @ 320° SC F No	Nil	CVC inaudible. VPPS hum consistently audible.
ATN006	22/6	16:45 (Day)	36	39	45	47	55	67	63	Nil	IA	N/A	37	N/A	0.5 m/s @ 173° SC D No	Nil	CVC inaudible. VPPS hum and construction noise consistently audible. Resident noise and pedestrians frequently audible. Dogs barking occasionally audible.
ATN006	22/6	18:50 (Eve.)	39	41	43	45	49	64	63	Nil	IA	N/A	37	N/A	0.3 m/s @ 70° SC F No	Nil	CVC inaudible. VPPS hum, insects and frogs consistently audible. Distant traffic frequently audible. Dogs barking occasionally audible.
ATN006	22/6	03:24 (Night)	37	39	41	42	43	49	64	Nil	IA	IA	37	45	1.0 m/s @ 265° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Birds occasionally audible.
ATN007 ⁴	22/6	17:15 (Day)	48	49	50	50	51	53	71	Nil	42	N/A	46	N/A	0.4 m/s @ 218° SC B No	Nil	CVC vent fans consistently audible. Insects and frogs consistently audible. Bird noise and distant traffic occasionally audible.
ATN007 ⁴	22/6	18:01 (Eve.)	47	49	49	50	51	58	71	2 dB	44 (42+2)	N/A	46	N/A	0.4 m/s @ 190° SC F No	Nil	CVC vent fans consistently audible. Insects and frogs consistently audible. Distant traffic frequently audible.

Table 4.1 CVC attended noise monitoring results – Q2 2022

0				Total r	noise lev	els, dB			Site co	Site contributions, dB N			imits, dB		Exceedance, dB	Comments	
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L _{Ceq}	LFN mod. factor ¹	L_{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	conditions ³ Very noise- enhancing?		
ATN007 ⁴	22/6	3:53 (Night)	48	50	51	51	53	60	71	2 dB	45 (43+2)	43	46	46	1.4 m/s @ 269° SC F No	Nil	CVC vent fan noise consistently audible. VPPS hum consistently audible in the background.
R12	22/6	15:41 (Day)	32	35	47	47	60	66	62	Nil	IA	N/A	49	N/A	1.6 m/s @ 272° SC B No	Nil	CVC inaudible. VPPS hum, insects, frogs and bird noise consistently audible. Distant traffic and resident noise occasionally audible.
R12	20/6	20:48 (Eve.)	39	40	42	42	44	52	65	Nil	IA	N/A	49	N/A	0.4 m/s @ 183° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Overland conveyor unrelated to Delta Coal barely audible. Distant traffic, nearby resident and dog barking occasionally audible.
R12	22/6	2:24 (Night)	42	44	45	46	47	49	69	Nil	IA	IA	49	53	1.5 m/s @ 244° SC F No	Nil	CVC inaudible. VPPS hum consistently audible.
R13	22/6	15:19 (Day)	37	40	56	54	67	79	69	Nil	IA	N/A	43	N/A	1.2 m/s @ 284° SC A No	Nil	CVC inaudible. VPPS hum, bird noise and resident noise consistently audible. Dogs barking and traffic passbys occasionally audible.
R13	20/6	21:06 (Eve.)	36	38	40	41	45	58	59	Nil	IA	N/A	43	N/A	0.3 m/s @ 257° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Overland conveyor unrelated to Delta Coal consistently audible. Distant traffic occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q2 2022

					Total n	oise lev	els, dB			Site con	tributio	ons, dB	Noise I	imits, dB		Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L _{Ceq}	LFN mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	conditions ³ Very noise- enhancing?		
R13	22/6	02:41 (Night)	41	43	44	45	47	65	61	Nil	IA	IA	43	49	1.4 m/s @ 232° SC F No		CVC inaudible. VPPS hum consistently audible. Mannering Colliery and overland conveyor unrelated to Delta Coal barely audible.

Notes

- 1. Modifying factor adjustment for LFN in accordance with Fact sheet C of the NPfI (refer to Section 2.2).
- 2. For assessment purposes the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1min}$.
- 3. Meteorological data including wind speed, wind direction and stability category (SC) were taken as an average over 15 minutes from MC's weather station (Refer to Section 3.3).
- 4. Due to access issues, noise monitoring for ATN007 was conducted at an intermediate location. Total noise levels shown were measured at the alternative location and site contributions calculated back to R22/EPL Point 23.

5. IA = inaudible, N/A = not applicable.

5 Conclusion

EMM has completed a review of mine noise from CVC within the surrounding community based on attended measurements conducted on 20 and 22 June 2022.

The meteorological data for the monitoring period was sourced from Mannering Colliery's meteorological station to determine if the standard noise limits applied as per the NMP or if a positive adjustment of 5 dB to the noise limits was applicable due to 'very noise-enhancing' meteorological conditions in accordance with the NPfl. Meteorological conditions were 'standard' or 'noise-enhancing' at the time of the monitoring and, in accordance with the NMP, the standard noise limits applied for all measurements.

The assessment of noise contributions from site included consideration of modifying factors for annoying noise characteristics, where relevant, and in accordance with the NPfl. A modifying factor for LFN was applicable at R22 (ATN007) during the evening and night-time measurements. Therefore, in accordance with the NPfl, a 2 dB positive adjustment was applied to the estimated site $L_{Aeq,15min}$ noise contribution for these measurements before comparison to the relevant noise limits.

CVC L_{Aeq,15min} and L_{Amax} noise contributions for this round (Q2 2022) of noise monitoring satisfied the relevant noise limits at all monitoring locations as outlined in the DC, EPL and NMP.

CVC $L_{Aeq,15min}$ noise contributions were also compared to the long-term noise goals applicable at R11 (ATN002), R12, R13 and R22 (ATN007). CVC $L_{Aeq,15min}$ noise contributions satisfied the relevant long-term goals during all measurements at R11 (ATN002), R12 and R13. However, during the daytime measurements at R22 (ATN007), site $L_{Aeq,15min}$ noise contributions exceeded the relevant long-term goals by 2 dB, and during the evening and night-time measurements at R22 (ATN007), site $L_{Aeq,15min}$ noise contributions (inclusive of the 2 dB positive adjustment for LFN) exceeded the relevant long-term goals by 4 and 5 dB respectively.

References

Chain Valley Colliery and Mannering Colliery Noise Management Plan, 2022.NSW Department of Planning and Environment, Development Consent SSD5465, 2020.

NSW Environment Protection Authority, Environment Protection License 1770, 2022.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Glossary of acoustic terms

Several technical terms are discussed in this report. These are explained in Table A.1.

Table A.1Glossary of acoustic terms

Term	Description	
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.	
L _{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.	
L _{A1,1min}	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.	
L _{A10}	The 'A-weighted' noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise level.	
L _{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.	
L _{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15min}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.	
L _{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.	
L _{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.	
L _{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15min}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.	
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.	
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.	
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.	
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.	

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table A.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure A.1.

Table A.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment	
up to 2	not perceptible	
3	just perceptible	
5	noticeable difference	
10	twice (or half) as loud	
15	large change	
20	four times (or quarter) as loud	

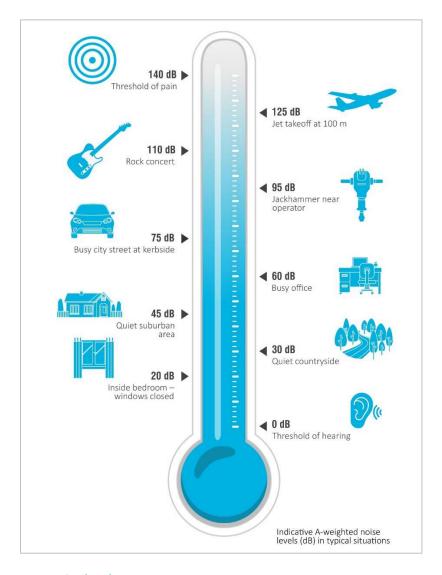


Figure A.1 Common noise levels

Appendix B

Project approval extract

- 4. Prior to 31 March 2014, and every 12 months thereafter for each calendar year in which coal haulage from the site is undertaken utilising public roads, unless the Planning Secretary directs otherwise, the Applicant must commission a suitably qualified person, whose appointment has been approved by the Planning Secretary at least one month prior to undertaking the audit, to conduct an Independent Traffic Audit of the development. This audit must:
 - (a) be undertaken without prior notice to the Applicant, and in consultation with TfNSW, NCC, CC Council and the CCC;
 - (b) assess the impact of the development on the performance and safety of the road network, including a review of:
 - haulage records;
 - accident records on the haulage route, infringements relating to the code of conduct and any incidents involving haulage vehicles;
 - · community complaints register; and
 - (c) assess the effectiveness of the Road Transport Protocol; and, if necessary, recommend measures to reduce or mitigate any adverse (or potentially adverse) impacts.
- 5. Within 1 month of receiving the audit report, or as otherwise agreed by the Planning Secretary, the Applicant must submit a copy of the report to the Planning Secretary, with a detailed response to any of the recommendations contained in the audit report, including a timetable for the implementation of any measures proposed to address the recommendations in the audit report.

A summary of the audit report must be included in the Annual Review.

Alternative Coal Transport Options

- 6. Prior to 31 December 2014, and every three years thereafter, the Applicant must prepare and submit to the Planning Secretary for approval, a study of the reasonable and feasible options to reduce or eliminate the use of public roads to transport coal from the development, unless otherwise agreed by the Planning Secretary. The assessment must include:
 - (a) an analysis of the capital, construction and operating costs of the alternative transport options; and
 - (b) quantified social and environmental impacts associated with road and rail transport.

NOISE

Noise Impact Assessment Criteria

7. The Applicant must ensure that the noise generated by the development at any residence on privatelyowned land does not exceed the criteria for the location in Table 1 nearest to that residence.

Table 1: Noise Criteria dB(A)

Location	Day	Evening	Ni	ght
Location	L _{Aeq(15 min)}	L _{Aeq(15 min)}	L Aeq(15 min)	LA1(1 min)
R8	38	38	38	45
R11	49	49	49	54
R12	49	49	49	53
R13	43	43	43	49
R15	36	36	36	45
R19	37	37	37	45
R22	46	46	46	46
all other privately-owned land	35	35	35	45

Notes:

- To interpret the locations referred to in Table 1, see Appendix 6 and the EIS; and
- Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 8 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has a written agreement with the relevant landowner to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Operating Conditions

- 8. The Applicant must:
 - implement best management practice, including all reasonable and feasible noise mitigation measures, to minimise the construction, operational and transport noise generated by the development;
 - regularly assess the noise monitoring and meteorological data and relocate, modify, and/or stop operations on site to ensure compliance with the relevant conditions of this consent;
 - (c) minimise the noise impacts of the development during meteorological conditions under which the noise limits in this consent do not apply (see Appendix 8);
 - (d) use its best endeavours to achieve the long-term noise goals in Table 2, where reasonable and feasible, and report on progress towards achieving these goals in each Annual Review;
 - (e) carry out a comprehensive noise audit of the development in conjunction with each independent environmental audit; and
 - (f) prepare an action plan to implement any additional reasonable and feasible onsite noise mitigation measures identified by each audit:

to the satisfaction of the Planning Secretary.

Table 2: Long-term Noise Goals dB(A)

Location	Day	Evening	Night
Location	L _{Aeq(15 min)}	L _{Aeq(15 min)}	L _{Aeq(15 min)}
R11 – R13	41	41	41
R22	40	40	40

Notes:

- To interpret the locations referred to in Table 2, see Appendix 6 and the EIS; and
- Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 8 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

Noise Management Plan

- The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
 - (a) be prepared in consultation with the EPA and submitted to the Planning Secretary for approval within 4 months of the date of this consent, unless otherwise agreed by the Planning Secretary;
 - (b) describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this consent;
 - (c) describe the proposed noise management system in detail including the mitigation measures that would be implemented to minimise noise during construction and operations, including on and off site road noise generated by vehicles associated with the development; and
 - (d) include a monitoring program that:
 - uses attended monitoring to evaluate the compliance of the development against the noise criteria in this consent;
 - evaluates and reports on:
 - the effectiveness of the on-site noise management system; and
 - compliance against the noise operating conditions; and
 - defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.

AIR QUALITY

Odour

10. The Applicant must ensure that no offensive odours are emitted from the site, as defined under the POEO

APPENDIX 6 NOISE RECEIVER LOCATIONS

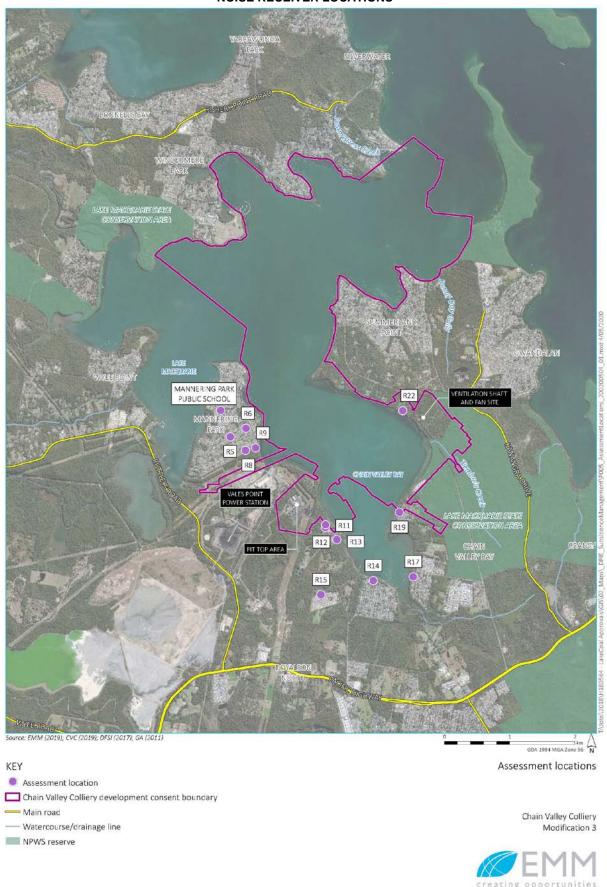


Figure 1: Noise Receiver Locations

APPENDIX 8 NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

- 1. The noise criteria in Table 1 of the conditions are to apply under all meteorological conditions except the following:
 - (a) during periods of rain or hail;
 - (b) average wind speed at microphone height exceeds 5 m/s;
 - (c) wind speeds greater than 3 m/s measured at 10 m above ground level; or
 - (d) temperature inversion conditions greater than 3°C/100 m.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions must be that recorded by the meteorological station described in condition 14 of schedule 3.

Compliance Monitoring

- 3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this consent.
- 4. This monitoring must be carried out at least 4 times in each calendar year (ie at least once every 3 months), unless the Planning Secretary directs otherwise.
- 5. Unless otherwise agreed with the Planning Secretary, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
 - (a) monitoring locations for the collection of representative noise data;
 - (b) meteorological conditions during which collection of noise data is not appropriate;
 - (c) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
 - (d) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

- results of this monitoring program will be reviewed by a suitably qualified expert and used to determine the appropriateness of the existing irrigation area to receive this effluent:
- develop a program to monitor creek line channel stability and the health of riparian vegetation within Swindles Creek. Monitoring will be undertaken in accordance with Section 8.5.2 of the Surface Water Impact Assessment (EIS Appendix E) and incorporated into the Colliery's WMP or Biodiversity Management Plan; and
- record monitoring data in accordance with the Colliery's WMP and EPL 1770.
 Monitoring data will be interpreted as it is received to ensure appropriate operational guidance on monitoring water quality within desired parameters.

 Results of water quality monitoring will be reported in the Annual Review and made available to the CCC, as well as CC Council and LMCC.

Noise

Management and monitoring of noise will continue to be undertaken in accordance with the Colliery's NMP, which will be reviewed and updated as required to include the commitments made below. Great Southern Energy Pty Limited will:

- continue attended compliance monitoring on site which will be used to identify potential hot spots and primary noise sources;
- continue real-time noise monitoring alerts to site personnel to enable implementation of any required rapid noise management initiatives;
- manage potential non-compliance through a noise complaint handling and response system, including the identification of responsible sources to enable targeted remedial action;
- assess if further noise mitigation options for the ventilation fans are reasonable and feasible following the receipt of attenuation proposals; and
- discuss potential management measures or agreement options with the landowner at 275 Cams Boulevard, following receipt of proposals from acoustics specialists.

In addition to the above, Great Southern Energy Pty Limited is committed to the progressive implementation of feasible measures to target long-term noise goals which are designed to reduce noise emissions from the Colliery. Long-term options for investigation include:

- modification to belt/movement alarms;
- investigation of surface conveyer and coal preparation equipment, to determine if noise reductions are possible;
- identifying sound attenuation options for the surface bulldozer and front-end loader;
- strategic placement of acoustic barriers;
- attenuation for the surface screener/shaker;
- installation of quiet rollers for surface conveyor belts:
- acoustic treatments around compressors; and
- the use of a conveyor stacker for product coal stockpiling.

Air Quality and greenhouse gases

Management and monitoring of air quality and greenhouse gases will continue to be undertaken in accordance with the Colliery's AQGHGMP, which will be reviewed and updated as required to include the commitments made below Great Southern Energy Pty Limited will:

- investigate the use of a stacker to replace hauling between current conveyor system and stockpiles;
- undertake GHG monitoring comprising measurement of carbon dioxide and methane at the ventilation shaft and fan sites; and
- record and report annual diesel, oil, grease, acetylene and electricity use to fulfil National Greenhouse and Energy Reporting Scheme requirements.

Traffic and transport

Management and monitoring of traffic and transport will continue to be undertaken in accordance with the Colliery's RTP. In addition, Great Southern Energy Pty Limited will continue to investigate alternative options for transporting export coal to the Port of Newcastle, specifically the preferred rail transport option, requiring the construction of a private haul road to the VPPS coal unloading facility and associated infrastructure upgrades. In addition, Great Southern Energy Pty Limited will investigate options to reduce peak hour traffic would be investigated including potentially limiting the peak hourly volumes of the Colliery truck traffic which would be permitted to travel via this intersection should the Colliery not be using rail transport for export coal by five years from the granting of development consent. Alternatively, a pro-rata financial contribution to the cost of installing traffic signals at the southbound intersection of the F3 and Sparks Road interchange could be made commensurate with the percentage of Colliery generated traffic using the intersection.

Subsidence

Management and monitoring of subsidence will continue to be undertaken in accordance with the Colliery's SMP or Extraction Plans, which will be reviewed and

Appendix C

EPL extract



Licence - 1770

1	Discharge to waters Discharge quality and volume monitoring	Discharge to waters Discharge quality and volume monitoring	Discharge to waters and monitoring from final settlement pond, gravity fed discharge pipe as identified in plan titled "Delta Coal Chain Valley Colliery, Surface EPA Premises Plan, DRG No: C1S0165_2" 10 August 2021 and saved as EPA Document DOC21/691135.
27	Discharge to waters Discharge quality and volume monitoring	Discharge to waters Discharge quality and volume monitoring	Discharge to waters via dam spillway from final settlement pond adjacent to EPA Point 1 as identified in plan titled "Delta Coal Chain Valley Colliery, Surface EPA Premises Plan, DRG No: C1S0165_2" 10 August 2021 and saved as EPA Document DOC21/691135.

P1.4 The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.

Noise/Weather

EPA identi- fication no.	Type of monitoring point	Location description
9	Noise monitoring	Noise monitoring site R8 as defined in Development Consent SSD-5465 (MOD 3), located at 109 Griffith Street, MANNERING PARK, 2259
12	Noise monitoring	Noise monitoring site R11 as defined in Development Consent SSD-5465 (MOD 3), located at 35 Lakeshore Avenue, CHAIN VALLEY BAY, 2259
13	Noise monitoring	Noise monitoring site R12 as defined in Development Consent SSD-5465 (MOD 3), located at 20 Lakeshore Avenue, Kingfisher Shores, CHAIN VALLEY BAY, 2259
14	Noise monitoring	Noise monitoring site R13 as defined in Development Consent SSD-5465 (MOD 3), located at 33 Karoola Avenue, Kingfisher Shores, CHAIN VALLEY BAY, 2259
16	Noise monitoring	Noise monitoring site R15 as defined in Development Consent SSD-5465 (MOD 3), located at Short Street, Macquarie Shores, CHAIN VALLEY BAY, 2259
20	Noise monitoring	Noise monitoring site R19 as defined in Development Consent SSD-5465 (MOD 3), located at 2 Sunset Parade, CHAIN VALLEY BAY, 2259



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23	Noise monitoring	Noise monitoring site R22 as defined in Development Consent SSD-5465 (MOD 3), located at 275a Cams Boulevard, CHAIN VALLEY BAY, 2259
26	Meteorological Station	Mannering Colliery Meteorological Station, Ruttleys Road, Doyalson 2259.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

- L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.
- L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.
- L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.
- L2.4 Water and/or Land Concentration Limits

POINT 1,27

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Faecal Coliforms	colony forming units per 100 millilitres				200
рН	рН				6.5-8.5
Total suspended solids	milligrams per litre				50



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L3 Volume and mass limits

- L3.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of:
 - a) liquids discharged to water; or;
 - b) solids or liquids applied to the area;

must not exceed the volume/mass limit specified for that discharge point or area.

Point	Unit of Measure	Volume/Mass Limit
1	kilolitres per day	12161
27	kilolitres per day	12161

L3.2 The volumetric daily discharge limit for the premises is the combined discharge measured at EPA discharge points 1 and 27 and must not exceed 12161 kilolitres per day.

L4 Waste

L4.1 The licensee must not cause, permit or allow any waste to be received at the premises, except the wastes expressly referred to in the column titled "Waste" and meeting the definition, if any, in the column titled "Description" in the table below.

Any waste received at the premises must only be used for the activities referred to in relation to that waste in the column titled "Activity" in the table below.

Any waste received at the premises is subject to those limits or conditions, if any, referred to in relation to that waste contained in the column titled "Other Limits" in the table below.

This condition does not limit any other conditions in this licence.

Code	Waste	Description	Activity	Other Limits
NA	General or Specific exempted waste	Waste that meets all the conditions of a resource exemption under Clause 92 of the Protection of the Environment Operations (Waste) Regulation 2014.	As specified in each particular resource recovery exemption	NA

L5 Noise limits

L5.1 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 12

•	Measurement frequency	Noise level dB(A)
parameter		



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Day	Day-LAeq (15 minute)	-	49
Evening	Evening-LAeq (15 minute)	-	49
Night	Night-LAeq (15 minute)	-	49
Night	Night-LA1 (1 minute)	-	54

POINT 13

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	49
Evening	Evening-LAeq (15 minute)	-	49
Night	Night-LAeq (15 minute)	-	49
Night	Night-LA1 (1 minute)	-	53

POINT 14

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	43
Evening	Evening-LAeq (15 minute)	-	43
Night	Night-LAeq (15 minute)	-	43
Night	Night-LA1 (1 minute)	-	49

POINT 16

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	36
Evening	Evening-LAeq (15 minute)	-	36
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	45

POINT 20

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	37
Evening	Evening-LAeq (15 minute)	-	37
Night	Night-LAeq (15 minute)	-	37



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Night	Night-LA1 (1 minute)	-	45

POINT 23

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	46
Evening	Evening-LAeq (15 minute)	-	46
Night	Night-LAeq (15 minute)	-	46
Night	Night-LA1 (1 minute)	-	46

POINT 9

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	38
Night	Night-LA1 (1 minute)	-	45

- L5.2 The licensee must ensure that noise generated on the premises does not exceed:
 - a) 35 LAeq(15min) during the day, evening or night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1; and
 - b) 45 LA1(1min) during the night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1.

Note: The licensee may provide to the EPA written evidence of any agreement with a landholder which is subject to the above noise limits. The written evidence may be submitted with a licence variation to remove the landholder from the above tables.

- L5.3 For the purpose of condition L5.1 and condition L5.2:
 - (a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays;
 - (b) Evening is defined as the period 6pm to 10pm, and
 - (c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.
- L5.4 The noise limits set out in condition L5.1 and condition L5.2 apply under all meterorological conditions except for any one of the following:



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- (a) Wind speeds greater than 3 metres/second at 10 metres above ground level; or
- (b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at
- 10 metres above ground level; or
- (c) Stability category G temperature inversion conditions.
- (d) Or as defined under the NSW EPA Noise Policy for Industry 2017.
- L5.5 For the purpose of condition L5.4:
 - (a) the meteorological data to be used for determining meteorological conditions is the data recorded at the meteorological station identified in this licence as EPA Identification Point 26.
 - (b) Stability category temperature inversion conditions are to be determined in accordance with the NSW EPA Noise Policy for Industry 2017.
- Note: The weather station must be designed, commissioned and operated in a manner to obtain the necessary parameters required under the above condition.
- L5.6 For the purpose of determining the noise generated at the premises the licensee must use a Class 1 or Class 2 noise monitoring device as defined by AS IEC61672.1 and AS IEC61672.2-2004, or other noise monitoring equipment accepted by the EPA in writing.
- L5.7 To determine compliance:
 - 1. With the L_{Aeq(15 min)} noise limits in condition L5.1 and condition L5.2, the licensee must locate noise monitoring equipment;
 - (a) within 30 metres of a dwelling facade (but not closer than 3 metres) where any dwelling on the property is situated more then 30 metres from the property boundary that is closest to the premises;
 - (b) approximately on the boundary where any dwelling is situated 30 metres or less from the property boundary that is closest to the premises, or, where applicable,
 - (c) within approximately 50 metres if the boundary of a national park or nature reserve.
 - 2. With the LA1(1 minute) noise limits in condition L5.1 and L5.2, the noise monitoring equipment must be located within 1 metre of a dwelling facade.
 - 3. With the noise limits in condition L5.1 and condition L5.2, the noise monitoring equipment must be located;
 - (a) at the most affected point at a location where there is no dwelling at the location, or
 - (b) at the most affected point within an area at a location prescribed by conditions L5.7 1(a) or L5.7 1(b).
- L5.8 A non-compliance of condition L5.1 or condition L5.2 will still occur where noise generated from the premises in excess of the appropriate limit is measured;
 - a) at a location other than an area prescribed by conditions L5.7 1(a) and L5.7 1(b), and /or
 - b) at a point other than the most affected point at a location.
- L5.9 For the purposes of determining the noise generated at the premises all applicable modification factors as described in the NSW EPA Noise Policy for Industry 2017 must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

Environment Protection Authority - NSW Licence version date: 24-Feb-2022



Licence - 1770

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

M4 Environmental monitoring

Requirement to monitor noise

- M4.1 To determine compliance with condition L5.1, attended noise monitoring must be undertaken in accordance with conditions L5.7 and L5.8, and
 - (a) at each one of the locations listed in condition L5.1;
 - (b) occur quarterly within the reporting period of the Environment Protection Licence with at least 2 months between monitoring periods;
 - (c) occur during each day, evening and night period as defined in the NSW Industrial Noise Policy (EPA 2000) for a minimum of 15 minutes for three of the quarters;
 - (d) the night time 15 minute attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am;
 - (e) the night time LA1 (1 min) attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am;
 - (f) one quarterly monitoring must occur during each day, evening and night period as defined in the NSW EPA Noise Policy for Industry 2017 for a minimum of 1.5 hours during the day; 30 minutes during the evening; and 1 hours during the night, and
 - (g) each quarterly monitoring must be undertaken on a different day(s) of the week not including Saturdays, Sundays and public holidays; and
 - (h) these monitoring conditions take effect in the 2015 Reporting period.

Note: The intention of this condition is that quarterly monitoring be undertaken at each sensitive receiver. That at each sensitive receiver monitoring is undertaken over a range of different days excluding weekends and public holidays during the reporting period so as to be representative of operating hours. That night time 15 minute attended monitoring and the LA1 (1min) monitoring for three of the quarters be undertaken at worst case being the most stable atmospheric conditions and when noise would be most intrusive to sleep. All of the sensitive receivers do not have to be monitored on the same day, evening and night for sub condition f.

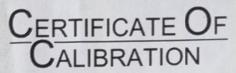
M4.2 For the Annual Reporting Period ending March 2015 the EPA will accept all monitoring required by the current Department of Planning and Environment consent (usually quarterly monitoring for noise as dB(A) Leq15minutes) for compliance with noise monitoring requirements in this licence, as a single report attached to the Annual Return for the premises.

M5 Weather monitoring

M5.1 At the point(s) identified below, the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1 of the table below, using the corresponding sampling method, units of measure, averaging period and sampling frequency, specified opposite in the Columns 2, 3, 4 and 5 respectively.

Appendix D

Calibration certificates



CERTIFICATE No: SLM31670

EQUIPMENT TESTED: Sound Level Meter

Manufacturer: B&K

Type No: 2250

Mic. Type: 4189

Pre-Amp. Type: ZC0032

Filter Type: 1/3 Octave

Owner: EMM Consulting

Level 3, 175 Scott Street Newcastle, NSW 2300

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Temperature

Ambient Pressure

Relative Humidity

992 hPa ±1 hPa

26 °C ±1° C

48 % ±5%

Date of Receipt: 02/02/2022

Serial No: 2759405

Serial No: 2983733

Test No: F031671

Serial No: 22666

Date of Calibration: 02/02/2022

Date of Issue: 03/02/2022

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY:

AUTHORISED SIGNATURE:

Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.



Accredited Lab No. 9262 Acoustic and Vibration Measurements

Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 2154 (02) 9680 8133 www.acu-vib.com.au

Page 1 of 2 Calibration Certificate AVCERT10.14 Rev.2.0 14/04/2021



The Calibration Laboratory Skodsborgvej 307, DK-2850 Nærum, Denmark





CERTIFICATE OF CALIBRATION

No: CDK2007931

Page 1 of 12

CALIBRATION OF

Sound Level Meter:

Brüel & Kjær Type 2250

No: 3029363 Id: -

Microphone:

Brüel & Kjær Type 4189

No: 3260501

PreAmplifier:

Brüel & Kjær Type ZC-0032

No: 30109

Supplied Calibrator:

None

Software version:

BZ7222 Version 4.7.6

Pattern Approval:

Instruction manual:

BE1712-22

CUSTOMER

EMM Consulting Ground Floor, Suite 1 20 Chandos Street 2065 St Leonards

New South Wales, Australia

CALIBRATION CONDITIONS

Preconditioning:

4 hours at $23^{\circ}C \pm 3^{\circ}C$

Environment conditions:

See actual values in sections.

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 has been calibrated in accordance with the requirements as specified in IEC 61672-1:2013 class 1. Procedures from IEC 61672-3:2013 were used to perform the periodic tests. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 8.2 - DB: 8.20) by using procedure B&K proc 2250, 4189 (IEC 61672:2013).

RESULTS

Calibration Mode: Calibration as received.

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor k = 2 providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2020-11-26

Date of issue: 2020-11-26

Lene Petersen

Calibration Technician

Erik Bruus

Approved Signatory

Reproduction of the complete certificate is allowed. Parts of the certificate may only be reproduced after written permission.

500 A



CERTIFICATE NO: C30591

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Syantek

Type No: SV-36 Serial No: 79952

Owner: EMM Consulting Pty Ltd

L3, 175 Scott Street Newcastle, NSW 2300

Tests Performed: Measured Output Pressure level, Frequency & Distortion

Comments: See Details overleaf All Test Passed

Parameter	Pre- Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N	
Level1:	NA	N	94.12 dB	999.99 Hz	1.58 %	
Level2:	NA	N	114.05 dB	999.99 Hz	1.12 %	
Unce	ertainty		±0.11 dB	±0.05%	±0.20 %	

Uncertainty (at 95% c.l.) k=2

CONDITION OF TEST:

Ambient Pressure 1007 hPa ±1 hPa

Temperature 21 °C ±1° C **Relative Humidity** 43 % ±5%

Date of Receipt: 16/09/2021

Date of Calibration: 16/09/2021 Date of Issue: 16/09/2021

Acu-Vib Test AVP02 (Calibrators)

Procedure: Test Method: AS IEC 60942 - 2017

CHECKED BY: .

AUTHORISED SIGNATURE:

Accredited for compliance with ISO/IEC 17025 - Calibration Results of the tests, calibration and/or measurements included in this document are traceable to SI units

through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.

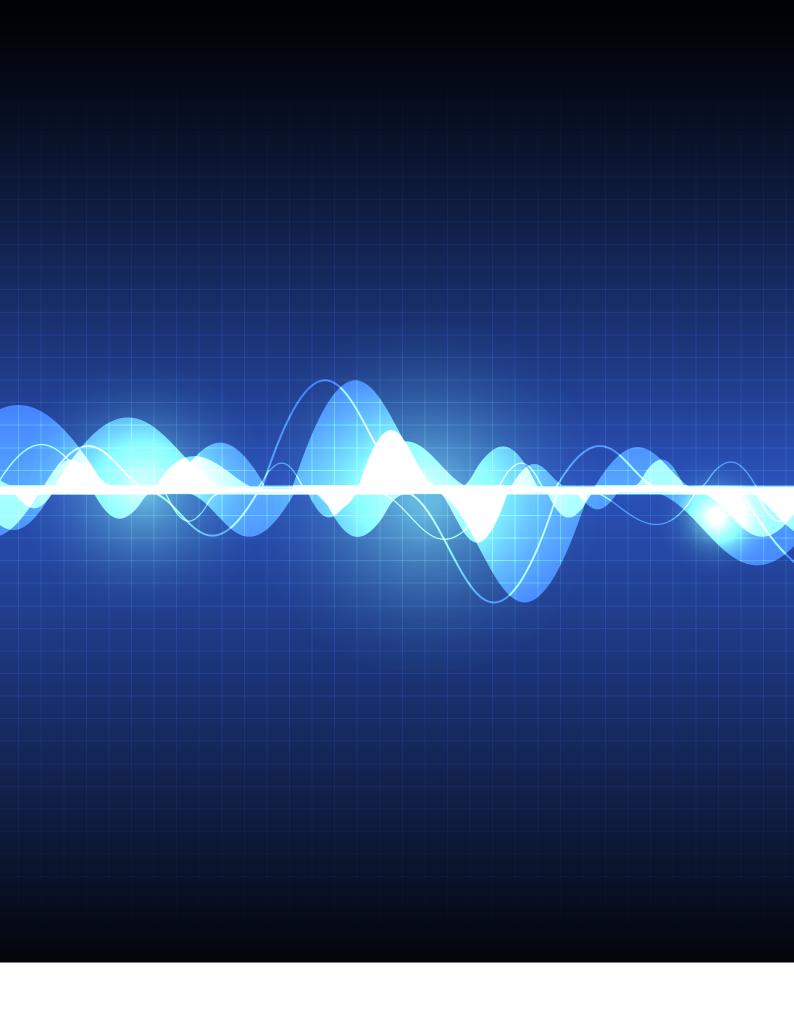


Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS

Accredited Lab No. 9262 Acoustic and Vibration Measurements

Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 21 (02) 9680 8133 www.acu-vib.com.au

Page 1 of 2 Calibration Certificate AVCERT02.1 Rev.2.0 14.04.2021





Chain Valley Colliery Quarterly attended noise monitoring - Q3 2022

Prepared for Great Southern Energy Pty Ltd (trading as Delta Coal)

November 2022

Chain Valley Colliery

Quarterly attended noise monitoring - Q3 2022

Great Southern Energy Pty Ltd (trading as Delta Coal)

E220750 RP2

November 2022

Version	Date	Prepared by	Approved by	Comments	
2	1 November 2022	Teanuanua Villierme	Tony Welbourne	Final	

Approved by

Tony Welbourne

Associate Director

1 November 2022

Level 3 175 Scott Street

J. Wellen.

Newcastle NSW 2300

This report has been prepared in accordance with the brief provided by Great Southern Energy Pty Ltd (trading as Delta Coal) and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of Great Southern Energy Pty Ltd (trading as Delta Coal) and no responsibility will be taken for its use by other parties. Great Southern Energy Pty Ltd (trading as Delta Coal) may, at its discretion, use the report to inform regulators and the public.

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E220750 | RP2 | v2 ES.1

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1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to undertake operator-attended noise surveys on behalf of Great Southern Energy Pty Ltd (Delta Coal).

The purpose of the noise monitoring was to address requirements of the approved Chain Valley Colliery Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent SSD-5465 (DC) and Environment Protection License (EPL) 1770.

Compliance noise monitoring is required to occur on a quarterly basis for Chain Valley Colliery (CVC or the site). This report presents the results and findings for the third quarter (Q3) of 2022 from attended noise monitoring conducted on 7, 12 and 15 September 2022.

The following material was referenced as part of this assessment:

- NSW Department of Planning, Industry and Environment (DPIE), Development Consent SSD-5465, as modified (Modification 4) July 2021 (current as of the monitoring date 7 September 2022);
- NSW Environment Protection Authority (EPA), Environment Protection License 1770, as varied on 10 August 2022 (current as of the monitoring date 7 September 2022);
- Chain Valley Colliery and Mannering Colliery Noise Management Plan (NMP) (approved 19 April 2022) updated following CVC Modification 4 (Mod 4) approval;
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

A glossary of acoustic terms relevant to this report is provided in Appendix A.

2 Noise limits

2.1 Operational and sleep disturbance noise limits

Noise limits for CVC are provided in Table 1, Condition 7 of Schedule 3 of the DC and Conditions L5.1 and L5.2 of the EPL. Extracts of DC and EPL sections pertaining to noise are provided in Appendix B and Appendix C, respectively. Assessment locations and relevant noise limits are summarised in Table 2.1.

Table 2.1 Noise limits

Assessment location	Day L _{Aeq,15min} , dB	Evening L _{Aeq,15min} , dB	Night L _{Aeq,15min} , dB	Night L _{A1,1min} , dB
R8 (EPL Point 9)	38	38	38	45
R11 (EPL Point 12)	49	49	49	54
R12 (EPL Point 13)	49	49	49	53
R13 (EPL Point 14)	43	43	43	49
R15 (EPL Point 16)	36	36	36	45
R19 (EPL Point 20)	37	37	37	45
R22 (EPL Point 23)	46	46	46	46
All other privately-owned land	35	35	35	45

Appendix 8 of the DC states meteorological conditions under which noise limits do not apply as follows:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 m above ground level; or
- temperature inversion conditions greater than 3°C/100 m.

Condition L5.4 of the EPL states meteorological conditions under which noise limits do not apply as follows:

- wind speeds greater than 3 m/s at 10 m above ground level;
- stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 m above ground level;
- stability category G temperature inversion conditions; or
- as defined under the NPfl.

The last point refers to 'very noise-enhancing' conditions which are considered outside the 'standard' or 'noise-enhancing' meteorological conditions defined in Table D1 of Fact Sheet D of the NPfI. Table D1 of the NPfI is reproduced in Table 2.2.

Table 2.2 Standard and noise-enhancing meteorological conditions

Meteorological conditions	Meteorological parameters
Standard meteorological conditions	Day/evening/night: stability categories A-D with wind speed up to 0.5 m/s at 10 m above ground level.
Noise-enhancing meteorological conditions	Day/evening: stability categories A-D with wind light winds (up to 3 m/s at 10 m above ground level).
	Night: stability categories A-D with light winds (up to 3 m/s at 10 m above ground level) and/or stability category F with winds up to 2 m/s at 10 m above ground level.

Source: NPfl (EPA 2017).

Further, Fact Sheet E of the NPfI (point 6 of Section E1) provides additional guidance on monitoring the performance of a site against 'suitable' noise limits placed in the consent/environment protection licence. Noise limits are based on 'achievable' noise levels under the 'standard' and/or 'noise-enhancing' meteorological conditions (refer to Table 2.2). Where meteorological conditions are considered 'very noise-enhancing', a positive adjustment of 5 dB applies to noise limits for 'standard' or 'noise-enhancing' meteorological conditions.

In accordance with the NPfI and for consistency between the DC and EPL, where 'very noise-enhancing' meteorological conditions were present during a noise survey, a positive adjustment of 5 dB has been applied to the noise limits stated in the DC and EPL (refer to Table 2.1). This approach means that noise limits will always be applicable, with or without a positive adjustment of 5 dB, depending on whether meteorological conditions are 'very noise-enhancing' or not.

For this assessment, the measured L_{Amax} has been used as a conservative estimate of $L_{A1,1min}$. The INP application notes (EPA 2017) state that the EPA accepts sleep disturbance analysis based on either $L_{A1,1min}$ or L_{Amax} metrics, with the L_{Amax} resulting in a more conservative assessment of site noise emissions.

The DC and EPL state that all modifying factor adjustments must be applied as appropriate to the measured site noise levels before comparison to the relevant noise limits, where applicable. Fact Sheet C of the NPfl outlines the method for assessing the presence of noise with annoying characteristics and applying the relevant modifying factor adjustment(s) to measured site noise at a residential receiver.

2.2 CVC long term goals

Long-term goals for CVC are provided in Condition 8(d) of Schedule 3 of the DC, which states:

8. The Applicant must:

(d) use its best endeavours to achieve the long-term noise goals in Table 2, where reasonable and feasible, and report on progress towards achieving these goals in each Annual Review;

The long-term goals for CVC in Table 2 of the DC are summarised in Table 2.3 for the relevant assessment locations.

Table 2.3 CVC long-term goals

Assessment location	Day L _{Aeq,15min} , dB	Evening L _{Aeq,15min} , dB	Night L _{Aeq,15min} , dB
R11 (EPL Point 12)	41	41	41
R12 (EPL Point 13)	41	41	41

Table 2.3 CVC long-term goals

Assessment location	Day L _{Aeq,15min} , dB	Evening L _{Aeq,15min} , dB	Night L _{Aeq,15min} , dB
R13 (EPL Point 14)	41	41	41
R22 (EPL Point 23)	40	40	40

As stated in Appendix 9 of the DC, Delta Coal is committed to the progressive implementation of feasible measures to target long-term noise goals which are designed to reduce noise emissions from CVC. For the purpose of this compliance noise monitoring assessment, site $L_{Aeq,15min}$ noise contributions have also been compared to the long-term goals in Section 4, where relevant.

2.3 Modifying factors

Assessment and reporting of modifying factors has been done in accordance with Fact Sheet C of the NPfl.

3 Assessment methodology

3.1 Attended noise monitoring

To quantify noise emissions from CVC, attended noise measurements were made at representative locations, in accordance with the NMP.

Attended noise monitoring locations as per the NMP, and their coordinates are listed in Table 3.1 and are shown in Figure 3.1.

Table 3.1 Attended noise monitoring locations

Attended noise	Assessment location	Description	Coordinates (MGA56)				
monitoring location			Easting	Northing			
ATN001	R8 (EPL Point 9)	Griffith Street, Mannering Park	363990	6330529			
ATN002	R11 (EPL Point 12)	Lakeshore Avenue, Kingfisher Shores	365218	6329388			
ATN003	R15 (EPL Point 16)	Short Street, Macquarie Shores	365165	6328323			
ATN004	R14	Lloyd Avenue, Chain Valley Bay	365949	6328530			
ATN005	R17	Teragalin Drive, Chain Valley Bay	366560	6328590			
ATN006	R19 (EPL Point 20)	Sunset Parade, Chain Valley Bay	366305	6329321			
ATN007 ¹	R22 (EPL Point 23)	Cams Boulevard, Chain Valley Bay	366425	6331135			
R12	R12 (EPL Point 13)	Lakeshore Avenue, Kingfisher Shores	365185	6329352			
R13	R13 (EPL Point 14)	Karoola Avenue, Kingfisher Shores	365391	6329169			

Notes: 1. Due to access issues, noise monitoring for ATN007 was conducted at an intermediate location within the site boundary and site noise contributions were calculated back to R22 (EPL Point 23).

Condition M4.1 of the EPL specifies additional noise monitoring requirements to determine compliance, including the following:

- locations of monitoring EPL points listed in Table 3.1;
- frequency of monitoring quarterly and at least two months between monitoring periods;
- periods of monitoring:
 - for three out of four quarterly periods each day, evening and night periods for a minimum of 15 minutes. Night period monitoring must be undertaken between the hours of 1 am and 4 am; and
 - for one out of four quarterly periods day period monitoring must be undertaken for a minimum of 1.5 hours (six 15-minute periods); evening period monitoring must be undertaken for a minimum of 30 minutes (two 15-minute periods); night period monitoring must be undertaken for a minimum of 1 hour (four 15-minute periods).
- days of monitoring each quarterly monitoring must be undertaken on a different day of the week excluding Saturday, Sundays and public holidays.

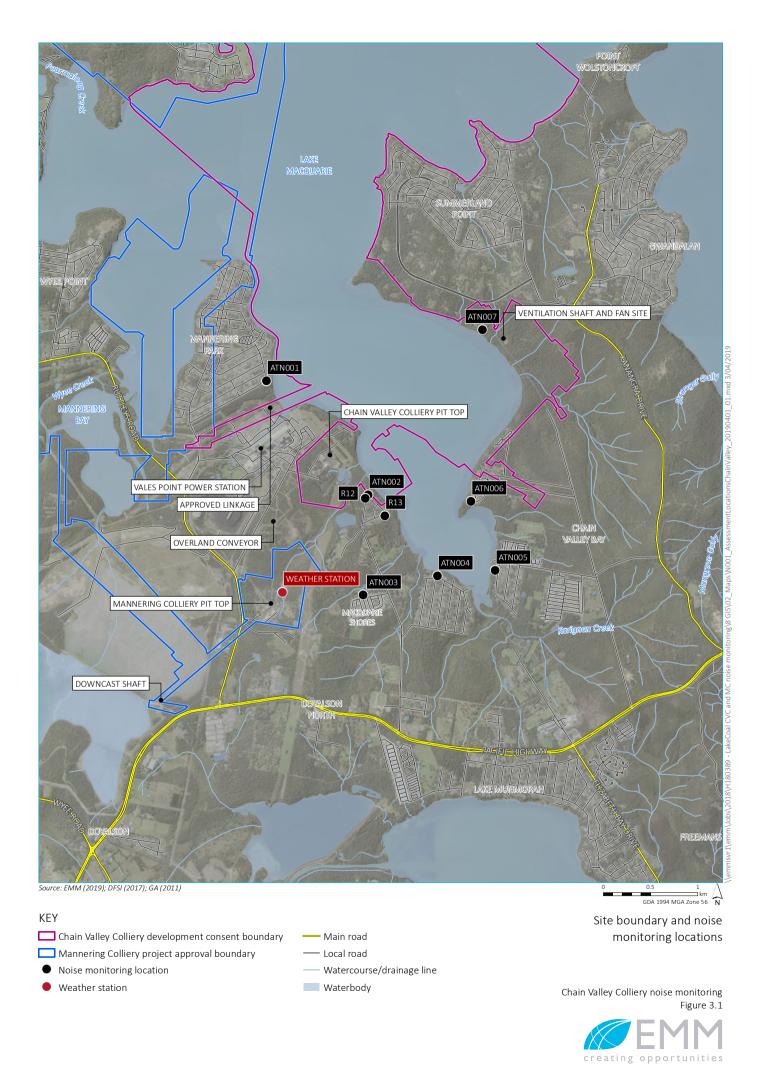
In accordance with the preceding, this round of quarterly attended noise monitoring (Q3 2022) was undertaken on Wednesday 7, Monday 12 and Thursday 15 September 2022 which is more than two months since the last quarterly round of monitoring (Q2 2022) conducted on Monday 20 and Wednesday 22 June 2022.

As per the NMP, attended noise monitoring is scheduled considering the occurrence of regular operations at CVC. Noise monitoring avoids scheduled down-time or maintenance. Regular operations were occurring during this round (Q3 2022) of noise monitoring.

3.2 Instrumentation

Two Brüel & Kjær (B&K) 2250 Type 1 sound analysers (s/n 2759405 and s/n 3029363) were used to conduct 15-minute attended measurements and record one-third octave frequency and statistical noise indices. The sound analysers were calibrated before and on completion of each measurement using a Svantek Type SV 36 calibrator (s/n 79952). Instrumentation calibration certificates are provided in Appendix D.

Where possible throughout each measurement, the operator has quantified separately site noise and other significant sources. This was done by matching audible sounds with the sound analyser response (where applicable) and/or via post-analysis of data (eg low-pass filtering).



3.3 Determination of stability category

For the purpose of this assessment and as required by the DC, EPL and NMP, stability categories were determined for each 15-minute attended monitoring period. The stability category data for the monitoring period as well as the average wind data (speed and direction) were obtained from MC's weather station located to the south of the site (refer to Figure 3.1).

The stability categories and associated ranges in temperature lapse rates are presented in Table 3.2.

 Table 3.2
 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)	
А	ΔT < -1.9	
В	-1.9 ≤ ΔT < -1.7	
С	-1.7 ≤ ΔT < -1.5	
D	-1.5 ≤ ΔT < -0.5	
Е	-0.5 ≤ ΔT < 1.5	
F	1.5 ≤ ∆T < 4.0	
G	ΔT ≥ 4.0	

Source: NPfl (EPA 2017).

4 Review of data and discussion

Noise levels from CVC were determined for each measurement using in-field observations and post-analysis of data as required (eg removing higher frequencies that are not mine related). Attended noise monitoring was completed on 7, 12 and 15 September. Monitoring occurred at all locations for 15 minutes during the day, evening and night periods as per the EPL. Results for this Q3 2022 attended noise survey are summarised in Table 4.1.

Meteorological data for the monitoring period was sourced from Mannering Colliery's weather station to determine if a positive adjustment of 5 dB to the noise limits was applicable due to 'very noise-enhancing' meteorological conditions as per the NPfl. Meteorological conditions were 'standard' or 'noise-enhancing' at the time of the monitoring and, in accordance with the NMP, the standard noise limits shown in Table 2.1 applied for all 28 measurements.

Site noise was inaudible during 23 of the 28 measurements. Typically, when a particular source is not audible above local ambient noise, the likely contribution of that source is at least 10 dB below the measured background (LA90) level. For all the measurements where site noise was inaudible, the measured LA90 was not more than 10 dB above the relevant L_{Aeq,15min} limit.

At the noise monitoring locations where site noise was audible, ATN007 (R22) and R12 (during the night measurement only), CVC noise contributions were below relevant limits.

With regard to LFN modifying factor adjustments, these have not been applied to locations where CVC was inaudible. Measured site noise levels exceeded the relevant LFN threshold levels during the day, evening and night period measurements at ATN007 (R22). Therefore, in accordance with the NPfI, a 2 dB positive adjustment was applied to the estimated site $L_{Aeq,15min}$ for the day period measurement and a 5 dB positive adjustment was applied to the estimated site $L_{Aeq,15min}$ contributions for the evening and night period measurements (as shown in Table 4.1).

Site $L_{Aeq,15min}$ noise levels were also compared to the long-term noise goals (refer to Table 2.3) for the relevant locations (ie R11, R12, R13 and R22). Site $L_{Aeq,15min}$ measured at ATN002 (R11), R12 and R13 satisfied the relevant long-term goals during the day, evening and night periods. At ATN007 (R22), the site $L_{Aeq,15min}$ exceeded the relevant long-term goal by 1, 2 and 3 dB during the day, evening and night period measurements respectively.

Table 4.1 CVC attended noise monitoring results – Q3 2022

					Total r	noise lev	els, dB			Site	e levels,	dB		e limits, dB	Meteorological conditions ³	Exceedance, dB	
Location	Date	Start time	L _{Amin}	L _{A90}	L_{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L_{Ceq}	Mod. factor	L _{Aeq}	L _{Amax}	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN001	12/9	13.57 (Day)	39	41	51	45	64	76	64	Nil	IA	N/A	38	N/A	2.2 m/s @ 135° SC A No	Nil	CVC inaudible. Vales Point Power Station (VPPS) hum, insects, frogs and bird noise consistently audible. Resident noise, distant traffic and traffic passbys occasionally audible.
ATN001	12/9	19:26 (Eve.)	40	41	52	47	67	75	62	Nil	IA	N/A	38	N/A	1.0 m/s @ 254° SC E No	Nil	CVC inaudible . VPPS hum, insects and frogs consistently audible. Bird noise, Resident noise, distant traffic and traffic passbys occasionally audible.
ATN001	15/9	1:36 (Night)	41	43	44	45	47	57	63	Nil	IA	IA	38	45	1.2 m/s @ 38° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Distant traffic and wind in foliage occasionally audible.
ATN002	12/9	16:45 (Day)	46	48	51	53	58	70	63	Nil	IA	N/A	49	N/A	0.5 m/s @ 103° SC A No	Nil	CVC inaudible. Resident noise, bird noise and distant traffic consistently audible. Traffic passbys, pedestrians and dogs barking occasionally audible.
ATN002	7/9	20:38 (Eve.)	37	39	43	43	53	66	61	Nil	IA	N/A	49	N/A	1.6 m/s @ 28° SC F No	Nil	CVC inaudible . VPPS hum consistently audible. Insects and frogs consistently audible. Car passby, local traffic and wind in foliage occasionally audible. Aircraft noise audible once.
ATN002	15/9	2:02 (Night)	35	38	39	41	43	57	61	Nil	<38	<38	49	54	2.0 m/s @ 9° SC F No	Nil	CVC forklift briefly audible on one occasion. VPPS hum consistently audible. Insects consistently audible. Wind in foliage and birds occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q3 2022

					Total r	noise lev	els, dB			Site	e levels,	dB		e limits, dB	Meteorological conditions ³	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L_{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L_{Ceq}	Mod. factor	L_{Aeq}	L _{Amax} 2	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN003	12/9	17:23 (Day)	35	37	42	45	51	63	60	Nil	IA	N/A	36	N/A	0.3 m/s @ 241° SC A No	Nil	CVC inaudible . VPPS hum, insects, frogs, bird noise and distant traffic consistently audible. Resident noise frequently audible.
ATN003	7/9	21:15 (Eve.)	36	38	39	40	42	50	58	Nil	IA	N/A	36	N/A	1.7 m/s @ 36° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Traffic on Tall Timbers Road frequently audible.
ATN003	7/9	23:30 (Night)	35	37	38	40	43	54	59	Nil	IA	IA	36	45	2.0 m/s @ 46° SC F No	Nil	CVC inaudible . VPPS hum consistently audible. Insects consistently audible. Wind in foliage occasionally audible. Distant traffic audible once.
ATN003	15/9	2:45 (Night)	38	39	41	42	44	62	61	Nil	IA	IA	36	45	0.5 m/s @ 312° SC F No	Nil	CVC inaudible . VPPS hum consistently audible. Insects consistently audible. Water from nearby pond just audible. Aircraft noise audible once.
ATN004	12/9	14:35 (Day)	31	35	53	49	67	76	67	Nil	IA	N/A	35	N/A	2.0 m/s @ 124° SC A No	Nil	CVC inaudible. Insects, frogs and bird noise consistently audible. Resident noise, aircraft noise, distant dogs barking and wind in foliage occasionally audible.
ATN004	12/9	19:01 (Eve.)	28	30	44	38	56	68	60	Nil	IA	N/A	35	N/A	0.5 m/s @ 234° SC E No	Nil	CVC inaudible . VPPS hum, insects and frogs consistently audible. Resident noise, aircraft noise and distant dogs barking occasionally audible.
ATN004	7/9	22:48 (Night)	29	32	34	36	40	47	53	Nil	IA	IA	35	45	1.5 m/s @ 42° SC F No	Nil	CVC inaudible . VPPS hum consistently audible. Insects consistently audible. Distant traffic, birds and wind in foliage occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q3 2022

					Total n	ioise lev	els, dB			Site	e levels,	dB		e limits, dB	Meteorological conditions ³	Exceedance,	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L_{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L_Ceq	Mod. factor	L_{Aeq}	L _{Amax}	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN005	12/9	16:00 (Day)	34	37	47	50	57	74	61	Nil	IA	N/A	35	N/A	1.3 m/s @ 113° SC A No	Nil	CVC inaudible. VPPS hum, insects, frogs and bird noise consistently audible. Traffic passbys frequently audible. Aircraft noise and distant dogs barking occasionally audible.
ATN005	7/9	21:41 (Eve.)	32	34	37	38	41	64	53	Nil	IA	N/A	35	N/A	1.9 m/s @ 40° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Humming noise consistently audible from NBN node box. Distant and local traffic occasionally audible.
ATN005	7/9	22:00 (Night)	32	33	35	37	39	51	53	Nil	IA	IA	35	45	1.7 m/s @ 34° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Humming noise consistently audible from NBN node box. Distant and local traffic occasionally audible.
ATN006	12/9	16:20 (Day)	32	35	51	49	65	79	60	Nil	IA	N/A	37	N/A	1.1 m/s @ 121° SC A No	Nil	CVC inaudible. VPPS hum, insects, frogs, bird noise and distant traffic consistently audible. Resident noise frequently audible. Traffic passbys, aircraft noise, pedestrians and dogs barking occasionally audible.
ATN006	12/9	18:00 (Eve.)	31	33	51	40	65	79	57	Nil	IA	N/A	37	N/A	0.3 m/s @ 182° SC D No	Nil	CVC inaudible. VPPS hum, insects, frogs, bird noise, pedestrian noise and distant traffic consistently audible. Dogs barking frequently audible. Aircraft noise occasionally audible.
ATN006	15/9	3:12 (Night)	28	30	33	35	41	62	53	Nil	IA	IA	37	45	0.3 m/s @ 58° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Birds frequently audible. Distant traffic occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q3 2022

					Total r	noise lev	els, dB			Site	e levels, (dB	l	e limits, dB	Meteorological conditions ³	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L_{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L_{Ceq}	Mod. factor	L_{Aeq}	L _{Amax}	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN007 ⁴	12/9	15:10 (Day)	49	50	52	53	57	61	71	2	41 (39+2)	N/A	46	N/A	1.6 m/s @ 128° SC A No	Nil	CVC vent fans consistently audible. Insects, frogs and bird noise consistently audible. Wind in foliage and aircraft noise occasionally audible.
ATN007 ⁴	12/9	18:28 (Eve.)	47	48	49	49	51	55	71	5	42 (37+5)	N/A	46	N/A	0.3 m/s @ 238° SC F No	Nil	CVC vent fans consistently audible. Insects and frogs consistently audible.
ATN007 ⁴	15/9	3:44 (Night)	48	49	50	50	50	62	71	5	43 (38+5)	39	46	46	0.7 m/s @ 47° SC F No	Nil	CVC vent fans consistently audible. Insects consistently audible.
R12	12/9	16:45 (Day)	46	48	51	53	58	70	63	Nil	IA	N/A	49	N/A	0.5 m/s @ 103° SC A No	Nil	CVC inaudible. Resident noise, bird noise and distant traffic consistently audible. Traffic passbys, pedestrians and dogs barking occasionally audible.
R12	7/9	20:38 (Eve.)	37	39	43	43	53	66	61	Nil	IA	N/A	49	N/A	1.6 m/s @ 28° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and frogs consistently audible. Car passby, local traffic and wind in foliage occasionally audible. Aircraft noise audible once.
R12	15/9	2:02 (Night)	35	38	39	41	43	57	61	Nil	<38	<38	49	53	2.0 m/s @ 9° SC F No	Nil	CVC forklift briefly audible on one occasion. VPPS hum consistently audible. Insects consistently audible. Wind in foliage and birds occasionally audible.
R13	12/9	17:02 (Day)	31	33	47	50	60	65	55	Nil	IA	N/A	43	N/A	0.3 m/s @ 15° SC A No	Nil	CVC inaudible . Bird noise frequently audible. Distant traffic and resident noise occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q3 2022

					Total r	noise lev	els, dB			Site	e levels,	dB		e limits, dB	Meteorological conditions ³	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	L_{Ceq}	Mod. factor	L _{Aeq}	L _{Amax} 2	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
R13	7/9	20:56 (Eve.)	34	37	40	41	43	47	56	Nil	IA	N/A	43	N/A	1.6 m/s @ 39° SC F No	Nil	CVC inaudible. VPPS hum consistently audible. Wind in foliage frequently audible. Dog barking briefly audible. Aircraft noise audible once.
R13	15/9	2:21 (Night)	35	37	39	40	42	66	56	Nil	IA	IA	43	49	1.5 m/s @ 317° SC F No	Nil	CVC inaudible . VPPS hum consistently audible. Wind in foliage occasionally audible.

Notos

- 1. Modifying factor adjustment in accordance with Fact sheet C of the NPfI (refer to Section Error! Reference source not found.).
- 2. For assessment purposes the recorded L_{Amax} has been used as a conservative estimate of the L_{A1,1min}.
- 3. Meteorological data including wind speed, wind direction and stability category (SC) were taken as an average over 15 minutes from MC's weather station (Refer to Section 3.3).
- 4. Due to access issues, noise monitoring for ATN007 was conducted at an intermediate location. Total noise levels shown were measured at the alternative location and site contributions calculated back to R22/EPL Point 23.

5. IA = inaudible, N/A = not applicable.

5 Conclusion

EMM has completed a survey of mine noise from CVC within the surrounding community based on attended measurements conducted on 7, 12 and 15 September.

Meteorological data for the survey was sourced from Mannering Colliery's meteorological station to determine if the standard noise limits applied as per the NMP or if a positive adjustment of 5 dB to noise limits was applicable due to 'very noise-enhancing' meteorological conditions in accordance with the NPfl. Meteorological conditions were 'standard' or 'noise-enhancing' during all monitoring and, in accordance with the NMP, the standard noise limits applied for all measurements.

The assessment of noise from site included consideration of modifying factors for annoying noise characteristics, where relevant, and in accordance with the NPfl. A modifying factor for LFN was applicable at R22 (ATN007) during the day, evening and night period measurements. Therefore, in accordance with the NPfl, a 2 dB positive adjustment was applied to the estimated site $L_{Aeq,15min}$ for the day measurement and a 5 dB positive adjustment was applied to the estimated site $L_{Aeq,15min}$ for the evening and night period measurements.

CVC L_{Aeq,15min} and L_{Amax} noise levels during this survey (Q3 2022) were below relevant noise limits at all monitoring locations as outlined in the DC, EPL and NMP.

CVC $L_{Aeq,15min}$ were also compared to the long-term noise goals applicable at R11 (ATN002), R12, R13 and R22 (ATN007). CVC $L_{Aeq,15min}$ were less than these during all measurements at R11 (ATN002), R12 and R13. However, at R22 (ATN007), site $L_{Aeq,15min}$ exceeded the relevant long-term goal by 1, 2 and 3 dB during the day, evening and night period measurements respectively.

References

Chain Valley Colliery and Mannering Colliery Noise Management Plan, 2022.

NSW Department of Planning and Environment, Development Consent SSD5465, 2020.

NSW Environment Protection Authority, Environment Protection License 1770, 2022.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

Appendix A

Glossary of acoustic terms



Several technical terms are discussed in this report. These are explained in Table A.1.

Table A.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L _{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
L _{A1,1min}	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L _{A10}	The 'A-weighted' noise level which is exceeded 10% of the time.
L _{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L _{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The L _{Aeq,15min} descriptor refers to an L _{Aeq} noise level measured over a 15-minute period.
L _{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L _{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L _{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{Ceq,15min}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table A.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure A.1.

E220750 | RP2 | v2 A.2

Table A.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud

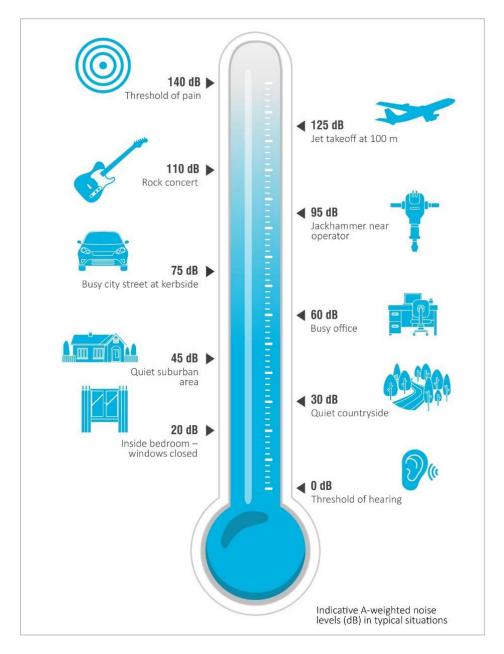


Figure A.1 Common noise levels

Appendix B
Project approval extract



- 4. Prior to 31 March 2014, and every 12 months thereafter for each calendar year in which coal haulage from the site is undertaken utilising public roads, unless the Planning Secretary directs otherwise, the Applicant must commission a suitably qualified person, whose appointment has been approved by the Planning Secretary at least one month prior to undertaking the audit, to conduct an Independent Traffic Audit of the development. This audit must:
 - (a) be undertaken without prior notice to the Applicant, and in consultation with TfNSW, NCC, CC Council and the CCC;
 - (b) assess the impact of the development on the performance and safety of the road network, including a review of:
 - haulage records;
 - accident records on the haulage route, infringements relating to the code of conduct and any incidents involving haulage vehicles;
 - · community complaints register; and
 - (c) assess the effectiveness of the Road Transport Protocol; and, if necessary, recommend measures to reduce or mitigate any adverse (or potentially adverse) impacts.
- 5. Within 1 month of receiving the audit report, or as otherwise agreed by the Planning Secretary, the Applicant must submit a copy of the report to the Planning Secretary, with a detailed response to any of the recommendations contained in the audit report, including a timetable for the implementation of any measures proposed to address the recommendations in the audit report.

A summary of the audit report must be included in the Annual Review.

Alternative Coal Transport Options

- 6. Prior to 31 December 2014, and every three years thereafter, the Applicant must prepare and submit to the Planning Secretary for approval, a study of the reasonable and feasible options to reduce or eliminate the use of public roads to transport coal from the development, unless otherwise agreed by the Planning Secretary. The assessment must include:
 - (a) an analysis of the capital, construction and operating costs of the alternative transport options; and
 - (b) quantified social and environmental impacts associated with road and rail transport.

NOISE

Noise Impact Assessment Criteria

7. The Applicant must ensure that the noise generated by the development at any residence on privatelyowned land does not exceed the criteria for the location in Table 1 nearest to that residence.

Table 1: Noise Criteria dB(A)

Location	Day	Evening	Ni	ght
Location	L _{Aeq(15 min)}	L _{Aeq(15 min)}	L Aeq(15 min)	LA1(1 min)
R8	38	38	38	45
R11	49	49	49	54
R12	49	49	49	53
R13	43	43	43	49
R15	36	36	36	45
R19	37	37	37	45
R22	46	46	46	46
all other privately-owned land	35	35	35	45

Notes:

- To interpret the locations referred to in Table 1, see Appendix 6 and the EIS; and
- Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 8 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has a written agreement with the relevant landowner to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Operating Conditions

- 8. The Applicant must:
 - implement best management practice, including all reasonable and feasible noise mitigation measures, to minimise the construction, operational and transport noise generated by the development;
 - regularly assess the noise monitoring and meteorological data and relocate, modify, and/or stop operations on site to ensure compliance with the relevant conditions of this consent;
 - (c) minimise the noise impacts of the development during meteorological conditions under which the noise limits in this consent do not apply (see Appendix 8);
 - (d) use its best endeavours to achieve the long-term noise goals in Table 2, where reasonable and feasible, and report on progress towards achieving these goals in each Annual Review;
 - (e) carry out a comprehensive noise audit of the development in conjunction with each independent environmental audit; and
 - (f) prepare an action plan to implement any additional reasonable and feasible onsite noise mitigation measures identified by each audit:

to the satisfaction of the Planning Secretary.

Table 2: Long-term Noise Goals dB(A)

Location	Day	Evening	Night	
Location	L _{Aeq(15 min)}	L _{Aeq(15 min)}	L _{Aeq(15 min)}	
R11 – R13	41	41	41	
R22	40	40	40	

Notes:

- To interpret the locations referred to in Table 2, see Appendix 6 and the EIS; and
- Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 8 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

Noise Management Plan

- The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
 - (a) be prepared in consultation with the EPA and submitted to the Planning Secretary for approval within 4 months of the date of this consent, unless otherwise agreed by the Planning Secretary;
 - (b) describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this consent;
 - (c) describe the proposed noise management system in detail including the mitigation measures that would be implemented to minimise noise during construction and operations, including on and off site road noise generated by vehicles associated with the development; and
 - (d) include a monitoring program that:
 - uses attended monitoring to evaluate the compliance of the development against the noise criteria in this consent;
 - evaluates and reports on:
 - the effectiveness of the on-site noise management system; and
 - compliance against the noise operating conditions; and
 - defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.

AIR QUALITY

Odour

10. The Applicant must ensure that no offensive odours are emitted from the site, as defined under the POEO

APPENDIX 6 NOISE RECEIVER LOCATIONS

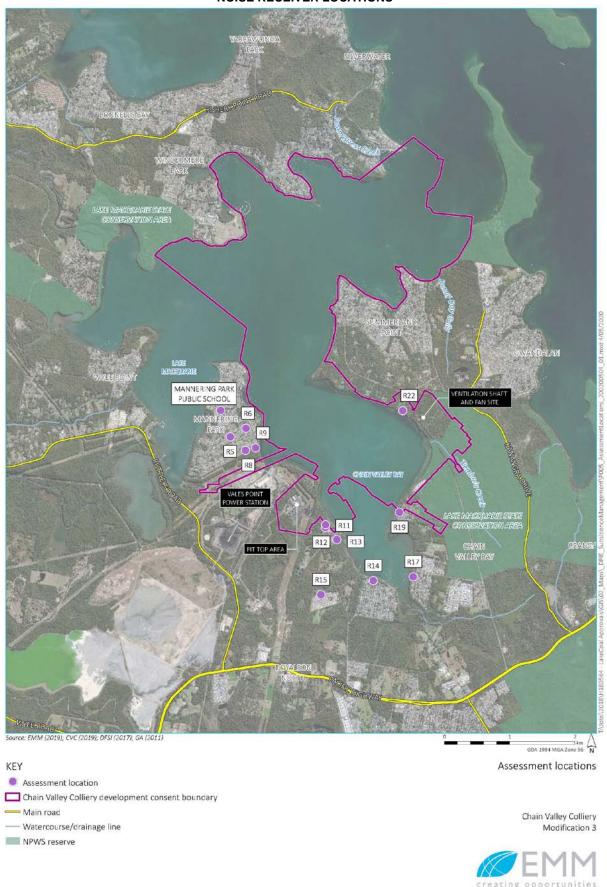


Figure 1: Noise Receiver Locations

APPENDIX 8 NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

- 1. The noise criteria in Table 1 of the conditions are to apply under all meteorological conditions except the following:
 - (a) during periods of rain or hail;
 - (b) average wind speed at microphone height exceeds 5 m/s;
 - (c) wind speeds greater than 3 m/s measured at 10 m above ground level; or
 - (d) temperature inversion conditions greater than 3°C/100 m.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions must be that recorded by the meteorological station described in condition 14 of schedule 3.

Compliance Monitoring

- 3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this consent.
- 4. This monitoring must be carried out at least 4 times in each calendar year (ie at least once every 3 months), unless the Planning Secretary directs otherwise.
- 5. Unless otherwise agreed with the Planning Secretary, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
 - (a) monitoring locations for the collection of representative noise data;
 - (b) meteorological conditions during which collection of noise data is not appropriate;
 - (c) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
 - (d) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

- results of this monitoring program will be reviewed by a suitably qualified expert and used to determine the appropriateness of the existing irrigation area to receive this effluent:
- develop a program to monitor creek line channel stability and the health of riparian vegetation within Swindles Creek. Monitoring will be undertaken in accordance with Section 8.5.2 of the Surface Water Impact Assessment (EIS Appendix E) and incorporated into the Colliery's WMP or Biodiversity Management Plan; and
- record monitoring data in accordance with the Colliery's WMP and EPL 1770.
 Monitoring data will be interpreted as it is received to ensure appropriate operational guidance on monitoring water quality within desired parameters.

 Results of water quality monitoring will be reported in the Annual Review and made available to the CCC, as well as CC Council and LMCC.

Noise

Management and monitoring of noise will continue to be undertaken in accordance with the Colliery's NMP, which will be reviewed and updated as required to include the commitments made below. Great Southern Energy Pty Limited will:

- continue attended compliance monitoring on site which will be used to identify
 potential hot spots and primary noise sources;
- continue real-time noise monitoring alerts to site personnel to enable implementation of any required rapid noise management initiatives;
- manage potential non-compliance through a noise complaint handling and response system, including the identification of responsible sources to enable targeted remedial action;
- assess if further noise mitigation options for the ventilation fans are reasonable and feasible following the receipt of attenuation proposals; and
- discuss potential management measures or agreement options with the landowner at 275 Cams Boulevard, following receipt of proposals from acoustics specialists.

In addition to the above, Great Southern Energy Pty Limited is committed to the progressive implementation of feasible measures to target long-term noise goals which are designed to reduce noise emissions from the Colliery. Long-term options for investigation include:

- modification to belt/movement alarms;
- investigation of surface conveyer and coal preparation equipment, to determine if noise reductions are possible;
- identifying sound attenuation options for the surface bulldozer and front-end loader;
- strategic placement of acoustic barriers;
- attenuation for the surface screener/shaker;
- installation of quiet rollers for surface conveyor belts:
- acoustic treatments around compressors; and
- the use of a conveyor stacker for product coal stockpiling.

Air Quality and greenhouse gases

Management and monitoring of air quality and greenhouse gases will continue to be undertaken in accordance with the Colliery's AQGHGMP, which will be reviewed and updated as required to include the commitments made below Great Southern Energy Pty Limited will:

- investigate the use of a stacker to replace hauling between current conveyor system and stockpiles;
- undertake GHG monitoring comprising measurement of carbon dioxide and methane at the ventilation shaft and fan sites; and
- record and report annual diesel, oil, grease, acetylene and electricity use to fulfil National Greenhouse and Energy Reporting Scheme requirements.

Traffic and transport

Management and monitoring of traffic and transport will continue to be undertaken in accordance with the Colliery's RTP. In addition, Great Southern Energy Pty Limited will continue to investigate alternative options for transporting export coal to the Port of Newcastle, specifically the preferred rail transport option, requiring the construction of a private haul road to the VPPS coal unloading facility and associated infrastructure upgrades. In addition, Great Southern Energy Pty Limited will investigate options to reduce peak hour traffic would be investigated including potentially limiting the peak hourly volumes of the Colliery truck traffic which would be permitted to travel via this intersection should the Colliery not be using rail transport for export coal by five years from the granting of development consent. Alternatively, a pro-rata financial contribution to the cost of installing traffic signals at the southbound intersection of the F3 and Sparks Road interchange could be made commensurate with the percentage of Colliery generated traffic using the intersection.

Subsidence

Management and monitoring of subsidence will continue to be undertaken in accordance with the Colliery's SMP or Extraction Plans, which will be reviewed and

Appendix C EPL extract



Environment Protection Licence



Licence - 1770

1	Discharge to waters Discharge quality and volume monitoring	Discharge to waters Discharge quality and volume monitoring	Discharge to waters and monitoring from final settlement pond, gravity fed discharge pipe as identified in plan titled "Delta Coal Chain Valley Colliery, Surface EPA Premises Plan, DRG No: C1S0165_2" 10
27	Discharge to waters Discharge quality and volume monitoring	Discharge to waters Discharge quality and volume monitoring	August 2021 and saved as EPA Document DOC21/691135. Discharge to waters via dam spillway from final settlement pond adjacent to EPA Point 1 as identified in plan titled "Delta Coal Chain Valley Colliery, Surface EPA Premises Plan, DRG No: C1S0165_2" 10 August 2021 and saved as EPA Document DOC21/691135.

P1.4 The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.

Noise/Weather

EPA identi- fication no.	Type of monitoring point	Location description
9	Noise monitoring	Noise monitoring site R8 as defined in Development Consent SSD-5465 (MOD 3), located at 109 Griffith Street, MANNERING PARK, 2259
12	Noise monitoring	Noise monitoring site R11 as defined in Development Consent SSD-5465 (MOD 3), located at 35 Lakeshore Avenue, CHAIN VALLEY BAY, 2259
13	Noise monitoring	Noise monitoring site R12 as defined in Development Consent SSD-5465 (MOD 3), located at 20 Lakeshore Avenue, Kingfisher Shores, CHAIN VALLEY BAY, 2259
14	Noise monitoring	Noise monitoring site R13 as defined in Development Consent SSD-5465 (MOD 3), located at 33 Karoola Avenue, Kingfisher Shores, CHAIN VALLEY BAY, 2259
16	Noise monitoring	Noise monitoring site R15 as defined in Development Consent SSD-5465 (MOD 3), located at Short Street, Macquarie Shores, CHAIN VALLEY BAY, 2259
20	Noise monitoring	Noise monitoring site R19 as defined in Development Consent SSD-5465 (MOD 3), located at 2 Sunset Parade, CHAIN VALLEY BAY, 2259

Environment Protection Licence



Licence - 1770

23	Noise monitoring	Noise monitoring site R22 as defined in Development Consent SSD-5465 (MOD 3), located at 275a Cams Boulevard, CHAIN VALLEY BAY, 2259
26	Meteorological Station	Mannering Colliery Meteorological Station, Ruttleys Road, Doyalson 2259.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

- L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.
- L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.
- L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.
- L2.4 Water and/or Land Concentration Limits

POINT 1,27

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Faecal Coliforms	colony forming units per 100 millilitres				200
рН	рН				6.5-8.5
Total suspended solids	milligrams per litre				50

Environment Protection Licence



Licence - 1770

L3 Volume and mass limits

- L3.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of:
 - a) liquids discharged to water; or;
 - b) solids or liquids applied to the area;

must not exceed the volume/mass limit specified for that discharge point or area.

Point	Unit of Measure	Volume/Mass Limit
1	kilolitres per day	12161
27	kilolitres per day	12161

L3.2 The volumetric daily discharge limit for the premises is the combined discharge measured at EPA discharge points 1 and 27 and must not exceed 12161 kilolitres per day.

L4 Waste

L4.1 The licensee must not cause, permit or allow any waste to be received at the premises, except the wastes expressly referred to in the column titled "Waste" and meeting the definition, if any, in the column titled "Description" in the table below.

Any waste received at the premises must only be used for the activities referred to in relation to that waste in the column titled "Activity" in the table below.

Any waste received at the premises is subject to those limits or conditions, if any, referred to in relation to that waste contained in the column titled "Other Limits" in the table below.

This condition does not limit any other conditions in this licence.

Code	Waste	Description	Activity	Other Limits
NA	General or Specific exempted waste	Waste that meets all the conditions of a resource exemption under Clause 92 of the Protection of the Environment Operations (Waste) Regulation 2014.	As specified in each particular resource recovery exemption	NA

L5 Noise limits

L5.1 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 12

Time period Measure	ment Measurement fre	equency Noise level of	dB(A)
paramete	er		



Licence - 1770

Day	Day-LAeq (15 minute)	-	49
Evening	Evening-LAeq (15 minute)	-	49
Night	Night-LAeq (15 minute)	-	49
Night	Night-LA1 (1 minute)	-	54

POINT 13

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	49
Evening	Evening-LAeq (15 minute)	-	49
Night	Night-LAeq (15 minute)	-	49
Night	Night-LA1 (1 minute)	-	53

POINT 14

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	43
Evening	Evening-LAeq (15 minute)	-	43
Night	Night-LAeq (15 minute)	-	43
Night	Night-LA1 (1 minute)	-	49

POINT 16

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	36
Evening	Evening-LAeq (15 minute)	-	36
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	45

POINT 20

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	37
Evening	Evening-LAeq (15 minute)	-	37
Night	Night-LAeq (15 minute)	-	37



Licence - 1770

Night Night-LA1 (1 minute) - 45

POINT 23

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	46
Evening	Evening-LAeq (15 minute)	-	46
Night	Night-LAeq (15 minute)	-	46
Night	Night-LA1 (1 minute)	-	46

POINT 9

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	38
Night	Night-LA1 (1 minute)	-	45

- L5.2 The licensee must ensure that noise generated on the premises does not exceed:
 - a) 35 LAeq(15min) during the day, evening or night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1; and
 - b) 45 LA1(1min) during the night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1.

Note: The licensee may provide to the EPA written evidence of any agreement with a landholder which is subject to the above noise limits. The written evidence may be submitted with a licence variation to remove the landholder from the above tables.

- L5.3 For the purpose of condition L5.1 and condition L5.2:
 - (a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays;
 - (b) Evening is defined as the period 6pm to 10pm, and
 - (c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.
- L5.4 The noise limits set out in condition L5.1 and condition L5.2 apply under all meterorological conditions except for any one of the following:



Licence - 1770

- (a) Wind speeds greater than 3 metres/second at 10 metres above ground level; or
- (b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at
- 10 metres above ground level; or
- (c) Stability category G temperature inversion conditions.
- (d) Or as defined under the NSW EPA Noise Policy for Industry 2017.
- L5.5 For the purpose of condition L5.4:
 - (a) the meteorological data to be used for determining meteorological conditions is the data recorded at the meteorological station identified in this licence as EPA Identification Point 26.
 - (b) Stability category temperature inversion conditions are to be determined in accordance with the NSW EPA Noise Policy for Industry 2017.
- Note: The weather station must be designed, commissioned and operated in a manner to obtain the necessary parameters required under the above condition.
- L5.6 For the purpose of determining the noise generated at the premises the licensee must use a Class 1 or Class 2 noise monitoring device as defined by AS IEC61672.1 and AS IEC61672.2-2004, or other noise monitoring equipment accepted by the EPA in writing.
- L5.7 To determine compliance:
 - 1. With the L_{Aeq(15 min)} noise limits in condition L5.1 and condition L5.2, the licensee must locate noise monitoring equipment;
 - (a) within 30 metres of a dwelling facade (but not closer than 3 metres) where any dwelling on the property is situated more then 30 metres from the property boundary that is closest to the premises;
 - (b) approximately on the boundary where any dwelling is situated 30 metres or less from the property boundary that is closest to the premises, or, where applicable,
 - (c) within approximately 50 metres if the boundary of a national park or nature reserve.
 - 2. With the LA1(1 minute) noise limits in condition L5.1 and L5.2, the noise monitoring equipment must be located within 1 metre of a dwelling facade.
 - 3. With the noise limits in condition L5.1 and condition L5.2, the noise monitoring equipment must be located;
 - (a) at the most affected point at a location where there is no dwelling at the location, or
 - (b) at the most affected point within an area at a location prescribed by conditions L5.7 1(a) or L5.7 1(b).
- L5.8 A non-compliance of condition L5.1 or condition L5.2 will still occur where noise generated from the premises in excess of the appropriate limit is measured;
 - a) at a location other than an area prescribed by conditions L5.7 1(a) and L5.7 1(b), and /or
 - b) at a point other than the most affected point at a location.
- L5.9 For the purposes of determining the noise generated at the premises all applicable modification factors as described in the NSW EPA Noise Policy for Industry 2017 must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

Environment Protection Authority - NSW Licence version date: 10-Aug-2022



Licence - 1770

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

M4 Environmental monitoring

Requirement to monitor noise

- M4.1 To determine compliance with condition L5.1, attended noise monitoring must be undertaken in accordance with conditions L5.7 and L5.8, and
 - (a) at each one of the locations listed in condition L5.1;
 - (b) occur quarterly within the reporting period of the Environment Protection Licence with at least 2 months between monitoring periods;
 - (c) occur during each day, evening and night period as defined in the NSW Industrial Noise Policy (EPA 2000) for a minimum of 15 minutes for three of the quarters;
 - (d) the night time 15 minute attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am;
 - (e) the night time LA1 (1 min) attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am;
 - (f) one quarterly monitoring must occur during each day, evening and night period as defined in the NSW EPA Noise Policy for Industry 2017 for a minimum of 1.5 hours during the day; 30 minutes during the evening; and 1 hours during the night, and
 - (g) each quarterly monitoring must be undertaken on a different day(s) of the week not including Saturdays, Sundays and public holidays; and
 - (h) these monitoring conditions take effect in the 2015 Reporting period.

Note: The intention of this condition is that quarterly monitoring be undertaken at each sensitive receiver. That at each sensitive receiver monitoring is undertaken over a range of different days excluding weekends and public holidays during the reporting period so as to be representative of operating hours. That night time 15 minute attended monitoring and the LA1 (1min) monitoring for three of the quarters be undertaken at worst case being the most stable atmospheric conditions and when noise would be most intrusive to sleep. All of the sensitive receivers do not have to be monitored on the same day, evening and night for sub condition f.

M4.2 For the Annual Reporting Period ending March 2015 the EPA will accept all monitoring required by the current Department of Planning and Environment consent (usually quarterly monitoring for noise as dB(A) Leq15minutes) for compliance with noise monitoring requirements in this licence, as a single report attached to the Annual Return for the premises.

M5 Weather monitoring

M5.1 At the point(s) identified below, the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1 of the table below, using the corresponding sampling method, units of measure, averaging period and sampling frequency, specified opposite in the Columns 2, 3, 4 and 5 respectively.

Environment Protection Authority - NSW Licence version date: 10-Aug-2022

Appendix D Calibration certificates





CERTIFICATE NO: C30591

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Syantek

Type No: SV-36 Serial No: 79952

Owner: EMM Consulting Pty Ltd

L3, 175 Scott Street Newcastle, NSW 2300

Tests Performed: Measured Output Pressure level, Frequency & Distortion

Comments: See Details overleaf All Test Passed

Parameter	Pre- Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level1:	NA	N	94.12 dB	999.99 Hz	1.58 %
Level2:	NA	N	114.05 dB	999.99 Hz	1.12 %
Unce	ertainty		±0.11 dB	±0.05%	±0.20 %

Uncertainty (at 95% c.l.) k=2

CONDITION OF TEST:

Ambient Pressure 1007 hPa ±1 hPa

Temperature 21 °C ±1° C **Relative Humidity** 43 % ±5%

Date of Receipt: 16/09/2021

Date of Calibration: 16/09/2021 Date of Issue: 16/09/2021

Acu-Vib Test AVP02 (Calibrators)

Procedure: Test Method: AS IEC 60942 - 2017

CHECKED BY: .

AUTHORISED SIGNATURE:

Accredited for compliance with ISO/IEC 17025 - Calibration Results of the tests, calibration and/or measurements included in this document are traceable to SI units

through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.



Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS

Accredited Lab No. 9262 Acoustic and Vibration Measurements

Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 21 (02) 9680 8133 www.acu-vib.com.au

Page 1 of 2 Calibration Certificate AVCERT02.1 Rev.2.0 14.04.2021



The Calibration Laboratory Skodsborgvej 307, DK-2850 Nærum, Denmark





CERTIFICATE OF CALIBRATION

No: CDK2007931

Page 1 of 12

CALIBRATION OF

Sound Level Meter:

Brüel & Kjær Type 2250

No: 3029363 Id: -

Microphone:

Brüel & Kjær Type 4189

No: 3260501

PreAmplifier:

Brüel & Kjær Type ZC-0032

No: 30109

Supplied Calibrator:

None

Software version:

BZ7222 Version 4.7.6

Pattern Approval:

Instruction manual:

BE1712-22

CUSTOMER

EMM Consulting Ground Floor, Suite 1 20 Chandos Street 2065 St Leonards

New South Wales, Australia

CALIBRATION CONDITIONS

Preconditioning:

4 hours at $23^{\circ}C \pm 3^{\circ}C$

Environment conditions:

See actual values in sections.

SPECIFICATIONS

The Sound Level Meter Brüel & Kjær Type 2250 has been calibrated in accordance with the requirements as specified in IEC 61672-1:2013 class 1. Procedures from IEC 61672-3:2013 were used to perform the periodic tests. The accreditation assures the traceability to the international units system SI.

PROCEDURE

The measurements have been performed with the assistance of Brüel & Kjær Sound Level Meter Calibration System 3630 with application software type 7763 (version 8.2 - DB: 8.20) by using procedure B&K proc 2250, 4189 (IEC 61672:2013).

RESULTS

Calibration Mode: Calibration as received.

The reported expanded uncertainty is based on the standard uncertainty multiplied by a coverage factor k = 2 providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from the standards, calibration method, effect of environmental conditions and any short time contribution from the device under calibration.

Date of calibration: 2020-11-26

Date of issue: 2020-11-26

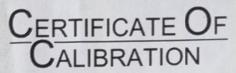
Lene Petersen

Calibration Technician

Erik Bruus
Approved Signatory

Reproduction of the complete certificate is allowed. Parts of the certificate may only be reproduced after written permission.

rsen



CERTIFICATE No: SLM31670

EQUIPMENT TESTED: Sound Level Meter

Manufacturer: B&K

Type No: 2250

Mic. Type: 4189

Pre-Amp. Type: ZC0032

Filter Type: 1/3 Octave

Owner: EMM Consulting

Level 3, 175 Scott Street Newcastle, NSW 2300

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Temperature

Ambient Pressure

Relative Humidity

992 hPa ±1 hPa

26 °C ±1° C

48 % ±5%

Date of Receipt: 02/02/2022

Serial No: 2759405

Serial No: 2983733

Test No: F031671

Serial No: 22666

Date of Calibration: 02/02/2022

Date of Issue: 03/02/2022

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY:

AUTHORISED SIGNATURE:

Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.



Accredited Lab No. 9262 Acoustic and Vibration Measurements

Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 2154 (02) 9680 8133 www.acu-vib.com.au

Page 1 of 2 Calibration Certificate AVCERT10.14 Rev.2.0 14/04/2021

Australia

SYDNEY

Ground floor 20 Chandos Street St Leonards NSW 2065 T 02 9493 9500

NEWCASTLE

Level 3 175 Scott Street Newcastle NSW 2300 T 02 4907 4800

BRISBANE

Level 1 87 Wickham Terrace Spring Hill QLD 4000 T 07 3648 1200

CANBERRA

Suite 2.04 Level 2 15 London Circuit Canberra City ACT 2601

ADELAIDE

Level 4 74 Pirie Street Adelaide SA 5000 T 08 8232 2253

MELBOURNE

Suite 8.03 Level 8 454 Collins Street Melbourne VIC 3000 T 03 9993 1900

PERTH

Suite 9.02 Level 9 109 St Georges Terrace Perth WA 6000 T 08 6430 4800

Canada

TORONTO

2345 Younge Street Suite 300 Toronto ON M4P 2E5 T 647 467 1605

VANCOUVER

60 W 6th Ave Suite 200 Vancouver BC V5Y 1K1 T 604 999 8297







Chain Valley Colliery Quarterly attended noise monitoring - Q4 2022

Prepared for Great Southern Energy Pty Ltd (trading as Delta Coal)

January 2023

Chain Valley Colliery

Quarterly attended noise monitoring - Q4 2022

Great Southern Energy Pty Ltd (trading as Delta Coal)

E220750 RP2

January 2023

Version	Date	Prepared by	Approved by	Comments
2	19 January 2023	Lucas Adamson	Najah Ishac	Final

Approved by

Najah Ishac

Director – Acoustics Team Lead 19 January 2023

Najah thac

Level 3 175 Scott Street Newcastle NSW 2300

This report has been prepared in accordance with the brief provided by Great Southern Energy Pty Ltd (trading as Delta Coal) and, in its preparation, EMM has relied upon the information collected at the times and under the conditions specified in this report. All findings, conclusions or recommendations contained in this report are based on those aforementioned circumstances. The contents of this report are private and confidential. This report is only for Great Southern Energy Pty Ltd (trading as Delta Coal) use in accordance with its agreement with EMM and is not to be relied on by or made available to any other party without EMM's prior written consent. Except as permitted by the *Copyright Act 1968* (Cth) and only to the extent incapable of exclusion, any other use (including use or reproduction of this report for resale or other commercial purposes) is prohibited without EMM's prior written consent. Except where expressly agreed to by EMM in writing, and to the extent permitted by law, EMM will have no liability (and assumes no duty of care) to any person in relation to this document, other than to Great Southern Energy Pty Ltd (trading as Delta Coal)(and subject to the terms of EMM's agreement with Great Southern Energy Pty Ltd).

 $\hbox{@ EMM Consulting Pty Ltd, Ground Floor Suite 01, 20 Chandos Street, St Leonards NSW 2065. 2023.}\\$

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1 Introduction

EMM Consulting Pty Limited (EMM) was engaged to undertake operator-attended noise surveys on behalf of Great Southern Energy Pty Ltd (Delta Coal).

The purpose of the noise monitoring was to address requirements of the approved Chain Valley Colliery Noise Management Plan (NMP), prepared to satisfy the requirements of the Development Consent SSD-5465 (DC) and Environment Protection License (EPL) 1770.

Compliance noise monitoring is required to occur on a quarterly basis for Chain Valley Colliery (CVC or the site). This report presents the results and findings for the fourth quarter (Q4) of 2022 from attended noise monitoring conducted on 14, 15 and 16 December 2022.

The following material was referenced as part of this assessment:

- NSW Department of Planning, Industry and Environment (DPIE), Development Consent SSD-5465, as modified (Modification 4) July 2021 (current as of the monitoring date 16 December 2022);
- NSW Environment Protection Authority (EPA), Environment Protection License 1770, as varied on 10 August 2022 (current as of the monitoring date 16 December 2022);
- Chain Valley Colliery and Mannering Colliery Noise Management Plan (NMP) (approved 19 April 2022) updated following CVC Modification 4 (Mod 4) approval;
- NSW EPA, Industrial Noise Policy (INP), 2000;
- NSW EPA, Industrial Noise Policy application notes, 2017; and
- NSW EPA, Noise Policy for Industry (NPfI), 2017.

A glossary of acoustic terms relevant to this report is provided in Appendix A.

2 Noise limits

2.1 Operational and sleep disturbance noise limits

Noise limits for CVC are provided in Table 1, Condition 7 of Schedule 3 of the DC and Conditions L5.1 and L5.2 of the EPL. Extracts of DC and EPL sections pertaining to noise are provided in Appendix B and Appendix C, respectively. Assessment locations and relevant noise limits are summarised in Table 2.1.

Table 2.1 Noise limits

Assessment location	Day L _{Aeq,15min} , dB	Evening L _{Aeq,15min} , dB	Night L _{Aeq,15min} , dB	Night L _{A1,1min} , dB
R8 (EPL Point 9)	38	38	38	45
R11 (EPL Point 12)	49	49	49	54
R12 (EPL Point 13)	49	49	49	53
R13 (EPL Point 14)	43	43	43	49
R15 (EPL Point 16)	36	36	36	45
R19 (EPL Point 20)	37	37	37	45
R22 (EPL Point 23)	46	46	46	46
All other privately-owned land	35	35	35	45

Appendix 8 of the DC states meteorological conditions under which noise limits do not apply as follows:

- during periods of rain or hail;
- average wind speed at microphone height exceeds 5 m/s;
- wind speeds greater than 3 m/s at 10 m above ground level; or
- temperature inversion conditions greater than 3°C/100 m.

Condition L5.4 of the EPL states meteorological conditions under which noise limits do not apply as follows:

- wind speeds greater than 3 m/s at 10 m above ground level;
- stability category F temperature inversion conditions and wind speeds greater than 2 m/s at 10 m above ground level;
- stability category G temperature inversion conditions; or
- as defined under the NPfl.

The last point refers to 'very noise-enhancing' conditions which are considered outside the 'standard' or 'noise-enhancing' meteorological conditions defined in Table D1 of Fact Sheet D of the NPfI. Table D1 of the NPfI is reproduced in Table 2.2.

Table 2.2 Standard and noise-enhancing meteorological conditions

Meteorological conditions	Meteorological parameters
Standard meteorological conditions	Day/evening/night: stability categories A-D with wind speed up to 0.5 m/s at 10 m above ground level.
Noise-enhancing meteorological conditions	Day/evening: stability categories A-D with wind light winds (up to 3 m/s at 10 m above ground level).
	Night: stability categories A-D with light winds (up to 3 m/s at 10 m above ground level) and/or stability category F with winds up to 2 m/s at 10 m above ground level.

Source: NPfI (EPA 2017).

Further, Fact Sheet E of the NPfI (point 6 of Section E1) provides additional guidance on monitoring the performance of a site against 'suitable' noise limits placed in the consent/environment protection licence. Noise limits are based on 'achievable' noise levels under the 'standard' and/or 'noise-enhancing' meteorological conditions (refer to Table 2.2). Where meteorological conditions are considered 'very noise-enhancing', a positive adjustment of 5 dB applies to noise limits for 'standard' or 'noise-enhancing' meteorological conditions.

In accordance with the NPfI and for consistency between the DC and EPL, where 'very noise-enhancing' meteorological conditions were present during a noise survey, a positive adjustment of 5 dB has been applied to the noise limits stated in the DC and EPL (refer to Table 2.1). This approach means that noise limits will always be applicable, with or without a positive adjustment of 5 dB, depending on whether meteorological conditions are 'very noise-enhancing' or not.

For this assessment, the measured L_{Amax} has been used as a conservative estimate of $L_{A1,1min}$. The INP application notes (EPA 2017) state that the EPA accepts sleep disturbance analysis based on either $L_{A1,1min}$ or L_{Amax} metrics, with the L_{Amax} resulting in a more conservative assessment of site noise emissions.

The DC and EPL state that all modifying factor adjustments must be applied as appropriate to the measured site noise levels before comparison to the relevant noise limits, where applicable. Fact Sheet C of the NPfI outlines the method for assessing the presence of noise with annoying characteristics and applying the relevant modifying factor adjustment(s) to measured site noise at a residential receiver.

2.2 CVC long term goals

Long-term goals for CVC are provided in Condition 8(d) of Schedule 3 of the DC, which states:

8. The Applicant must:

(d) use its best endeavours to achieve the long-term noise goals in Table 2, where reasonable and feasible, and report on progress towards achieving these goals in each Annual Review;

The long-term goals for CVC in Table 2 of the DC are summarised in Table 2.3 for the relevant assessment locations.

Table 2.3 CVC long-term goals

Assessment location	Day L _{Aeq,15min} , dB	Evening L _{Aeq,15min} , dB	Night L _{Aeq,15min} , dB
R11 (EPL Point 12)	41	41	41
R12 (EPL Point 13)	41	41	41
R13 (EPL Point 14)	41	41	41
R22 (EPL Point 23)	40	40	40

As stated in Appendix 9 of the DC, Delta Coal is committed to the progressive implementation of feasible measures to target long-term noise goals which are designed to reduce noise emissions from CVC. For the purpose of this compliance noise monitoring assessment, site $L_{Aeq,15min}$ noise contributions have also been compared to the long-term goals in Section 4, where relevant.

3 Assessment methodology

3.1 Attended noise monitoring

To quantify noise emissions from CVC, attended noise measurements were made at representative locations, in accordance with the NMP.

Attended noise monitoring locations as per the NMP, and their coordinates are listed in Table 3.1 and are shown in Figure 3.1.

Table 3.1 Attended noise monitoring locations

Attended noise	Assessment location	Description	Coordinate	es (MGA56)
monitoring location			Easting	Northing
ATN001	R8 (EPL Point 9)	Griffith Street, Mannering Park	363990	6330529
ATN002	R11 (EPL Point 12)	Lakeshore Avenue, Kingfisher Shores	365218	6329388
ATN003	R15 (EPL Point 16)	Short Street, Macquarie Shores	365165	6328323
ATN004	R14	Lloyd Avenue, Chain Valley Bay	365949	6328530
ATN005	R17	Teragalin Drive, Chain Valley Bay	366560	6328590
ATN006	R19 (EPL Point 20)	Sunset Parade, Chain Valley Bay	366305	6329321
ATN007 ¹	R22 (EPL Point 23)	Cams Boulevard, Chain Valley Bay	366559	6331109
R12	R12 (EPL Point 13)	Lakeshore Avenue, Kingfisher Shores	365185	6329352
R13	R13 (EPL Point 14)	Karoola Avenue, Kingfisher Shores	365391	6329169

Notes: 1. Due to access issues, noise monitoring for ATN007 was conducted at an intermediate location within the site boundary and site noise contributions were calculated back to R22 (EPL Point 23).

Condition M4.1 of the EPL specifies additional noise monitoring requirements to determine compliance, including the following:

- locations of monitoring EPL points listed in Table 3.1;
- frequency of monitoring quarterly and at least two months between monitoring periods;
- periods of monitoring:
 - for three out of four quarterly periods each day, evening and night periods for a minimum of 15 minutes. Night period monitoring must be undertaken between the hours of 1 am and 4 am; and
 - for one out of four quarterly periods day period monitoring must be undertaken for a minimum of 1.5 hours (six 15-minute periods); evening period monitoring must be undertaken for a minimum of 30 minutes (two 15-minute periods); night period monitoring must be undertaken for a minimum of 1 hour (four 15-minute periods).
- days of monitoring each quarterly monitoring must be undertaken on a different day of the week excluding Saturday, Sundays and public holidays.

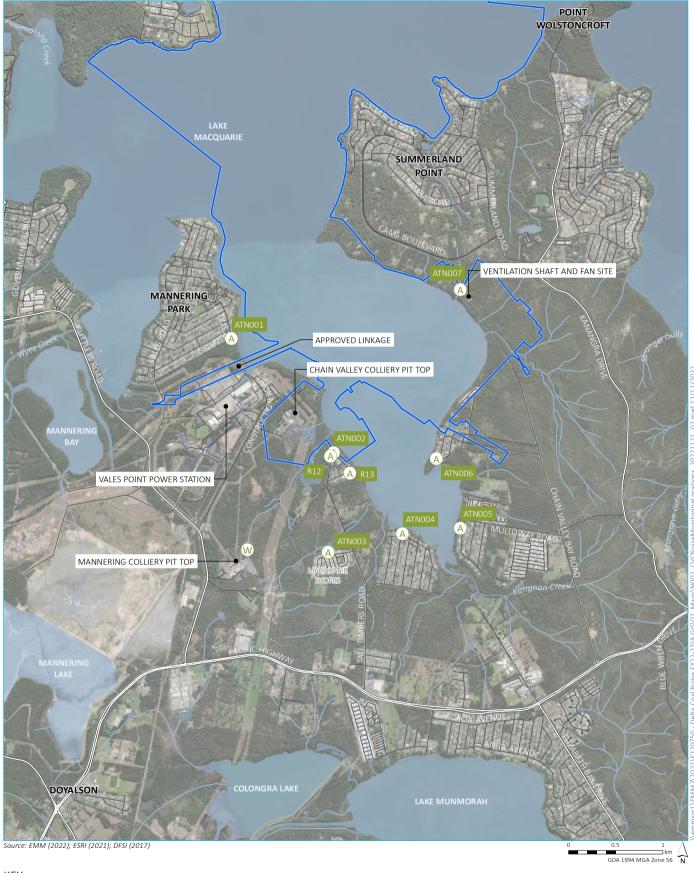
In accordance with the preceding, this round of quarterly attended noise monitoring (Q4 2022) was undertaken on Wednesday 14, Thursday 15 and Friday 16 December 2022 which is more than two months since the last quarterly round of monitoring (Q3 2022) conducted on Wednesday 7, Monday 12 and Thursday 15 September 2022.

As per the approved NMP, attended noise monitoring is scheduled considering the occurrence of regular operations at CVC. Noise monitoring avoids scheduled down-time or maintenance. Regular operations were occurring during this round (Q4 2022) of noise monitoring.

3.2 Instrumentation

Two Brüel & Kjær (B&K) 2250 Type 1 sound analysers (s/n 2759405 and s/n 3029363) were used to conduct 15-minute attended measurements and record one-third octave frequency and statistical noise indices. The sound analysers were calibrated before and on completion of each measurement using a Svantek Type SV 36 calibrator (s/n 79952). Instrumentation calibration certificates are provided in Appendix D.

Where possible throughout each measurement, the operator has quantified separately site noise and other significant sources. This was done by matching audible sounds with the sound analyser response (where applicable) and/or via post-analysis of data (eg low-pass filtering).



KEY

A Noise monitoring location

W Meteorological station

CVC Consent Boundary

─ Major road

— Minor road

— Watercourse/drainage line

Waterbody

CVC attended noise monitoring locations

Chain Valley Colliery Quarterly attended noise monitoring Figure 3.1



3.3 Determination of stability category

For the purpose of this assessment and as required by the DC, EPL and NMP, stability categories were determined for each 15-minute attended monitoring period. The stability category data for the monitoring period as well as the average wind data (speed and direction) were obtained from MC's weather station located to the south of the site (refer to Figure 3.1).

The stability categories and associated ranges in temperature lapse rates are presented in Table 3.2.

 Table 3.2
 Stability categories and temperature lapse rates

Stability category	Temperature lapse rate (ΔT) (°C/100 m)
А	ΔT < -1.9
В	-1.9 ≤ ∆T < -1.7
С	-1.7 ≤ ∆T < -1.5
D	-1.5 ≤ ΔT < -0.5
Е	-0.5 ≤ ΔT < 1.5
F	1.5 ≤ ∆T < 4.0
G	ΔT ≥ 4.0

Source: NPfl (EPA 2017).

4 Review of data and discussion

Noise levels from CVC were determined for each measurement using in-field observations and post-analysis of data as required (eg removing higher frequencies that are not mine related). Attended noise monitoring was completed on 14, 15 and 16 December. Monitoring durations were consistent with the requirements of the EPL. At most monitoring locations monitoring occurred for 1.5 hours during the day period, 30 minutes during the evening period and 1 hour during the night-time period as per the EPL. The exceptions were at ATN004 and ATN005 (not listed in the EPL) where monitoring surveys occurred for 15 minutes during the day, evening and night periods. Results are presented in 15-minute intervals for each location for direct comparison to the relevant noise limits. Results for this Q4 2022 attended noise survey are summarised in Table 4.1.

Meteorological data for the survey was sourced from Mannering Colliery's meteorological station to determine if the standard noise limits applied as per the NMP or if a positive adjustment of 5 dB to noise limits was applicable due to 'very noise-enhancing' meteorological conditions in accordance with the NPfl. Meteorological conditions were 'very noise-enhancing' due to average wind speeds greater than 3 m/s for 60 of the 90 noise measurements (15-minute). Therefore, a positive adjustment of 5 dB was applied to the noise limits for these measurements as indicated in Table 4.1. The standard noise limits as shown in Table 2.1 applied for all other 15-minute noise measurements.

Site noise was inaudible during 78 of the 90 measurements. Typically, when a particular source is not audible above local ambient noise, the likely contribution of that source is at least 10 dB below the measured background (LA90) level. For most of the measurements where site noise was inaudible, the measured L_{A90} was not more than 10 dB above the relevant $L_{Aeq,15min}$ limit. The exceptions were during the day period measurements at ATN002 and R12, where the measured noise levels were consistently and heavily influenced by noise from the Vales Point Power Station (VPPS) and insects.

At the noise monitoring location where site noise was audible, ATN007 (R22, CVC noise levels were below relevant noise limits.

With regard to LFN modifying factor adjustments, these have not been applied to locations where CVC was inaudible. At ATN007 (R22), where CVC noise was audible, measured site noise levels exceeded the relevant LFN threshold levels during the day, evening and night period measurements. Therefore, in accordance with the NPfI, a 2 dB positive adjustment was applied to the estimated site $L_{Aeq,15min}$ for the day period measurement and a 5 dB positive adjustment was applied to the estimated site $L_{Aeq,15min}$ for the evening and night period measurements (as indicated in Table 4.1).

Site $L_{Aeq,15min}$ noise levels were also compared to the long-term noise goals (refer to Table 2.3) for the relevant locations (ie R11, R12, R13 and R22). Site $L_{Aeq,15min}$ measured at ATN002 (R11), R12 and R13 satisfied the relevant long-term goals during the day, evening and night periods. At ATN007 (R22), the measured site $L_{Aeq,15min}$ complied with the relevant long term noise goal during the day period, however exceeded the relevant long-term goal by 3 dB during the evening and night period measurements.

Table 4.1 CVC attended noise monitoring results – Q4 2022

	<u> </u>			To	tal noise	e levels,	dB		Sit	e levels,	dB	Applicab limits		Meteorological conditions ³	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN001	14/12	10:15	43	46	53	57	60	72	Nil	IA	N/A	48 (43+5)	N/A	4.7 m/s 257° Stability Class B Yes	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
ATN001	14/12	10:30	46	48	54	56	63	74	Nil	IA	N/A	48 (43+5)	N/A	3.8 m/s 252° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
ATN001	14/12	10:45	43	45	51	52	64	71	Nil	IA	N/A	48 (43+5)	N/A	4.9 m/s 258° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
ATN001	14/12	11:00	44	46	53	54	65	71	Nil	IA	N/A	48 (43+5)	N/A	3.3 m/s 248° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
ATN001	14/12	11:15	46	49	56	59	64	72	Nil	IA	N/A	48 (43+5)	N/A	4.4 m/s 263° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
ATN001	14/12	11:30	49	51	55	59	61	67	Nil	IA	N/A	48 (43+5)	N/A	4.7 m/s 270° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
ATN001	14/12	19:21	43	45	52	52	65	73	Nil	IA	N/A	38	N/A	2.5 m/s 245° Stability Class E No	Nil	CVC inaudible. VPPS hum consistently audible. Wind in foliage and bird noise frequently audible. Traffic passbys and dogs barking occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

			Total noise levels, dB					Sit	e levels,	dB		ole noise s, dB	Meteorological conditions ³	Exceedance, dB	Comments	
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN001	14/12	19:36	41	44	48	48	58	68	Nil	IA	N/A	38	N/A	1.9 m/s 258° Stability Class F No	Nil	CVC inaudible. VPPS hum consistently audible. Wind in foliage and bird noise frequently audible. Traffic passbys and dogs barking occasionally audible.
ATN001	16/12	23:09	45	47	52	52	57	76	Nil	IA	IA	38	45	2.9 m/s 184° Stability Class D No	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in tree foliage frequently audible. Distant and local traffic occasionally audible.
ATN001	16/12	23:24	45	47	52	51	60	74	Nil	IA	IA	38	45	2.8 m/s 184° Stability Class E No	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in tree foliage frequently audible. Local traffic occasionally audible.
ATN001	16/12	23:39	46	48	51	52	56	71	Nil	IA	IA	48 (43+5)	55 (50+5)	3.5 m/s 181° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in tree foliage frequently audible. Local traffic occasionally audible.
ATN001	16/12	23:54	45	47	52	51	57	77	Nil	IA	IA	38	45	2.7 m/s 187° Stability Class E No	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in tree foliage frequently audible. Local traffic and dog barking occasionally audible.
ATN002	14/12	11:57	62	66	69	71	73	73	Nil	IA	N/A	59 (54+5)	N/A	3.4 m/s 271° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
ATN002	14/12	12:12	59	62	68	70	71	72	Nil	IA	N/A	59 (54+5)	N/A	4.2 m/s 271° Stability Class B Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

			Total noise levels, dB						Sit	e levels,	dB	Applicat limit		Meteorological conditions ³	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN002	14/12	12:27	55	59	67	69	72	73	Nil	IA	N/A	59 (54+5)	N/A	3.3 m/s 268° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
ATN002	14/12	12:42	47	50	63	68	69	74	Nil	IA	N/A	59 (54+5)	N/A	4.4 m/s 255° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
ATN002	14/12	12:57	61	64	67	69	69	70	Nil	IA	N/A	59 (54+5)	N/A	3.5 m/s 274° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
ATN002	14/12	13:12	59	62	66	69	71	72	Nil	IA	N/A	59 (54+5)	N/A	4.7 m/s 263° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
ATN002	15/12	20:06	40	43	51	55	57	60	Nil	IA	N/A	59 (54+5)	N/A	4.2 m/s 173° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in tree foliage frequently audible. Distant dog barking, mower in the distance, distant and local traffic occasionally audible.
ATN002	15/12	20:21	38	40	49	50	62	68	Nil	IA	N/A	59 (54+5)	N/A	4 m/s 173° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in tree foliage and birds frequently audible. Distant and local traffic occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

			Total noise levels, dB						Sit	e levels,	dB		ole noise s, dB	Meteorological conditions ³	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN002	15/12	23:20	36	39	45	48	55	68	Nil	IA	IA	59 (54+5)	64 (59+5)	3.2 m/s 176° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in tree foliage frequently audible. Distant and local traffic occasionally audible.
ATN002	15/12	23:36	36	39	45	47	54	67	Nil	IA	IA	59 (54+5)	64 (59+5)	3.9 m/s 174° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.
ATN002	15/12	23:51	35	38	42	44	50	66	Nil	IA	IA	59 (54+5)	64 (59+5)	3.1 m/s 181° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in tree foliage frequently audible. Distant dog barking audible once.
ATN002	16/12	0:06	36	38	43	45	50	70	Nil	IA	IA	59 (54+5)	64 (59+5)	3.3 m/s 177° Stability Class E Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.
ATN003	15/12	7:09	38	40	45	45	56	69	Nil	IA	N/A	36	N/A	2.9 m/s 263° Stability Class B No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and distant traffic consistently audible. Bird noise frequently audible. Wind in foliage occasionally audible.
ATN003	15/12	7:24	37	39	44	45	51	64	Nil	IA	N/A	46 (41+5)	N/A	3.1 m/s 259° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects and distant traffic consistently audible. Bird noise frequently audible. Wind in foliage occasionally audible.
ATN003	15/12	7:39	37	39	43	45	51	64	Nil	IA	N/A	36	N/A	2.7 m/s 253° Stability Class B No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and distant traffic consistently audible. Bird noise frequently audible. Wind in foliage occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

				To	tal noise	e levels,	dB		Sit	e levels,	dB		ole noise s, dB	Meteorological conditions ³	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN003	15/12	7:54	37	39	43	45	52	63	Nil	IA	N/A	36	N/A	2.8 m/s 245° Stability Class B No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and distant traffic consistently audible. Bird noise frequently audible. Wind in foliage occasionally audible.
ATN003	15/12	8:09	37	39	43	46	52	62	Nil	IA	N/A	36	N/A	2.6 m/s 244° Stability Class A No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and distant traffic consistently audible. Bird noise frequently audible. Wind in foliage occasionally audible.
ATN003	15/12	8:24	37	39	42	44	50	58	Nil	IA	N/A	36	N/A	2.7 m/s 234° Stability Class A No	Nil	CVC inaudible. VPPS hum consistently audible. Insects and distant traffic consistently audible. Bird noise frequently audible. Wind in foliage occasionally audible.
ATN003	14/12	21:00	38	39	41	42	44	48	Nil	IA	N/A	36	N/A	1.7 m/s 256° Stability Class F No	Nil	CVC inaudible. MC plant noise consistently audible (dominant). VPPS hum consistently audible. Insects consistently audible. Distant traffic frequently audible. Wind in tree foliage and local traffic occasionally audible.
ATN003	14/12	21:15	38	40	41	43	44	46	Nil	IA	N/A	36	N/A	1.3 m/s 253° Stability Class F No	Nil	CVC inaudible. MC plant noise consistently audible (dominant). VPPS hum consistently audible. Overland conveyor unrelated to Delta Coal audible at the end of the measurement period. Insects consistently audible. Wind in tree foliage, distant and local traffic occasionally audible.
ATN003	14/12	22:45	40	41	42	43	45	52	Nil	IA	IA	36	45	1.5 m/s 257° Stability Class E No	Nil	CVC inaudible. MC plant noise consistently audible (dominant). VPPS hum consistently audible in the background. Overland conveyor unrelated to Delta Coal consistently audible. Insects consistently audible. Distant traffic occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

				To	tal noise	e levels,	dB		Sit	e levels,	dB	Applicat limit		Meteorological conditions ³	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN003	14/12	23:45	41	43	44	45	46	51	Nil	IA	IA	36	45	1.7 m/s 261° Stability Class E No	Nil	CVC inaudible. MC plant noise consistently audible (dominant). VPPS hum consistently audible in the background. Overland conveyor unrelated to Delta Coal consistently audible. Insects consistently audible. Birds audible at the start of the measurement period.
ATN003	15/12	0:50	40	42	43	44	45	58	Nil	IA	IA	36	45	0.9 m/s 284° Stability Class F No	Nil	CVC inaudible. MC plant noise consistently audible (dominant). VPPS hum consistently audible in the background. Insects consistently audible.
ATN003	15/12	1:15	38	40	41	42	43	55	Nil	IA	IA	36	45	1 m/s 264° Stability Class E No	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Overland conveyor unrelated to Delta Coal consistently audible. Insects consistently audible.
ATN004	14/12	17:13	35	38	45	47	56	65	Nil	IA	N/A	45 (40+5)	N/A	3.3 m/s 242° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Bird noise frequently audible. Wind in foliage and distant traffic occasionally audible.
ATN004	14/12	18:57	37	39	49	48	59	82	Nil	IA	N/A	35	N/A	2.8 m/s 254° Stability Class E No	Nil	CVC inaudible. VPPS hum consistently audible. Bird noise frequently audible. Wind in foliage, distant traffic and resident noise occasionally audible.
ATN004	15/12	1:44	34	37	43	46	48	49	Nil	IA	IA	35	45	1.2 m/s 266° Stability Class E No	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Distant dog barking and aircraft noise audible once.
ATN005	14/12	16:49	39	43	48	50	56	66	Nil	IA	N/A	45 (40+5)	N/A	3.7 m/s 228° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects and lapping water consistently audible. Wind in foliage frequently audible. Bird noise and distant traffic occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

		Total noise levels, dB					Sit	e levels,	dB	Applicat limit		Meteorological conditions ³	Exceedance, dB	Comments		
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN005	14/12	18:34	41	44	48	50	54	70	Nil	IA	N/A	35	N/A	2.9 m/s 254° Stability Class E No	Nil	CVC inaudible. VPPS hum consistently audible. Lapping water consistently audible. Wind in foliage and bird noise frequently audible.
ATN005	15/12	2:11	39	41	46	48	56	58	Nil	IA	IA	34	45	1.5 m/s 262° Stability Class E No	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Frogs consistently audible.
ATN006	14/12	15:14	36	38	45	50	54	59	Nil	IA	N/A	47 (42+5)	N/A	4.8 m/s 263° Stability Class B Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise and traffic passbys occasionally audible.
ATN006	14/12	15:29	37	41	44	46	49	55	Nil	IA	N/A	47 (42+5)	N/A	3.8 m/s 258° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage and pedestrians talking frequently audible. Bird noise and traffic passbys occasionally audible.
ATN006	14/12	15:44	37	41	46	49	51	57	Nil	IA	N/A	47 (42+5)	N/A	3.8 m/s 254° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage and pedestrians talking frequently audible. Bird noise and traffic passbys occasionally audible.
ATN006	14/12	15:59	36	40	45	47	54	56	Nil	IA	N/A	37	N/A	2.8 m/s 237° Stability Class A No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage and pedestrians talking frequently audible. Bird noise and traffic passbys occasionally audible.
ATN006	14/12	16:14	37	40	45	48	53	62	Nil	IA	N/A	37	N/A	3 m/s 261° Stability Class A No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage and pedestrians talking frequently audible. Bird noise and traffic passbys occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

	Total noise levels, dB							Si	te levels,	dB	Applicat limit		Meteorological conditions ³	Exceedance, dB	Comments	
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN006	14/12	16:29	35	39	44	47	50	62	Nil	IA	N/A	47 (42+5)	N/A	3.4 m/s 241° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise and traffic passbys occasionally audible.
ATN006	14/12	18:00	35	38	42	42	52	65	Nil	IA	N/A	47 (42+5)	N/A	3.8 m/s 264° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible. Wind in foliage, resident noise, dogs barking and distant traffic occasionally audible.
ATN006	14/12	18:15	36	38	43	45	50	61	Nil	IA	N/A	47 (42+5)	N/A	4.4 m/s 257° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible. Wind in foliage, resident noise, dogs barking and distant traffic occasionally audible.
ATN006	15/12	5:57	38	40	48	44	55	76	Nil	IA	IA	37	45	1.5 m/s 256° Stability Class F No	Nil	CVC inaudible. VPPS hum consistently audible. Bird noise consistently audible. Distant traffic and dogs barking occasionally audible.
ATN006	15/12	6:12	38	41	44	45	51	67	Nil	IA	IA	37	45	1.4 m/s 263° Stability Class E No	Nil	CVC inaudible. VPPS hum consistently audible. Bird noise consistently audible. Distant traffic and dogs barking occasionally audible.
ATN006	15/12	6:28	38	41	43	44	47	63	Nil	IA	IA	37	45	1.9 m/s 264° Stability Class F No	Nil	CVC inaudible. VPPS hum consistently audible. Bird noise consistently audible. Distant traffic and dogs barking occasionally audible.
ATN006	15/12	6:43	38	40	48	44	62	71	Nil	IA	IA	37	45	1.6 m/s 265° Stability Class F No	Nil	CVC inaudible. VPPS hum consistently audible. Bird noise consistently audible. Distant traffic and dogs barking occasionally audible.
ATN007	15/12	9:10	48	50	54	56	58	66	2	40 (38+2)	N/A	56 (51+5)	N/A	3.5 m/s 236° Stability Class A Yes	Nil	CVC vent fan consistently audible. Insects and bird noise consistently audible. Distant traffic occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

				To	tal noise	e levels,	dB		Si	te levels, (dB	Applicat limit		Meteorological conditions ³ Very noise-	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN007	15/12	9:25	48	51	55	58	59	61	2	40 (38+2)	N/A	56 (51+5)	N/A	3.2 m/s 241° Stability Class A Yes	Nil	CVC vent fan consistently audible. Insects and bird noise consistently audible. Distant traffic occasionally audible.
ATN007	15/12	9:40	48	50	54	57	61	62	2	40 (38+2)	N/A	56 (51+5)	N/A	3.7 m/s 225° Stability Class A Yes	Nil	CVC vent fan consistently audible. Insects and bird noise consistently audible. Distant traffic occasionally audible.
ATN007	15/12	9:55	48	50	56	60	64	66	2	40 (38+2)	N/A	46	N/A	2.3 m/s 231° Stability Class A No	Nil	CVC vent fan consistently audible. Insects and bird noise consistently audible. Distant traffic occasionally audible.
ATN007	15/12	10:10	49	51	54	56	61	62	2	40 (38+2)	N/A	46	N/A	1.9 m/s 229° Stability Class A No	Nil	CVC vent fan consistently audible. Insects and bird noise consistently audible. Distant traffic occasionally audible.
ATN007	15/12	10:25	49	50	55	58	64	65	2	40 (38+2)	N/A	56 (51+5)	N/A	3.2 m/s 183° Stability Class A Yes	Nil	CVC vent fan consistently audible. Insects and bird noise consistently audible. Distant traffic occasionally audible.
ATN007	15/12	21:29	47	48	49	50	51	58	5	43 (38+5)	N/A	56 (51+5)	N/A	3.5 m/s 178° Stability Class D Yes	Nil	CVC vent fan consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.
ATN007	15/12	21:44	48	49	50	51	53	57	5	43 (38+5)	N/A	56 (51+5)	N/A	4.3 m/s 174° Stability Class D Yes	Nil	CVC vent fan consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.
ATN007	15/12	22:00	48	49	51	52	55	58	5	43 (38+5)	38	56 (51+5)	56 (51+5)	4.4 m/s 176° Stability Class D Yes	Nil	CVC vent fan consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

				То	tal noise	e levels,	dB		Si	te levels,	dB	• •	ble noise s, dB	conditions ³ Very noise-	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
ATN007	15/12	22:15	48	49	51	52	56	57	5	43 (38+5)	38	56 (51+5)	56 (51+5)	3.8 m/s 177° Stability Class D Yes	Nil	CVC vent fan consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.
ATN007	15/12	22:30	48	50	51	53	54	62	5	43 (38+5)	38	56 (51+5)	56 (51+5)	3.9 m/s 180° Stability Class E Yes	Nil	CVC vent fan consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.
ATN007	15/12	22:45	48	49	51	52	54	59	5	43 (38+5)	38	56 (51+5)	56 (51+5)	3.6 m/s 177° Stability Class D Yes	Nil	CVC vent fan consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.
R12	14/12	11:57	62	66	69	71	73	73	Nil	IA	N/A	59 (54+5)	N/A	3.4 m/s 271° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
R12	14/12	12:12	59	62	68	70	71	72	Nil	IA	N/A	59 (54+5)	N/A	4.2 m/s 271° Stability Class B Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
R12	14/12	12:27	55	59	67	69	72	73	Nil	IA	N/A	59 (54+5)	N/A	3.3 m/s 268° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
R12	14/12	12:42	47	50	63	68	69	74	Nil	IA	N/A	59 (54+5)	N/A	4.4 m/s 255° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

				То	tal noise	e levels,	dB		Sit	e levels,	dB		ole noise s, dB	Meteorological conditions ³ Very noise-	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
R12	14/12	12:57	61	64	67	69	69	70	Nil	IA	N/A	59 (54+5)	N/A	3.5 m/s 274° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
R12	14/12	13:12	59	62	66	69	71	72	Nil	IA	N/A	59 (54+5)	N/A	4.7 m/s 263° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise, dogs barking and traffic passbys occasionally audible.
R12	15/12	20:06	40	43	51	55	57	60	Nil	IA	N/A	59 (54+5)	N/A	4.2 m/s 173° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in tree foliage frequently audible. Distant dog barking, mower in the distance, distant and local traffic occasionally audible.
R12	15/12	20:21	38	40	49	50	62	68	Nil	IA	N/A	59 (54+5)	N/A	4 m/s 173° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible (dominant). Insects consistently audible. Wind in tree foliage and birds frequently audible. Distant and local traffic occasionally audible.
R12	15/12	23:20	36	39	45	48	55	68	Nil	IA	IA	59 (54+5)	64 (59+5)	3.2 m/s 176° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in tree foliage frequently audible. Distant and local traffic occasionally audible.
R12	15/12	23:36	36	39	45	47	54	67	Nil	IA	IA	59 (54+5)	64 (59+5)	3.9 m/s 174° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

				To	tal noise	e levels,	dB		Sit	e levels,	dB		ole noise s, dB	conditions ³ Very noise-	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
R12	15/12	23:51	35	38	42	44	50	66	Nil	IA	IA	59 (54+5)	64 (59+5)	3.1 m/s 181° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in tree foliage frequently audible. Distant dog barking audible once.
R12	16/12	0:06	36	38	43	45	50	70	Nil	IA	IA	59 (54+5)	64 (59+5)	3.3 m/s 177° Stability Class E Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.
R13	14/12	13:29	44	45	50	53	56	67	Nil	IA	N/A	53 (48+5)	N/A	3.2 m/s 274° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise and traffic passbys occasionally audible.
R13	14/12	13:44	43	46	52	55	60	70	Nil	IA	N/A	53 (48+5)	N/A	4.8 m/s 247° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise and traffic passbys occasionally audible.
R13	14/12	13:59	41	43	49	52	57	63	Nil	IA	N/A	53 (48+5)	N/A	4.1 m/s 243° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise and traffic passbys occasionally audible.
R13	14/12	14:14	40	44	52	53	60	72	Nil	IA	N/A	53 (48+5)	N/A	4.5 m/s 248° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise and traffic passbys occasionally audible.
R13	14/12	14:29	40	43	48	51	58	68	Nil	IA	N/A	53 (48+5)	N/A	3.2 m/s 252° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise and traffic passbys occasionally audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

				Tot	tal noise	e levels,	dB		Sit	e levels,	dB		ole noise s, dB	Meteorological conditions ³ Very noise-	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
R13	14/12	14:44	43	45	56	56	65	83	Nil	IA	N/A	53 (48+5)	N/A	3.4 m/s 258° Stability Class A Yes	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in foliage frequently audible. Bird noise and traffic passbys occasionally audible.
R13	15/12	20:38	35	38	48	49	57	70	Nil	IA	N/A	53 (48+5)	N/A	3.8 m/s 175° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible in the background. Insects consistently audible. Wind in tree foliage frequently audible. Distant and local traffic occasionally audible. Nearby residents talking briefly.
R13	15/12	20:53	36	39	48	47	60	76	Nil	IA	N/A	53 (48+5)	N/A	3.3 m/s 173° Stability Class D Yes	Nil	CVC inaudible. VPPS hum consistently audible in the background. Insects consistently audible. Wind in tree foliage frequently audible. Distant and local traffic occasionally audible. Nearby resident talking at the end of the measurement period.
R13	16/12	0:42	35	37	43	46	51	59	Nil	IA	IA	43	49	2.7 m/s 189° Stability Class E No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.
R13	16/12	0:57	35	37	44	47	55	58	Nil	IA	IA	43	49	3 m/s 189° Stability Class D No	Nil	CVC inaudible. VPPS hum consistently audible. Insects consistently audible. Wind in tree foliage frequently audible.
R13	16/12	22:23	39	42	46	49	51	62	Nil	IA	IA	53 (48+5)	59 (54+5)	3.3 m/s 175° Stability Class D Yes	Nil	CVC inaudible. VPPS hum just audible. Insects consistently audible. Wind in tree foliage frequently audible.

Table 4.1 CVC attended noise monitoring results – Q4 2022

				То	tal nois	e levels,	dB		Sit	e levels,	dB	Applicable noise limits, dB		Meteorological conditions ³	Exceedance, dB	Comments
Location	Date	Start time	L _{Amin}	L _{A90}	L _{Aeq}	L _{A10}	L _{A1}	L _{Amax}	Mod. factor ¹	L _{Aeq}	L _{Amax} ²	L _{Aeq}	L _{Amax} ²	Very noise- enhancing?		
R13	16/12	22:38	39	42	48	49	58	65	Nil	IA	IA	53 (48+5)	59 (54+5)	3.9 m/s 179° Stability Class D Yes	Nil	CVC inaudible. Insects consistently audible. Wind in tree foliage audible. Local traffic audible once.

Notes:

- 1. Modifying factor adjustment in accordance with Fact sheet C of the NPfl.
- 2. For assessment purposes the recorded L_{Amax} has been used as a conservative estimate of the $L_{A1,1min}$.
- 3. Meteorological data including wind speed, wind direction and stability category (SC) were taken as an average over 15 minutes from MC's weather station (Refer to Section 3.3).
- 4. Due to access issues, noise monitoring for ATN007 was conducted at an intermediate location. Total noise levels shown were measured at the alternative location and site noise levels calculated back to R22/EPL Point 23.

5. IA = inaudible, N/A = not applicable.

5 Conclusion

EMM has completed a survey of mine noise from CVC within the surrounding community based on attended measurements conducted on 14, 15 and 16 December.

Meteorological data for the survey was sourced from Mannering Colliery's meteorological station to determine if the standard noise limits applied as per the NMP or if a positive adjustment of 5 dB to noise limits was applicable due to 'very noise-enhancing' meteorological conditions in accordance with the NPfl. Meteorological conditions were 'very noise-enhancing' due to average wind speeds greater than 3 m/s for 60 of the 90 lots of 15-minute noise measurements. Therefore, a positive adjustment of 5 dB was applied to the noise limits for these measurements. The standard noise limits applied for all other 15-minute noise measurements.

The assessment of noise from site included consideration of modifying factors for annoying noise characteristics, where relevant, and in accordance with the NPfl. Measured site noise levels exceeded the relevant LFN threshold levels during the day, evening and night period measurements at ATN007 (R22). Therefore, in accordance with the NPfl, a 2 dB positive adjustment was applied to the estimated site $L_{Aeq,15min}$ for the day period measurement and a 5 dB positive adjustment was applied to the estimated site $L_{Aeq,15min}$ contributions for the evening and night period measurements.

CVC $L_{Aeq,15min}$ and L_{Amax} noise levels during this survey (Q4 2022) were below relevant noise limits at all monitoring locations as outlined and therefore compliant with the DC, EPL and NMP.

CVC $L_{Aeq,15min}$ were also compared to the long-term noise goals applicable at R11 (ATN002), R12, R13 and R22 (ATN007). CVC $L_{Aeq,15min}$ satisfied these during all measurements at R11 (ATN002), R12 and R13. However, at R22 (ATN007), site $L_{Aeq,15min}$ exceeded the relevant long-term goal by 3 dB during the evening and night period measurements.

References

Chain Valley Colliery and Mannering Colliery Noise Management Plan, 2022.

NSW Department of Planning and Environment, Development Consent SSD5465, 2020.

NSW Environment Protection Authority, Environment Protection License 1770, 2022.

NSW Environment Protection Authority, Industrial Noise Policy, 2000.

NSW Environment Protection Authority, Industrial Noise Policy application notes, 2017.

NSW Environment Protection Authority, Noise Policy for Industry, 2017.

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Appendix A

Glossary of acoustic terms



Several technical terms are discussed in this report. These are explained in Table A.1.

Table A.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
L _{A1}	The 'A-weighted' noise level which is exceeded 1% of the time.
L _{A1,1min}	The 'A-weighted' noise level exceeded for 1% of the specified time period of 1 minute.
L _{A10}	The 'A-weighted' noise level which is exceeded 10% of the time.
L _{A90}	Commonly referred to as the background noise level. The 'A-weighted' noise level exceeded 90% of the time.
L _{Aeq}	The energy average noise from a source. This is the equivalent continuous 'A-weighted' sound pressure level over a given period. The $L_{Aeq,15min}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L _{Amin}	The minimum 'A-weighted' noise level received during a measuring interval.
L _{Amax}	The maximum root mean squared 'A-weighted' sound pressure level (or maximum noise level) received during a measuring interval.
L _{Ceq}	The equivalent continuous 'C-weighted' sound pressure level over a given period. The $L_{\text{Ceq},15\text{min}}$ descriptor refers to an L_{Ceq} noise level measured over a 15 minute period. C-weighting can be used to measure low frequency noise.
Day period	Monday – Saturday: 7 am to 6 pm, on Sundays and Public Holidays: 8 am to 6 pm.
Evening period	Monday – Saturday: 6 pm to 10 pm, on Sundays and Public Holidays: 6 pm to 10 pm.
Night period	Monday – Saturday: 10 pm to 7 am, on Sundays and Public Holidays: 10 pm to 8 am.
Temperature inversion	A meteorological condition where the atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibels (dB), the unit of noise measurement. Table A.2 gives an indication as to what an average person perceives about changes in noise levels. Examples of common noise levels are provided in Figure A.1.

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Table A.2 Perceived change in noise

Change in sound pressure level (dB)	Perceived change in noise in surrounding environment
up to 2	not perceptible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud

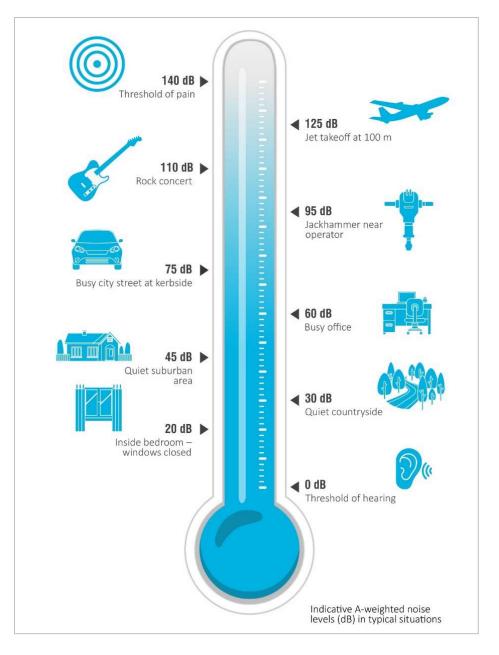


Figure A.1 Common noise levels

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Appendix B
Project approval extract



- 4. Prior to 31 March 2014, and every 12 months thereafter for each calendar year in which coal haulage from the site is undertaken utilising public roads, unless the Planning Secretary directs otherwise, the Applicant must commission a suitably qualified person, whose appointment has been approved by the Planning Secretary at least one month prior to undertaking the audit, to conduct an Independent Traffic Audit of the development. This audit must:
 - (a) be undertaken without prior notice to the Applicant, and in consultation with TfNSW, NCC, CC Council and the CCC;
 - (b) assess the impact of the development on the performance and safety of the road network, including a review of:
 - haulage records;
 - accident records on the haulage route, infringements relating to the code of conduct and any incidents involving haulage vehicles;
 - · community complaints register; and
 - (c) assess the effectiveness of the Road Transport Protocol; and, if necessary, recommend measures to reduce or mitigate any adverse (or potentially adverse) impacts.
- 5. Within 1 month of receiving the audit report, or as otherwise agreed by the Planning Secretary, the Applicant must submit a copy of the report to the Planning Secretary, with a detailed response to any of the recommendations contained in the audit report, including a timetable for the implementation of any measures proposed to address the recommendations in the audit report.

A summary of the audit report must be included in the Annual Review.

Alternative Coal Transport Options

- 6. Prior to 31 December 2014, and every three years thereafter, the Applicant must prepare and submit to the Planning Secretary for approval, a study of the reasonable and feasible options to reduce or eliminate the use of public roads to transport coal from the development, unless otherwise agreed by the Planning Secretary. The assessment must include:
 - (a) an analysis of the capital, construction and operating costs of the alternative transport options; and
 - (b) quantified social and environmental impacts associated with road and rail transport.

NOISE

Noise Impact Assessment Criteria

7. The Applicant must ensure that the noise generated by the development at any residence on privatelyowned land does not exceed the criteria for the location in Table 1 nearest to that residence.

Table 1: Noise Criteria dB(A)

Location	Day	Evening	Nig	ght
Location	L _{Aeq(15 min)}	L _{Aeq(15 min)}	L Aeq(15 min)	LA1(1 min)
R8	38	38	38	45
R11	49	49	49	54
R12	49	49	49	53
R13	43	43	43	49
R15	36	36	36	45
R19	37	37	37	45
R22	46	46	46	46
all other				
privately-owned land	35	35	35	45

Notes:

- To interpret the locations referred to in Table 1, see Appendix 6 and the EIS; and
- Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 8 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

However, these criteria do not apply if the Applicant has a written agreement with the relevant landowner to exceed the noise criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Operating Conditions

- 8. The Applicant must:
 - implement best management practice, including all reasonable and feasible noise mitigation measures, to minimise the construction, operational and transport noise generated by the development;
 - regularly assess the noise monitoring and meteorological data and relocate, modify, and/or stop operations on site to ensure compliance with the relevant conditions of this consent;
 - (c) minimise the noise impacts of the development during meteorological conditions under which the noise limits in this consent do not apply (see Appendix 8);
 - (d) use its best endeavours to achieve the long-term noise goals in Table 2, where reasonable and feasible, and report on progress towards achieving these goals in each Annual Review;
 - (e) carry out a comprehensive noise audit of the development in conjunction with each independent environmental audit; and
 - (f) prepare an action plan to implement any additional reasonable and feasible onsite noise mitigation measures identified by each audit;

to the satisfaction of the Planning Secretary.

Table 2: Long-term Noise Goals dB(A)

Location	Day	Evening	Night
Location	L _{Aeq(15 min)}	L _{Aeq(15 min)}	L _{Aeq(15 min)}
R11 – R13	41	41	41
R22	40	40	40

Notes:

- To interpret the locations referred to in Table 2, see Appendix 6 and the EIS; and
- Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 8 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.

Noise Management Plan

- The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must:
 - (a) be prepared in consultation with the EPA and submitted to the Planning Secretary for approval within 4 months of the date of this consent, unless otherwise agreed by the Planning Secretary;
 - (b) describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this consent;
 - (c) describe the proposed noise management system in detail including the mitigation measures that would be implemented to minimise noise during construction and operations, including on and off site road noise generated by vehicles associated with the development; and
 - (d) include a monitoring program that:
 - uses attended monitoring to evaluate the compliance of the development against the noise criteria in this consent;
 - evaluates and reports on:
 - the effectiveness of the on-site noise management system; and
 - compliance against the noise operating conditions; and
 - defines what constitutes a noise incident, and includes a protocol for identifying and notifying the Department and relevant stakeholders of any noise incidents.

The Applicant must implement the Noise Management Plan as approved by the Planning Secretary.

AIR QUALITY

Odour

10. The Applicant must ensure that no offensive odours are emitted from the site, as defined under the POEO

APPENDIX 6 NOISE RECEIVER LOCATIONS

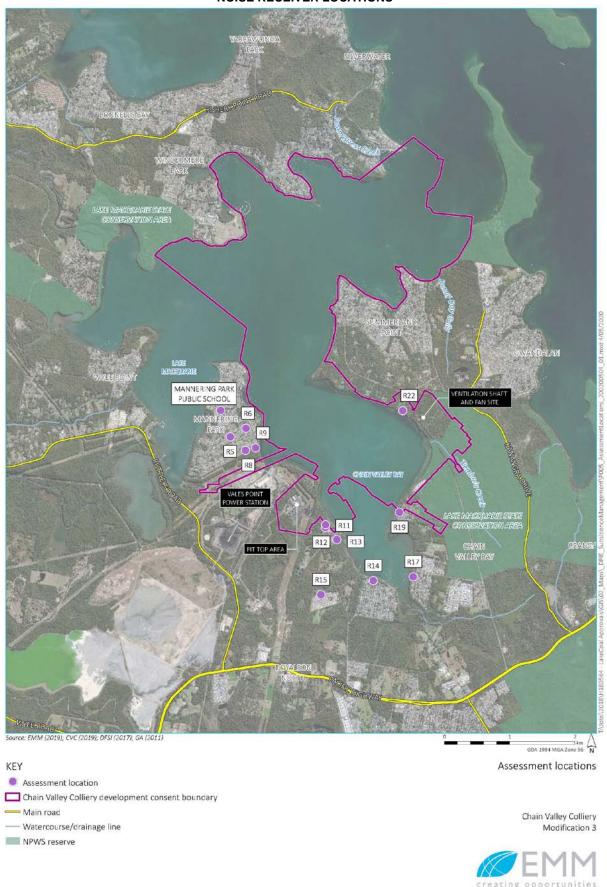


Figure 1: Noise Receiver Locations

APPENDIX 8 NOISE COMPLIANCE ASSESSMENT

Applicable Meteorological Conditions

- The noise criteria in Table 1 of the conditions are to apply under all meteorological conditions except the following:
 - (a) during periods of rain or hail;
 - (b) average wind speed at microphone height exceeds 5 m/s;
 - (c) wind speeds greater than 3 m/s measured at 10 m above ground level; or
 - (d) temperature inversion conditions greater than 3°C/100 m.

Determination of Meteorological Conditions

2. Except for wind speed at microphone height, the data to be used for determining meteorological conditions must be that recorded by the meteorological station described in condition 14 of schedule 3.

Compliance Monitoring

- 3. Attended monitoring is to be used to evaluate compliance with the relevant conditions of this consent.
- 4. This monitoring must be carried out at least 4 times in each calendar year (ie at least once every 3 months), unless the Planning Secretary directs otherwise.
- 5. Unless otherwise agreed with the Planning Secretary, this monitoring is to be carried out in accordance with the relevant requirements for reviewing performance set out in the *NSW Industrial Noise Policy* (as amended from time to time), in particular the requirements relating to:
 - (a) monitoring locations for the collection of representative noise data;
 - (b) meteorological conditions during which collection of noise data is not appropriate;
 - (c) equipment used to collect noise data, and conformity with Australian Standards relevant to such equipment; and
 - (d) modifications to noise data collected, including for the exclusion of extraneous noise and/or penalties for modifying factors apart from adjustments for duration.

- results of this monitoring program will be reviewed by a suitably qualified expert and used to determine the appropriateness of the existing irrigation area to receive this effluent:
- develop a program to monitor creek line channel stability and the health of riparian vegetation within Swindles Creek. Monitoring will be undertaken in accordance with Section 8.5.2 of the Surface Water Impact Assessment (EIS Appendix E) and incorporated into the Colliery's WMP or Biodiversity Management Plan; and
- record monitoring data in accordance with the Colliery's WMP and EPL 1770.
 Monitoring data will be interpreted as it is received to ensure appropriate operational guidance on monitoring water quality within desired parameters.

 Results of water quality monitoring will be reported in the Annual Review and made available to the CCC, as well as CC Council and LMCC.

Noise

Management and monitoring of noise will continue to be undertaken in accordance with the Colliery's NMP, which will be reviewed and updated as required to include the commitments made below. Great Southern Energy Pty Limited will:

- continue attended compliance monitoring on site which will be used to identify potential hot spots and primary noise sources;
- continue real-time noise monitoring alerts to site personnel to enable implementation of any required rapid noise management initiatives;
- manage potential non-compliance through a noise complaint handling and response system, including the identification of responsible sources to enable targeted remedial action;
- assess if further noise mitigation options for the ventilation fans are reasonable and feasible following the receipt of attenuation proposals; and
- discuss potential management measures or agreement options with the landowner at 275 Cams Boulevard, following receipt of proposals from acoustics specialists.

In addition to the above, Great Southern Energy Pty Limited is committed to the progressive implementation of feasible measures to target long-term noise goals which are designed to reduce noise emissions from the Colliery. Long-term options for investigation include:

- modification to belt/movement alarms;
- investigation of surface conveyer and coal preparation equipment, to determine if noise reductions are possible;
- identifying sound attenuation options for the surface bulldozer and front-end loader;
- strategic placement of acoustic barriers;
- attenuation for the surface screener/shaker;
- installation of guiet rollers for surface conveyor belts;
- acoustic treatments around compressors; and
- the use of a conveyor stacker for product coal stockpiling.

Air Quality and greenhouse gases

Management and monitoring of air quality and greenhouse gases will continue to be undertaken in accordance with the Colliery's AQGHGMP, which will be reviewed and updated as required to include the commitments made below Great Southern Energy Pty Limited will:

- investigate the use of a stacker to replace hauling between current conveyor system and stockpiles;
- undertake GHG monitoring comprising measurement of carbon dioxide and methane at the ventilation shaft and fan sites; and
- record and report annual diesel, oil, grease, acetylene and electricity use to fulfil National Greenhouse and Energy Reporting Scheme requirements.

Traffic and transport

Management and monitoring of traffic and transport will continue to be undertaken in accordance with the Colliery's RTP. In addition, Great Southern Energy Pty Limited will continue to investigate alternative options for transporting export coal to the Port of Newcastle, specifically the preferred rail transport option, requiring the construction of a private haul road to the VPPS coal unloading facility and associated infrastructure upgrades. In addition, Great Southern Energy Pty Limited will investigate options to reduce peak hour traffic would be investigated including potentially limiting the peak hourly volumes of the Colliery truck traffic which would be permitted to travel via this intersection should the Colliery not be using rail transport for export coal by five years from the granting of development consent. Alternatively, a pro-rata financial contribution to the cost of installing traffic signals at the southbound intersection of the F3 and Sparks Road interchange could be made commensurate with the percentage of Colliery generated traffic using the intersection.

Subsidence

Management and monitoring of subsidence will continue to be undertaken in accordance with the Colliery's SMP or Extraction Plans, which will be reviewed and

Appendix C EPL extract





Licence - 1770

1	Discharge to waters Discharge quality and volume monitoring	Discharge to waters Discharge quality and volume monitoring	Discharge to waters and monitoring from final settlement pond, gravity fed discharge pipe as identified in plan titled "Delta Coal Chain Valley Colliery, Surface EPA Premises Plan, DRG No: C1S0165_2" 10 August 2021 and saved as EPA Document DOC21/691135.
27	Discharge to waters Discharge quality and volume monitoring	Discharge to waters Discharge quality and volume monitoring	Discharge to waters via dam spillway from final settlement pond adjacent to EPA Point 1 as identified in plan titled "Delta Coal Chain Valley Colliery, Surface EPA Premises Plan, DRG No: C1S0165_2" 10 August 2021 and saved as EPA Document DOC21/691135.

P1.4 The following points referred to in the table below are identified in this licence for the purposes of weather and/or noise monitoring and/or setting limits for the emission of noise from the premises.

Noise/Weather

EPA identi- fication no.	Type of monitoring point	Location description
9	Noise monitoring	Noise monitoring site R8 as defined in Development Consent SSD-5465 (MOD 3), located at 109 Griffith Street, MANNERING PARK, 2259
12	Noise monitoring	Noise monitoring site R11 as defined in Development Consent SSD-5465 (MOD 3), located at 35 Lakeshore Avenue, CHAIN VALLEY BAY, 2259
13	Noise monitoring	Noise monitoring site R12 as defined in Development Consent SSD-5465 (MOD 3), located at 20 Lakeshore Avenue, Kingfisher Shores, CHAIN VALLEY BAY, 2259
14	Noise monitoring	Noise monitoring site R13 as defined in Development Consent SSD-5465 (MOD 3), located at 33 Karoola Avenue, Kingfisher Shores, CHAIN VALLEY BAY, 2259
16	Noise monitoring	Noise monitoring site R15 as defined in Development Consent SSD-5465 (MOD 3), located at Short Street, Macquarie Shores, CHAIN VALLEY BAY, 2259
20	Noise monitoring	Noise monitoring site R19 as defined in Development Consent SSD-5465 (MOD 3), located at 2 Sunset Parade, CHAIN VALLEY BAY, 2259



Licence - 1770

23	Noise monitoring	Noise monitoring site R22 as defined in Development Consent SSD-5465 (MOD 3), located at 275a Cams Boulevard, CHAIN VALLEY BAY, 2259
26	Meteorological Station	Mannering Colliery Meteorological Station, Ruttleys Road, Doyalson 2259.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

- L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.
- L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.
- L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.
- L2.4 Water and/or Land Concentration Limits

POINT 1,27

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Faecal Coliforms	colony forming units per 100 millilitres				200
рН	рН				6.5-8.5
Total suspended solids	milligrams per litre				50



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L3 Volume and mass limits

- L3.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of:
 - a) liquids discharged to water; or;
 - b) solids or liquids applied to the area;

must not exceed the volume/mass limit specified for that discharge point or area.

Point	Unit of Measure	Volume/Mass Limit
1	kilolitres per day	12161
27	kilolitres per day	12161

L3.2 The volumetric daily discharge limit for the premises is the combined discharge measured at EPA discharge points 1 and 27 and must not exceed 12161 kilolitres per day.

L4 Waste

L4.1 The licensee must not cause, permit or allow any waste to be received at the premises, except the wastes expressly referred to in the column titled "Waste" and meeting the definition, if any, in the column titled "Description" in the table below.

Any waste received at the premises must only be used for the activities referred to in relation to that waste in the column titled "Activity" in the table below.

Any waste received at the premises is subject to those limits or conditions, if any, referred to in relation to that waste contained in the column titled "Other Limits" in the table below.

This condition does not limit any other conditions in this licence.

Code	Waste	Description	Activity	Other Limits
NA	General or Specific exempted waste	Waste that meets all the conditions of a resource exemption under Clause 92 of the Protection of the Environment Operations (Waste) Regulation 2014.	As specified in each particular resource recovery exemption	NA

L5 Noise limits

L5.1 Noise generated at the premises that is measured at each noise monitoring point established under this licence must not exceed the noise levels specified in Column 4 of the table below for that point during the corresponding time periods specified in Column 1 when measured using the corresponding measurement parameters listed in Column 2.

POINT 12

•	Measurement frequency	Noise level dB(A)
parameter		



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Day	Day-LAeq (15 minute)	-	49
Evening	Evening-LAeq (15 minute)	-	49
Night	Night-LAeq (15 minute)	-	49
Night	Night-LA1 (1 minute)	-	54

POINT 13

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	49
Evening	Evening-LAeq (15 minute)	-	49
Night	Night-LAeq (15 minute)	-	49
Night	Night-LA1 (1 minute)	-	53

POINT 14

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	43
Evening	Evening-LAeq (15 minute)	-	43
Night	Night-LAeq (15 minute)	-	43
Night	Night-LA1 (1 minute)	-	49

POINT 16

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	36
Evening	Evening-LAeq (15 minute)	-	36
Night	Night-LAeq (15 minute)	-	36
Night	Night-LA1 (1 minute)	-	45

POINT 20

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	37
Evening	Evening-LAeq (15 minute)	-	37
Night	Night-LAeq (15 minute)	-	37



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Night	Night-LA1 (1 minute)	-	45

POINT 23

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	46
Evening	Evening-LAeq (15 minute)	-	46
Night	Night-LAeq (15 minute)	-	46
Night	Night-LA1 (1 minute)	-	46

POINT 9

Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
Day	Day-LAeq (15 minute)	-	38
Evening	Evening-LAeq (15 minute)	-	38
Night	Night-LAeq (15 minute)	-	38
Night	Night-LA1 (1 minute)	-	45

- L5.2 The licensee must ensure that noise generated on the premises does not exceed:
 - a) 35 LAeq(15min) during the day, evening or night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1; and
 - b) 45 LA1(1min) during the night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1.

Note: The licensee may provide to the EPA written evidence of any agreement with a landholder which is subject to the above noise limits. The written evidence may be submitted with a licence variation to remove the landholder from the above tables.

- L5.3 For the purpose of condition L5.1 and condition L5.2:
 - (a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays;
 - (b) Evening is defined as the period 6pm to 10pm, and
 - (c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.
- L5.4 The noise limits set out in condition L5.1 and condition L5.2 apply under all meterorological conditions except for any one of the following:



Licence - 1770

- (a) Wind speeds greater than 3 metres/second at 10 metres above ground level; or
- (b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at
- 10 metres above ground level; or
- (c) Stability category G temperature inversion conditions.
- (d) Or as defined under the NSW EPA Noise Policy for Industry 2017.
- L5.5 For the purpose of condition L5.4:
 - (a) the meteorological data to be used for determining meteorological conditions is the data recorded at the meteorological station identified in this licence as EPA Identification Point 26.
 - (b) Stability category temperature inversion conditions are to be determined in accordance with the NSW EPA Noise Policy for Industry 2017.
- Note: The weather station must be designed, commissioned and operated in a manner to obtain the necessary parameters required under the above condition.
- L5.6 For the purpose of determining the noise generated at the premises the licensee must use a Class 1 or Class 2 noise monitoring device as defined by AS IEC61672.1 and AS IEC61672.2-2004, or other noise monitoring equipment accepted by the EPA in writing.
- L5.7 To determine compliance:
 - 1. With the L_{Aeq(15 min)} noise limits in condition L5.1 and condition L5.2, the licensee must locate noise monitoring equipment;
 - (a) within 30 metres of a dwelling facade (but not closer than 3 metres) where any dwelling on the property is situated more then 30 metres from the property boundary that is closest to the premises;
 - (b) approximately on the boundary where any dwelling is situated 30 metres or less from the property boundary that is closest to the premises, or, where applicable,
 - (c) within approximately 50 metres if the boundary of a national park or nature reserve.
 - 2. With the LA1(1 minute) noise limits in condition L5.1 and L5.2, the noise monitoring equipment must be located within 1 metre of a dwelling facade.
 - 3. With the noise limits in condition L5.1 and condition L5.2, the noise monitoring equipment must be located;
 - (a) at the most affected point at a location where there is no dwelling at the location, or
 - (b) at the most affected point within an area at a location prescribed by conditions L5.7 1(a) or L5.7 1(b).
- L5.8 A non-compliance of condition L5.1 or condition L5.2 will still occur where noise generated from the premises in excess of the appropriate limit is measured;
 - a) at a location other than an area prescribed by conditions L5.7 1(a) and L5.7 1(b), and /or
 - b) at a point other than the most affected point at a location.
- L5.9 For the purposes of determining the noise generated at the premises all applicable modification factors as described in the NSW EPA Noise Policy for Industry 2017 must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.

Environment Protection Authority - NSW Licence version date: 10-Aug-2022



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M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

M4 Environmental monitoring

Requirement to monitor noise

- M4.1 To determine compliance with condition L5.1, attended noise monitoring must be undertaken in accordance with conditions L5.7 and L5.8, and
 - (a) at each one of the locations listed in condition L5.1;
 - (b) occur quarterly within the reporting period of the Environment Protection Licence with at least 2 months between monitoring periods;
 - (c) occur during each day, evening and night period as defined in the NSW Industrial Noise Policy (EPA 2000) for a minimum of 15 minutes for three of the quarters;
 - (d) the night time 15 minute attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am;
 - (e) the night time LA1 (1 min) attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am;
 - (f) one quarterly monitoring must occur during each day, evening and night period as defined in the NSW EPA Noise Policy for Industry 2017 for a minimum of 1.5 hours during the day; 30 minutes during the evening; and 1 hours during the night, and
 - (g) each quarterly monitoring must be undertaken on a different day(s) of the week not including Saturdays, Sundays and public holidays; and
 - (h) these monitoring conditions take effect in the 2015 Reporting period.

Note: The intention of this condition is that quarterly monitoring be undertaken at each sensitive receiver. That at each sensitive receiver monitoring is undertaken over a range of different days excluding weekends and public holidays during the reporting period so as to be representative of operating hours. That night time 15 minute attended monitoring and the LA1 (1min) monitoring for three of the quarters be undertaken at worst case being the most stable atmospheric conditions and when noise would be most intrusive to sleep. All of the sensitive receivers do not have to be monitored on the same day, evening and night for sub condition f.

M4.2 For the Annual Reporting Period ending March 2015 the EPA will accept all monitoring required by the current Department of Planning and Environment consent (usually quarterly monitoring for noise as dB(A) Leq15minutes) for compliance with noise monitoring requirements in this licence, as a single report attached to the Annual Return for the premises.

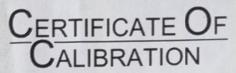
M5 Weather monitoring

M5.1 At the point(s) identified below, the licensee must monitor (by sampling and obtaining results by analysis) the parameters specified in Column 1 of the table below, using the corresponding sampling method, units of measure, averaging period and sampling frequency, specified opposite in the Columns 2, 3, 4 and 5 respectively.

Environment Protection Authority - NSW Licence version date: 10-Aug-2022

Appendix D Calibration certificates





CERTIFICATE No: SLM31670

EQUIPMENT TESTED: Sound Level Meter

Manufacturer: B&K

Type No: 2250

Mic. Type: 4189

Pre-Amp. Type: ZC0032

Filter Type: 1/3 Octave

Owner: EMM Consulting Level 3, 175 Scott Street

Newcastle, NSW 2300

Tests Performed: IEC 61672-3:2013 & IEC 61260-3:2016

Comments: All Test passed for Class 1. (See overleaf for details)

CONDITIONS OF TEST:

Temperature

Ambient Pressure

992 hPa ±1 hPa

26 °C ±1° C

Date of Calibration: 02/02/2022

Date of Receipt: 02/02/2022

Relative Humidity

48 % ±5%

Serial No: 2759405

Serial No: 2983733

Test No: F031671

Serial No: 22666

Date of Issue: 03/02/2022

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY:

AUTHORISED SIGNATURE:

Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration

Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.



Accredited Lab No. 9262 Acoustic and Vibration Measurements

Acu-Vib Electronics CALIBRATIONS SALES RENTALS REPAIRS

Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 2154 (02) 9680 8133 www.acu-vib.com.au

Page 1 of 2 Calibration Certificate AVCERT10.14 Rev.2.0 14/04/2021

CERTIFICATE OF CALIBRATION

CERTIFICATE NO: SLM34169

EQUIPMENT TESTED: Sound Level Meter

Manufacturer: B&K

Type No: 2250 Mic. Type: 4189

Pre-Amp. Type: ZC0032

Filter Type: 1/3 Octave

Owner: **EMM Consulting**

> Suite 01, 20 Chandos St St Leonards NSW 2065

IEC 61672-3:2013 & IEC 61260-3:2016 **Tests Performed:**

All Test passed for Class 1. (See overleaf for details) **Comments:**

CONDITIONS OF TEST:

Ambient Pressure 1002 hPa ±1 hPa **Temperature** 24 °C ±1° C

% ±5% **Relative Humidity**

Date of Receipt: 02/11/2022 Date of Calibration:

Serial No: 3029363

Test No: F034175

Serial No:

Serial No:

3260501

30109

03/11/2022 Date of Issue: 04/11/2022

Acu-Vib Test Procedure: AVP10 (SLM) & AVP06 (Filters)

CHECKED BY: **AUTHORISED SIGNATURE:**

Jack Kielt

Accredited for compliance with ISO/IEC 17025 - Calibration Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.



Accredited Lab No. 9262 Acoustic and Vibration Measurements



Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 215-(02) 9680 8133 www.acu-vib.com.au

Page 1 of 2 Calibration Certificate AVCERT10.14 Rev.2.0 14/04/2021

CERTIFICATE OF CALIBRATION

CERTIFICATE No: C33872

EQUIPMENT TESTED: Sound Level Calibrator

Manufacturer: Svantek

Type No: SV-36 Serial No: 79952

Owner: EMM Consulting Pty Ltd

L3, 175 Scott Street Newcastle. NSW 2300

Tests Performed: Measured Output Pressure level, Frequency & Distortion

Comments: See Details overleaf. All Test Passed.

Parameter	Pre- Adj	Adj Y/N	Output: (dB re 20 µPa)	Frequency (Hz)	THD&N (%)
Level1:	NA	N	94.09 dB	1000.00 Hz	1.12 %
Level2:	NA	N	114.06 dB	1000.00 Hz	0.71 %
Unce	ertainty		±0.11 dB	±0.05%	±0.20 %
Uncertainty (at	95% c.l.)	k=2	mid Mil aliene maid en	ni santamana di	10 10 1 135 C

CONDITION OF TEST:

Ambient Pressure 1004 hPa ±1 hPa Date of Receipt: 26/09/2022 Temperature 23 °C ±1° C Date of Calibration: 29/09/2022 Relative Humidity 55 % ±5% Date of Issue: 29/09/2022

Acu-Vib Test AVP02 (Calibrators)

Procedure: Test Method: AS IEC 60942 - 2017

CHECKED BY:

AUTHORISED SIGNATURE:

Hein Soe

Accredited for compliance with ISO/IEC 17025 - Calibration

Results of the tests, calibration and/or measurements included in this document are traceable to SI units through reference equipment that has been calibrated by the Australian National Measurement Institute or other NATA accredited laboratories demonstrating traceability.

This report applies only to the item identified in the report and may not be reproduced in part.

The uncertainties quoted are calculated in accordance with the methods of the ISO Guide to the Uncertainty of Measurement and quoted at a coverage factor of 2 with a confidence interval of approximately 95%.



WORLD RECOGNISED ACCREDITATION

Accredited Lab No. 9262
Acoustic and Vibration
Measurements



Head Office & Calibration Laboratory Unit 14, 22 Hudson Ave. Castle Hill NSW 2154 (02) 9680 8133 www.acu-vib.com.au

Page 1 of 2 Calibration Certificate
AVCERT02.1 Rev.2.0 14.04.2021

Australia

SYDNEY

Ground floor 20 Chandos Street St Leonards NSW 2065 T 02 9493 9500

NEWCASTLE

Level 3 175 Scott Street Newcastle NSW 2300 T 02 4907 4800

BRISBANE

Level 1 87 Wickham Terrace Spring Hill QLD 4000 T 07 3648 1200

CANBERRA

Suite 2.04 Level 2 15 London Circuit Canberra City ACT 2601

ADELAIDE

Level 4 74 Pirie Street Adelaide SA 5000 T 08 8232 2253

MELBOURNE

Suite 8.03 Level 8 454 Collins Street Melbourne VIC 3000 T 03 9993 1900

PERTH

Suite 9.02 Level 9 109 St Georges Terrace Perth WA 6000 T 08 6430 4800

Canada

TORONTO

2345 Younge Street Suite 300 Toronto ON M4P 2E5 T 647 467 1605

VANCOUVER

60 W 6th Ave Suite 200 Vancouver BC V5Y 1K1 T 604 999 8297







Appendix 9: Annual Subsidence Report

Review Date	Next Review Date	Revision No	Document Owner	Page	
		1	Environmental Compliance Coordinator	Page 110 of 114	
DOCUMENT UNCONTROLLED WHEN PRINTED					



SITE:	Chain Valley Colliery and Mannering Colliery
Department:	Technical Services
REPORT TITLE:	2022 Annual Subsidence Report
Prepared by:	Lachlan McWha
Report Date:	31 st March 2023
Distribution:	Department of Planning, Industry and Environment NSW Resources Regulator NSW EPA



Annual Subsidence Report 2022

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Annual Subsidence Report 2022

1 Introduction

1.1 Background

Chain Valley Colliery (CVC) and Mannering Colliery (MC) are underground coal mines on the southern side of Lake Macquarie, approximately 60 kilometres (km) south of Newcastle and 80 km north of Sydney.

CVC operates under Development Consent SSD-5465, as modified, which was originally granted on 23 December 2013 by the then Minister for Planning and Infrastructure under Part 4, Division 4.1 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act), which relates to State significant development (SSD). The consent permits underground bord and pillar mining as well as Miniwall mining in the Fassifern Seam at a maximum rate of 2.1 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal, with all secondary extraction confined to areas under the Lake Macquarie water body.

MC was granted Project Approval (MP06_0311) under Part 3A of the EP&A Act on 12 March 2008 and, as modified, permits the extraction of up to 1.1 Mtpa of ROM coal until 31 December 2027. It also permits the handling of up to 2.1 Mtpa ROM coal with that coal transported via a dedicated overland conveyor to Delta Electricity's Vales Point Power Station (VPPS) for domestic energy generation.

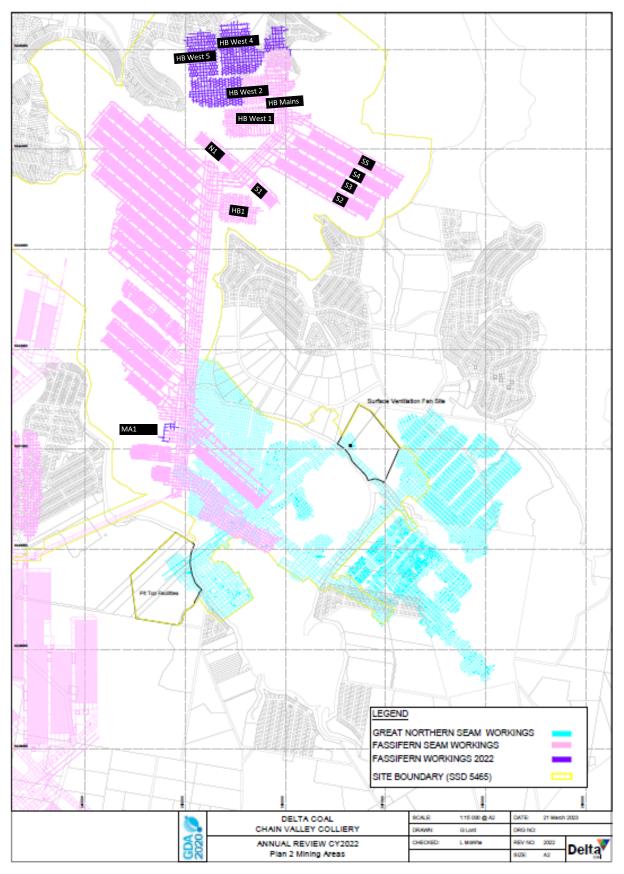
1.2 Purpose

This Annual Subsidence Report (ASR) provides an overview of subsidence monitoring data and management performance for CVC and MC in the 2022 calendar year and has been prepared as an appendix to the Chain Valley Colliery and Mannering Colliery Annual reviews.



Annual Subsidence Report 2022

Figure 1 - CVC Fassifern Workings (dark purple represents 2022 extraction)





Annual Subsidence Report 2022

1.3 Approvals and Legislation

This ASR has been prepared to meet the annual subsidence report requirement within the CVC SSD-5465 Statement of Commitments.

Subsidence monitoring is undertaken in accordance with Chain Valley Colliery's approved Subsidence Monitoring Programs (SMP):

- Chain Valley Colliery, Subsidence Monitoring Program, Northern Mining Area First Workings and Lake Macquarie Extraction, August 2021 (forms part of the approved CVC Mining Operations Plan 2020-2023 Amendment 2)
- Chain Valley Colliery, Subsidence Monitoring Program, Miniwall S5 and Northern Mining Area Pillar Extraction, November 2020 (forms part of the approved CVC MWS5 and NMA Extraction Plan).

1.4 Stakeholder Engagement

Delta Coal has consulted with the local community via the CVC and MC Community Consultative Committee (CCC) on subsidence results at the four quarterly meetings undertaken in 2022. This report is appended to the 2022 Mannering Colliery and Chain Valley Colliery Annual Reviews and will be provided to the CCC and applicable stakeholders as well as being made publicly available on the Delta Coal website.

1.5 Supporting Documentation

This ASR is informed by the relevant sections of the following documents:

- March 2022, Lake Macquarie Benthos Survey Report No. 19. Report prepared by J.H. & E.S. Laxton
 Environmental Consultants P/L for Delta Coal
- June 2022, Seagrass Survey of Chain Valley Bay, Summerland Point, Bardens Bay and Crangan Bay, Lake Macquarie, NSW (Results for 2008 to 2022). Report prepared by J.H. & E.S. Laxton – Environmental Consultants P/L for Delta Coal
- E. Laxton, September 2022, *Lake Macquarie Benthos Survey Report No. 20*. Report prepared by J.H. & E.S. Laxton Environmental Consultants P/L for Delta Coal
- 2021 Benthic Communities Management Plan, Delta Coal
- 2021 Seagrass Management Plan, Delta Coal
- 2020 Subsidence Monitoring Program, Delta Coal (Extraction Plan Miniwall S5 and Northern Pillar Extraction)
- 2021 Subsidence Monitoring Program, Delta Coal (Northern Mining Area First Workings and Lake Macquarie Pillar Extraction)
- 2020 Chain Valley Colliery Extraction Miniwall S5 and Northern Pillar Area Extraction Plan



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- 2021 Built Features Management Plan, Delta Coal
- 2021 Public Safety Management Plan, Delta Coal
- 2022 Benthic Communities Monitoring Statistical Analysis Report prepared by EMM Consulting for Delta Coal

2 Monitoring and Comparison

2.1 Monitoring Overview

As detailed in Section 1.4.1, CVC has a two actively approved Subsidence Monitoring Programs, with one program addressing Miniwall S5 and pillar extraction and the other addressing first-workings and pillar extraction in Lake Macquarie. Scope of Subsidence Monitoring.

Monitoring undertaken in 2022 comprised:

- Shoreline and terrestrial monitoring of fixed reference points installed prior to underground mining to determine levels of vertical subsidence;
- Bathymetric scans of the lake bed in areas of secondary extraction, surveys are undertaken prior to, during and following secondary extraction; and
- Visual inspections undertaken of areas overlying mining zones, with particular focus on steep slopes and cliffs in built areas, for signs of possible surface disturbance.

2.1.1 Shoreline (High Water subsidence Control Zones)

In accordance with Condition 1, Schedule 4 of SSD-5465, vertical subsidence within the HWMSB is limited to a maximum subsidence (S_{max}) of 20 mm. The primary control to achieve this limit is the implementation of a conservative mine design, utilising first workings only with long term stable pillars in this zone.

To monitor the effectiveness of the mine design, monitoring of the shoreline is carried out at fixed reference marks (subsidence marks) which are surveyed at regular intervals. The frequency is dependent on the proximity to active operations.

2.1.2 Seagrass

Condition 2, Schedule 4 of SSD-5465 specifies negligible environmental impacts on the species of seagrass found within the current area of mining operations as a condition of approval. Surveys of the seagrass extents are undertaken in order to monitor impacts on the seagrass population.

Delta Coal's *Seagrass Management Plan* (2021) outlines the methodology used to determine changes to composition and quantity of seagrass populations in Lake Macquarie as a result of mining activities at CVC.



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Subsidence monitoring of the lakebed is undertaken via bathymetric survey over CVC's current mining area in order to validate subsidence predictions.

2.1.3 Benthic Communities

Seasonal surveys of the lake bed are undertaken in order to monitor variations in the composition and density of benthos due to mining, environmental and/or other seasonal factors. Condition 2, Schedule 4 of SSD-5465 requires nil or minor environmental consequences on benthic communities as a result of mining induced subsidence.

Delta Coal's *Benthic Communities Management Plan* (Delta Coal 2021) outlines the methodology used to determine changes to species diversity and abundance.

Subsidence monitoring of the lakebed is undertaken via bathymetric survey over CVC's current mining area in order to validate subsidence predictions and to determine approximate levels of subsidence on specific benthic sample locations.

2.1.4 Methods of Subsidence Monitoring

2.1.4.1 Overview

Subsidence monitoring at CVC includes a combination of bathymetric surveys and terrestrial level monitoring. Results are used to validate modeled outcomes; enable early detection of subsidence trends which allows adaptive management and the implementation of contingency measures.

2.1.4.2 Bathymetric Surveys

A third party is commissioned to undertake bathymetric surveys over the areas of past, current and proposed workings at CVC and MC. Baseline bathymetric data was provided to NSW Office of Environment and Heritage (OEH) in 2010. The accuracy of the bathymetric surveys are ±0.1 m.

Since 2012, bathymetric surveys have been completed on at least an annual basis with ongoing surveys providing accurate details of the lake depth within CVC's mining areas. During the 2017 survey it was identified that the site had exceeded vertical subsidence predictions over the MW7-12 mining area by approximately 370mm. LakeCoal (the operator at that time) notified the relevant authorities of the exceedance and submitted an incident report on 11 November 2017. Subsidence associated with MW7-12 has proven to have stabilised since, with no discernible affect identified within seagrass and benthic communities monitoring.



Annual Subsidence Report 2022

Table 1 - Chain Valley Colliery Secondary Extraction Subsidence Monitoring Commitments

Secondary Extraction Panel	Approved S _{max} (mm)	Predicted S _{max} (mm)	Measured S _{max} (mm)	Extraction Completion date	Post Extraction Bathymetric Scanning Commitment
Miniwall S1	780	420	<200	September 2018	Annual for 3 years unless TARP triggered
Miniwall S2	780	300	300-350	March 2020	Annual for 3 years unless TARP triggered
Miniwall S3	780	300	500-550	July 2020	Annual for 3 years unless TARP triggered
Miniwall S4	780	300	600-650	February 2021	Annual for 3 years unless TARP triggered
Miniwall S5	780	500	450-500	August 2021	Annual for 3 years unless TARP triggered
NMA Pillar Extraction	780	500	n/a	Not commenced in 2021.	Annual for 3 years unless TARP triggered

Monitoring will continue in accordance with the approved *Miniwall S5 and Northern Pillar Extraction Plan* in the 2023 period.

3 Bathymetric Monitoring

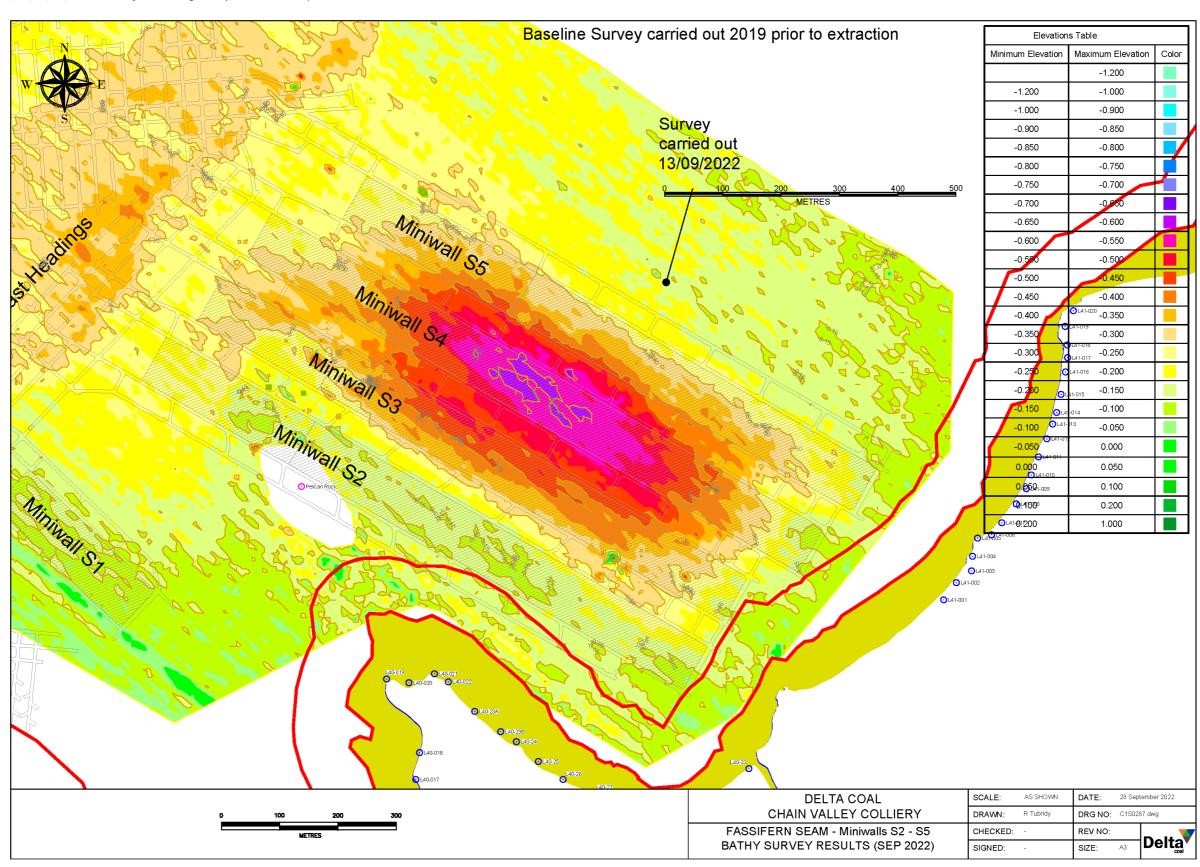
Bathymetric scans undertaken in the 2022 reporting period have been provided as Figure 2 and includes:

 MWS1, MWS2, MWS3, MWS4, MWS5 and NMA Mains (annual survey) undertaken in September 2022.

Figure 2 presents Bathymetric surveys over the Miniwall S1-S5 extraction area which have indicated subsidence of up to 600-650 mm directly over the extracted area of MWS4 which prompted a independent geotechnical review to ensure ongoing compliance with the subsidence limit of 780mm. There appears to be a measured difference of ~400-450mm in the lake bed over the mains area to the N/East of the page compared to the baseline. This appears unrelated to mining, given nil extraction in this area, with the roadways accessible and in good condition as per routine inspections. Rock head surveys in this area indicated the silt/sediments are in the order of 20m thick, and there may be gradual changes to the lake bed over time relating to sediment movement.

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Figure 2 - Miniwalls N1, S1, S2, S3, S4, S5 and NMA first workings Bathymetric Scan - September 2021





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4 Foreshore Monitoring

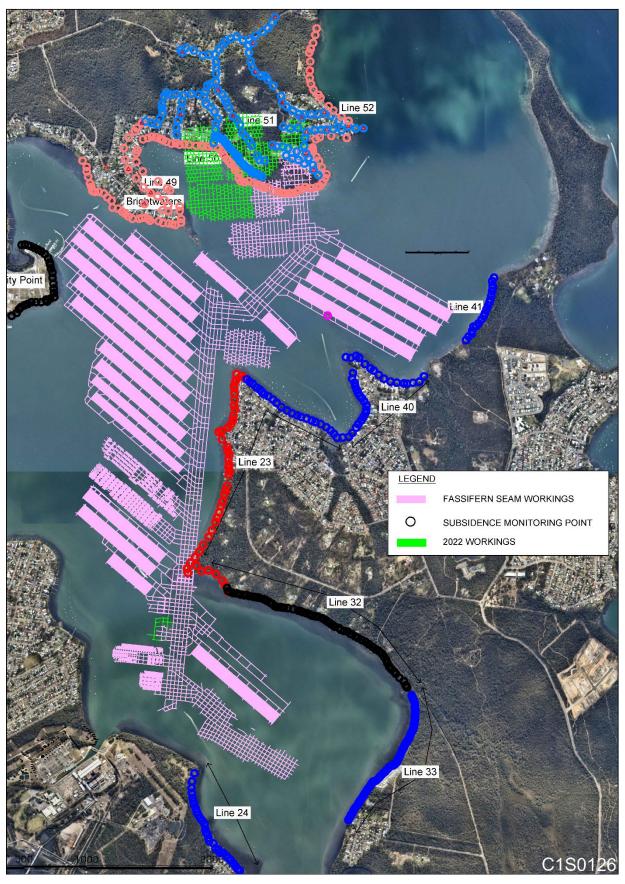
Delta Coal completes subsidence monitoring around Trinity Point, Brightwaters, Mirrabooka, Sunshine Frying Pan Bay, Summerland Point & Chain Valley Bay (**Figure 7**). Monitoring points occur along the foreshore at approximately 20 m - 30 m intervals where practicable / achievable. Monitoring survey results are uploaded to the Resources Regulator SSIMS portal within 10 days of survey.

A Visual Subsidence Inspection Proforma is completed at monthly intervals over the current mining areas under an agreement between Delta Coal and the Resources Regulator. These visual inspections, looking for any signs of impacts or changes to public safety, include visual inspection of steep slopes, ponding and other potential effects of mine subsidence. Annual foreshore surveying was undertaken throughout 2022.



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Figure 3 - Foreshore Subsidence Monitoring Points



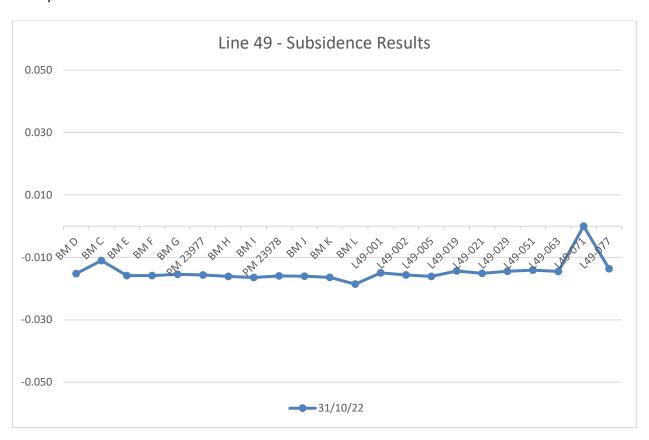


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4.1.1.1 Morisset Peninsula Line 49, 50, 51 and 52

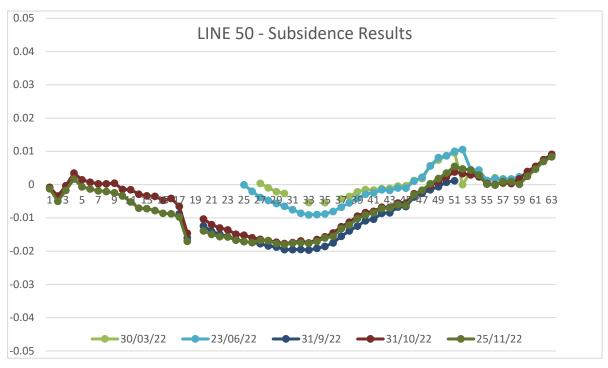
Foreshore monitoring lines 49, 50 and 51 were installed in 2021, for the purpose of monitoring potential subsidence associated with future northern mining area workings. An extra Line 52 has been installed in 2022 to cover the foreshore as mining extends to the north. Surveys are carried out over the current mining areas quarterly, with annual surveys over the full grid.

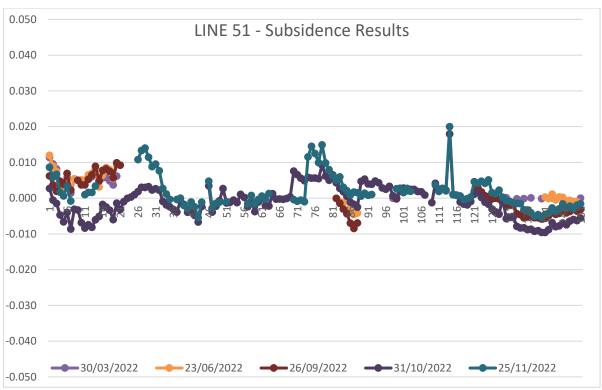
Survey results in the charts below show less than 20mm movement.





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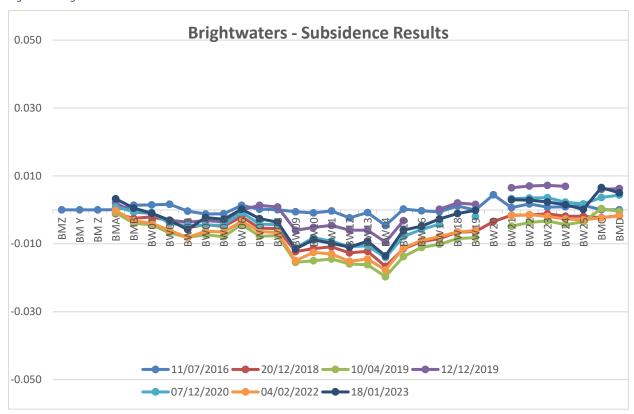
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4.1.1.2 Brightwaters

Monitoring points were installed along the Brightwaters peninsula in June 2016 to monitor the effects of Miniwall 11 and 12 extraction. Surveys are carried out over the Brightwaters foreshore annually.

Results for the reporting period are shown in **Figure 8**. Nil subsidence related movement has been detected along the monitoring line.

Figure 4 - Brightwaters Subsidence Results



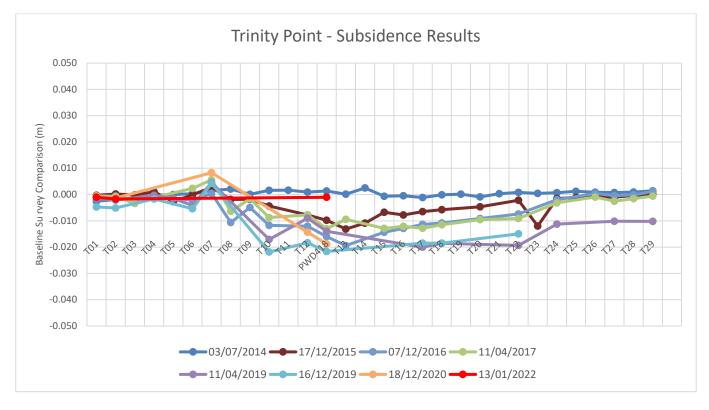


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4.1.1.3 Trinity Point

Monitoring points were installed in the Trinity Point area in 2014 for shoreline monitoring during extraction of Miniwalls 7-12 panels. A number of marks have been disturbed or destroyed due to development along the foreshore in the area, this was particularly obvious in the 04/02/2022 survey where only 3 marks where able to be identified, however nil movement attributable to subsidence has been detected. This monitoring line is surveyed annually. **Figure 9** shows the subsidence monitoring results for the reporting period at Trinity Point.

Figure 5 - Trinity Point Subsidence Results



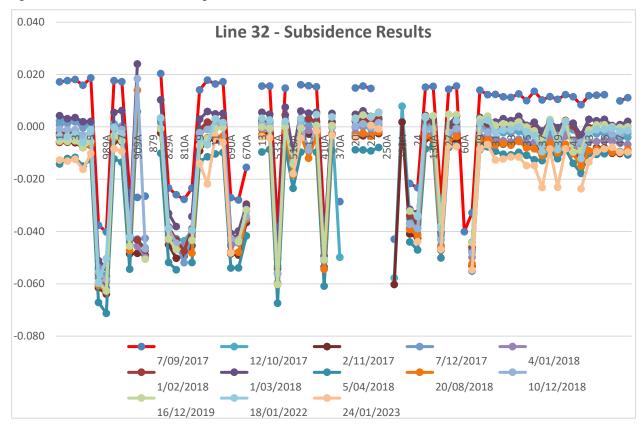


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4.1.1.4 Summerland Point, Lines 32, 23, 40 and 41

Line 32 was originally installed in 1989. Due to their age and that a number of the marks are steel star pickets, the integrity of some of the marks has been affected. However Figure 10 shows that the area has been stable for the past few years. Line 32 monitoring marks are surveyed annually.

Figure 6 - Line 32 Subsidence Monitoring Results

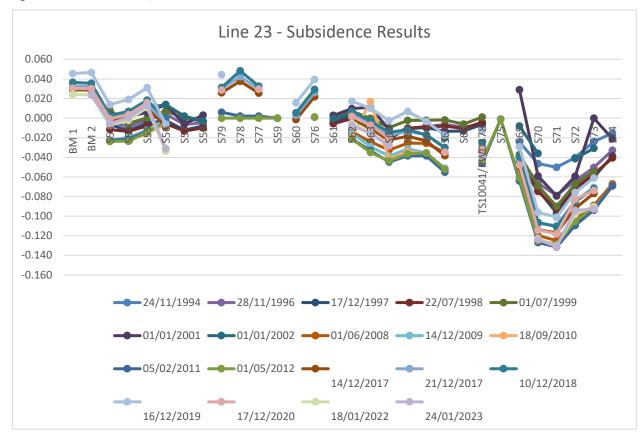




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The foreshore along Summerland Point has been monitored since 1994, after secondary extraction was undertaken in the Wallarah Seam beneath the south-western point (corresponding to mark S63 – 74 of Line 23). Approximately 130mm to 150mm of subsidence was measured (Point S71 - Line 23). There has been no observable movement from 2008 datasets to current (Figure 11). In general, suspected ground-swelling was observed in foreshore monitoring undertaken on 18/01/2022. Line 23 monitoring marks are surveyed annually.

Figure 7 - Summerland Point, Line 23 Subsidence Results

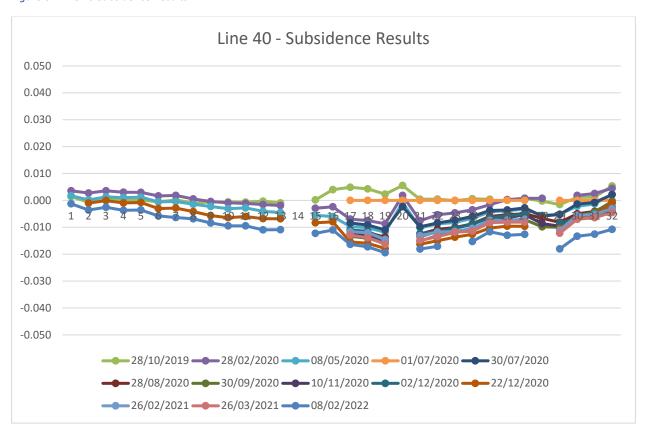




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Monitoring points along Line 40 were established in 2018 to monitor the shoreline adjacent to Miniwall S1. This line was extended in 2019 as part of the subsidence monitoring program for Miniwalls S2 and S3. Minor ground movement along the line appears seasonal, with movement limited to <20mm Figure 12 shows the reporting period subsidence results for Line 40. Monitoring of Line 40 is undertaken annually.

Figure 8 - Line 40 Subsidence Results

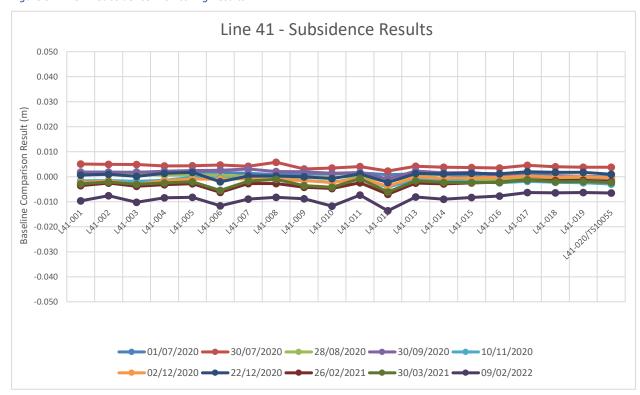




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Line 41 was established in July 2020 to monitor the shoreline adjacent Miniwall S4. Monitoring is undertaken annually, with surveys indicating negligible (<20mm) movement within compliance limits. Line 41 subsidence monitoring results are shown on **Figure 13**.

Figure 9 - Line 41 Subsidence Monitoring Results



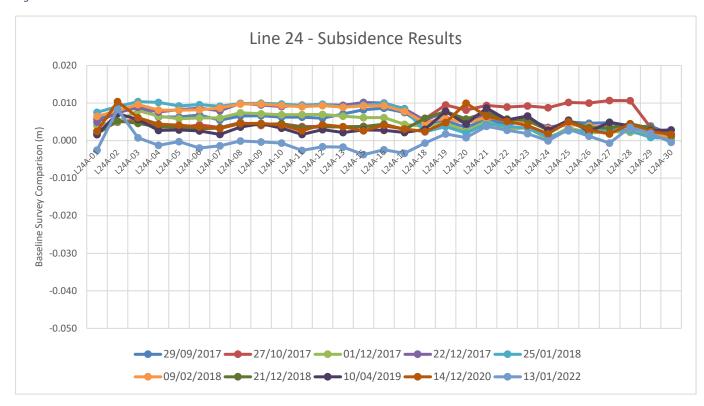


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4.1.1.5 Chain Valley Bay, Lines 24 and 33

Line 24 lies on the western foreshore of Chain Valley Bay. Monitoring results have identified negligible vertical movement (< 20mm). Line 24 monitoring points are surveyed annually. **Figure 14** shows subsidence monitoring results for Line 24 within compliance limits.

Figure 10 - Line 24 Subsidence Results



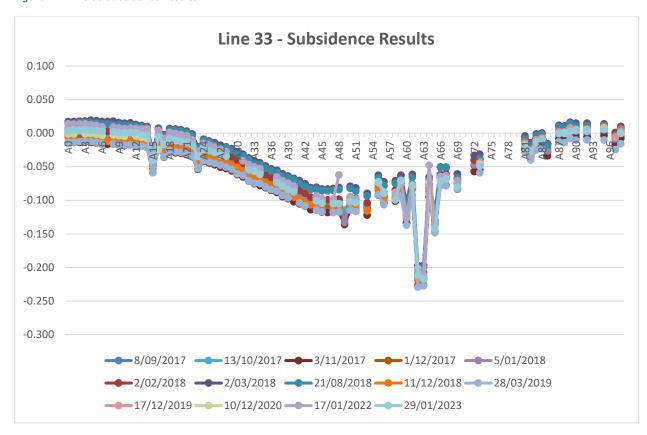
Line 33 is underlain with old mine workings in the upper seams and many of the historically monitored subsidence marks have experienced greater than negligible (20mm)subsidence, however no additional subsidence movement was detected during the minimal extraction in CVB. And no additional subsidence was observed at Line 33A within the reporting period.



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Figure 15 show the subsidence monitoring results for the reporting period at Line 33. The monitoring indicates compliance to limits with one monitoring location (A63) impacted by surface activities unrelated to the mine site.

Figure 11 - Line 33 Subsidence Results





Annual Subsidence Report 2022

4.1.2 Timing of Subsidence Monitoring

Timing of subsidence monitoring at CVC is defined in approved extraction plans and is summarised in **Table 2**. CVC has also made subsidence monitoring commitments to first-workings associated with the 2020-2023 Mining Operations Plan (Amendment 2), also presented in **Table 2**.

Table 2 - Frequency of Subsidence Monitoring for Secondary Extraction

Type of monitoring	Pre-extraction requirements	During extraction requirements	Post extraction requirements			
Secondary Extraction						
Bathymetric surveys	Single baseline survey prior to extraction	End of panel (of relevance to S2, S3, S4 and S5)	Annual for three years unless TARP triggered			
		Annual surveys over areas of pillar extraction (not commenced)				
Foreshore monitoring	Baseline survey prior to commencement of extraction	Monthly intervals	Annual for three years unless TARP triggered			
Pelican Rock Navigation Baseline RL and tilt measurements		End of panel (of relevance to S2 and S3)	Visual inspection and confirmation from RMS of nil impacts			
Seagrass survey points	Survey of concret	e monitoring points during regular	seagrass monitoring			
	Fi	rst Workings				
Terrestrial based subsidence monitoring (foreshore)	Baseline prior to extraction	Annual surveys during extraction unless TARP triggered	Annual surveys ongoing unless TARP triggered			
Terrestrial based subsidence monitoring (along main roads in suburbs of Brightwaters, Mirrabooka and Sunshine)	Baseline prior to extraction	Annual surveys during extraction unless TARP triggered	Annual surveys ongoing unless TARP triggered			

4.2 Mannering Colliery

4.2.1 Monitoring Overview

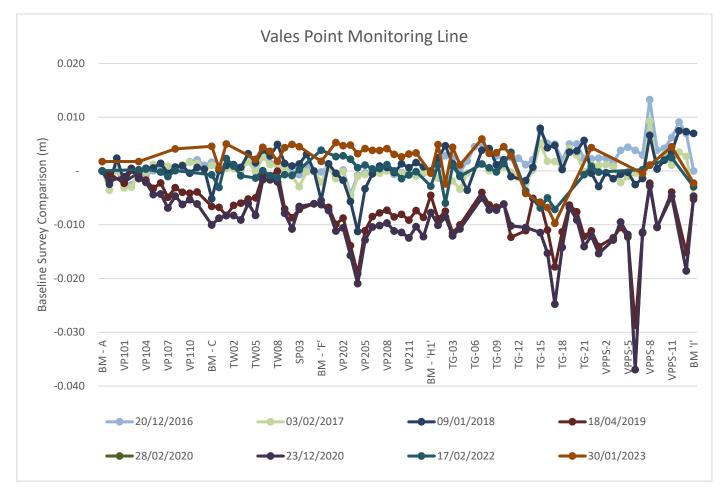
At the commencement of mining operations associated with the link road project between CVC and MC, a subsidence monitoring program was implemented. Due to the sensitive nature of the infrastructure being undermined (ie VPPS), subsidence monitoring was undertaken on a weekly basis within a 250 m radius of the mining activity. At the completion of mining, the frequency of subsidence monitoring of the link road development was reduced to an annual survey. Monitoring results have been presented in **Figure 16** and indicate <30 mm subsidence recorded to date, with anomalous readings recorded at monitoring point VPPS-6 from 18/04/2019.

There was no mining undertaken at Mannering Colliery during 2022.



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Figure 12 - Vales Point Power Station Subsidence Results





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5 Impacts to Built Features from 2022 Mining Activities

5.1 Chain Valley Colliery

5.1.1 Pelican Rock Navigational Marker

No built features have been identified as requiring direct subsidence management from mining activities undertaken at CVC during 2022.

First-workings were undertaken beneath the Morisset Peninsula within the NMA with no subsidence impacts to surface facilities or infrastructure reported to date.

As described in CVC's Subsidence Monitoring Program, Pelican Rock Navigation Marker is expected to be impacted by approximately 130 mm of subsidence from mining within Miniwall panels S2 and S3.

NSW Roads and Maritime Services (RMS) has indicated a functional impact on the marker is likely to occur at 500 mm of subsidence and 5° or 87 mm/m of tilt.

A survey for RL and tilt was conducted on 10 July 2019 by Daly Smith Surveyors prior to mining and measured Pelican Rock Navigation Marker was 1.14 mm Australian Height Datum (AHD) and the navigational pole was vertical.

A final survey was undertaken on the 25th June 2021, after the completion of MWS4 recording the level at 1.10 mAHD. No further monitoring was undertaken in 2022 for the pelican rock navigational marker however following further subsidence over MWS4 identified in September 2022 bathymetric scanning, Delta Coal will resurvey the Pelican Rock navigational marker and confirm the functionality of the marker with the RMS in 2023.





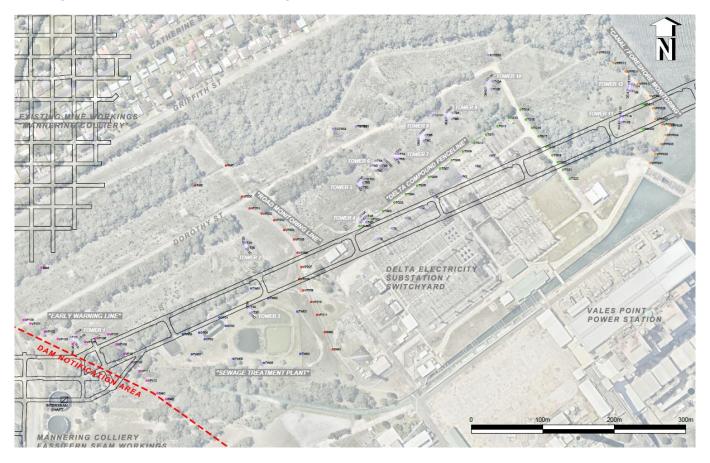
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5.2 Mannering Colliery

There were no built features identified as requiring direct subsidence management as a result of MC former workings during 2022.

No discernible subsidence impact from the Linkage Road Project workings was observed in 2022.

Figure 13 – Vales Point Power Station Monitoring Locations





Annual Subsidence Report 2022

6 Impacts to Natural Features

6.1 Chain Valley Colliery

Subsidence impact performance measures to natural and heritage features are detailed in SSD-5465 Modification 4, Table 6 as below.

Biodiversity				
Threatened species or endangered populations	Negligible environmental consequences			
Seagrass beds	Negligible environmental consequences including: negligible change in the size and distribution of seagrass beds; negligible change in the functioning of seagrass beds; and negligible change to the composition or distribution of seagrass species within seagrass beds.			
Benthic communities	Minor environmental consequences, including minor changes to species composition and/or distribution.			

6.1.1 Seagrass Bed Monitoring

Annual seagrass bed monitoring was undertaken in June 2022 as per the approved Seagrass Management Plan. The Seagrass monitoring report is publicly available at www.deltacoal.com.au. **Table 3** is taken from the report and displays compliance to the subsidence impact performance measures table for 2022.

Table 3 - Seagrass Monitoring Compliance

Condition from SSD5465 - Mod 4	Compliance Status and Comments
Schedule 4 Environmental Conditions - underground mining Performance Measures - Natural Environment Biodiversity - Benthic Communities.	Compliant - See section 16 - Conclusions
Subsidence Impact Performance Measure - Minor environmental consequences, including minor changes composition and/or distribution.	
Measurements undertaken by generally accepted methods.	Compliant - See section 4 and 5
Measurements Methods fully described.	Compliant - See section 4 and 5

6.1.2 Benthic Communities Monitoring

Benthic monitoring was undertaken in March 2022 and September 2022. The Benthic Communities reports are publicly available at www.deltacoal.com.au. The below table is taken from the September 2022 report and displays compliance to the subsidence impact performance measures table for 2022.



Annual Subsidence Report 2022

The results from the September 2022 benthic communities monitoring show compliance to SSD5465 (Mod 4) with respect to the Subsidence Impact Performance Measures for Benthic communities, which display nil to minor environmental consequences due to underground mining.

Table 4 - Benthic Communities Compliance

Conditions from SSD-5465 – Mod 4	Compliance Status and Comments
Schedule 4 Environmental Conditions – underground mining Performance Measures – Natural Environment Biodiversity – Benthic Communities Subsidence Impact Performance Measure – Minor environmental consequences, including minor changes composition and/or distribution.	Compliant – See section 16 - Conclusions
Measurements undertaken by generally accepted methods.	Compliant – See section 4 and 5
Measures Methods fully described.	Compliant – See section 4 and 5

In September 2022, EMM Consulting Pty Ltd were engaged by Delta Coal to undertaken statistical analysis of Benthic communities datasets recorded to date. The report concluded the following:

"Statistical analysis of CVC's benthic monitoring data, primarily undertaken for the period September 2016 to September 2022, did not identify statistical differences between the benthic assemblages evident at sites designated as Impact, Reference and Control.

In conclusion, the results of statistical analysis of CVC's benthic monitoring data indicate that no exceedance of the BCMP (CVC 2019) subsidence impact performance measure of "minor environmental consequences, including minor changes to species composition and/or distribution" has occurred. Consequently, CVC is not required to implement any additional investigations of benthic communities within the project study area at this time and should continue the routine monitoring of benthic assemblages."

The report also recommended the reduction in frequency of Benthic communities monitoring for CVC from 6-monthly to annually.



Annual Subsidence Report 2022

7 Adaptive Management – Subsidence Management Trigger Action Response Plan (TARP) Implementation and Remediation

7.1 Chain Valley Colliery

Adaptive management includes monitoring subsidence impacts and subsidence effects and, based on the results, modifying the mining plan as mining proceeds to ensure that the effects, impacts and/or associated environmental consequences remain within predicted and designated ranges and in compliance with the conditions of this consent. The subsidence Monitoring TARPs for Miniwall S5 and Northern Pillar Extraction has been provided as **Figure 18**.

Triggers and performance indicators (including measured subsidence and inspections for environmental impact) are provided across a number of different management plans at CVC and include specific information regarding:

- subsidence monitoring requirements (including baseline monitoring)
- remediation
- adaptive management techniques and
- contingency plans.

A summary of these is provided in CVC's Subsidence Management TARP which aims to consolidate all subsidence management requirements into a central location, triggering a response or set of responses commensurate with the nature of the measurement or the impact that has been identified.

There were no subsidence related remediation activities undertaken during 2022 as a result of mining activities at CVC. An independent geotechnical review was undertaken for the exceedance of subsidence predictions over Miniwall S4 identified in the September 2022 bathymetric survey.

7.2 Mannering Colliery

There is no subsidence management TARP at MC.

There were no subsidence related remediation activities undertaken during 2022 as associated with Mannering Colliery.



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Figure 14 - CVC Subsidence Management TARP

	SUBSIDE			ction response plan (tarp 00136) DOMAIN (S5 and Northern	
	DETAILED PERFORMANCE INDICATORS	MONITORING REQUIREMENTS	CONTAINMENT/REMEDIATION MEASURES	ADAPTIVE MANAGEMENT MEASURES	CONTINGENCY PLANS
	Normal Subsidence ≤ 500mm	As per Subsidence Monitoring (SM) Program			
SUBSIDENCE PARAMETERS	Trigger Level 1 Subsidence > 500mm to ≤ 780mm	6 monthly surveys until subsidence stabilises, then as per SM Program		Update subsidence predictions based on monitoring data Identify controlling mechanisms Review potential change in impact on natural and built features &	Review ability to limit further increases based on understood mechanisms including: Extraction heights, panel widths, panel recovery
(Bathymetric Survey)	Trigger Level 2 Subsidence >780mm	6 monthly until subsidence stabilises then as per SM Program	Review if increase likely to create impact at foreshore/seagrass or exceed final subsidence prediction Notify immediately DPIE if incident and within 7 days for non-compliance Notify RR, BCD, affected landholders or infrastructure owner	update management plans if required Implement further controls as applicable from review Update subsidence predictions based on monitoring data Update impact assessment on natural and built features	Immediately review mine plan including panel width, pilla extraction height and panel length Consult with DPIE and RR Review and update Extraction Plan
	Normal	The second of th	Notify N.Y., D.O.D., directed failunoiders of infrastructure owner	Optide impact assessment of Hatarar and built reatures	Interiew and appeare Extraction Fran
	<20mm recorded movement	Monitoring as per SM Program			
SUBSIDENCE PARAMETERS (Foreshore / Land Based	Trigger Level 1 <20mm recorded movement with slow (3-5mm/month) creep	Validate increase with additional monthy survey/s then as per SM program		Update subsidence predictions based on monitoring data Identify controlling mechanisms Review potential change in impact on natural and built features & update management plans if reqd	
Survey over minimum of	Trigger Level 2	Implement Ecological Monitoring program for HWMSB	Cease extraction in panel in question until review	Investigate cause of exceedance (ie validate impact due to	Provide offsets for any ecological communities or threate
2 adjacent pegs)	>20mm recorded movement (assoicated with mining)	exceedance Increase frequency of subsidence parameter monitoring to until rates stabilises. Then as per SM program	conducted in consultation with DPIE and DRE Notify immediately DPIE if incident and within 7 days for non- compliance Notify RR, OEH, affected landholders or infrastructure owner	FAS extraction or not). Update subsidence predictions based on monitoring data Update impact assessment on natural and built features	species in the HWMSB if impacts detected Immediately review mine plan including panel width, pilla extraction height in consultation. Consult with DPIE and RR Review and update Extraction Plan
	Normal No damage requiring remediation	Monitoring as per Subsidence Monitoring Program RMS routine monitoring navigation markers			
BUILT FEATURES	Trigger Level 1 Subsidence parameters exceeded such that Fassifern workings indicated to have potential impact on foreshore Private bore capacity reduced	Monitoring as per BFMP (Built Feature Management Plan)	Review navigational marker freeboard and notify Transport for NSW if impacted Notify immediately DPIE if incident and within 7 days for non- compliance Notify RR and potentially affected landholders or infrastructure		Develop BFMP in conjunction with owner for built features surrounding potential impact area
	Trigger Level 2 Impact to built feature	Monitoring as per BFMP	owner. Provide temporary water if required. Cease extraction in panel in question until review conducted in consultation with DPIE and RR Assist owner with information to aid in Subsidence Advisory NSW	Update impact assessment based on observed damage	Immediately review mine plan including panel width, pillal Consult with DPIE and RR Review and update Extraction Plan



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	SUBSIDE			CTION RESPONSE PLAN (TARP 00136) OOMAIN (S5 and Northern	
	DETAILED PERFORMANCE INDICATORS	MONITORING REQUIREMENTS	CONTAINMENT/REMEDIATION MEASURES	ADAPTIVE MANAGEMENT MEASURES	CONTINGENCY PLANS
	Normal No impact	Monitoring as per SM Program and Public Safety MP			
	ivo impaci				
	Trigger Level 1 Subsidence parameters exceeded such that Fassifern workings indicated to have potential impact on foreshore / land based areas	Increase visual inspection of foreshore to daily until public safety risk quantified as low Inspect Foreshore / Land Based areas in vicinity of steep slopes and retaining walls for signs of movement ASAP. Implement		Review potential of flooding and drainage impacts about foreshore or Land Based areasor stability concerns at steep slopes/ retaining walls. Undertake appropriate risk assessments	
PUBLIC SAFETY	Trigger Level 2	TARP as required.	Cease extraction in panel in question until review		
(Foreshore / Land Based areas and steep slopes)	-		conducted in consultation with DPIE and RR		
	Area around foreshore or other land based areas becomes unstable or shows signs of mining induced impact Flooding or drainage impacts considered likely as result of Fassifern extraction	Visual inspections frequency to be commensurate with level of risk (ie increase until controls put in place) Inspect Foreshore / Land Based areas in vicinity of other steep slopes and retaining walls for signs of movement ASAP. Implement TARP as required.	Immediately implement temporary safety controls (barricades and signage available from mine site). Arrange for assistance and stay at site if immediate risk to public exists Inform ECC as to result of inspection Geotechnical Engineer to inspect area immediately.	Implement longer term safety controls	Foreshore / Land based area stabilisation of unsafe areas consultation with LMCC/CC Council and RR as soon as possible Flooding and drainage rectification works in consultation winfrastructure owner as soon as possible
	Normal		Notify LMCC and Transport for NSW Notify BCD, DPIE and RR		
	ANOVA/ANOSIM >5%	Monitoring as per Benthic MP			
	Trigger Level 1 ANOVA/ANOSIM level is approaching 5%	Liaise with monitoring consultant & undertake internal review to determine if impacts are related to mining			
BENTHIC COMMUNITIES		Arrange a peer review of the monitoring results and statistical analysis			
	Trigger Level 2 ANOVA/ANOSIM <5%	Undertake rollow up monitoring at аffected sites to obtain confirmation of impacts. Incident Report to be completed and distributed to relevant	Notify DPIE-Fisheries, LMCC and DPIE Notify immediately DPIE if incident and within 7 days for non- compliance	Consult with relevant authorities about monitoring and management controls	Consult with relevant authorities to identify if offsets are re how these are to be implemented.
	Normal	agencies			
	Negligible impact	Monitoring as per Seagrass MP			
SEAGRASS	Trigger Level 1 Approaching 20% decline in condition Approaching 20mm of additional mine induced subsidence within mapped seagrass	Liaise with monitoring consultant & undertake internal review to determine if impacts are related to mining		Review if variation is within broader background variation range for the site.	
	Trigger Level 2 >20% decline in conditions from year baseline survey >150mm of additional mine induced subsidence at survey location	Incident Report to be completed and distributed to relevant agencies	Notify immediately DPIE if incident and within 7 days for non- compliance Notify DPIE-Fisheries and LMCC	Consult with relevant authorities about monitoring and management controls	Consult with relevant authorities to identify if offsets are re how these are to be implemented.
	Normal Negligible environmental consequences	Monitoring as per Subsidence Monitoring Program, Benthic Communities Management Plan and Seagrass Management Plan			
	Trigger Level 1			Review if variation is within broader background variation	
THREATENED SPECIES AND ENDANGERED POPULATIONS	As per Seagrass and Benthic Community Management Plans Monitoring Level 1 triggers	Liaise with monitoring consultant & undertake internal review to determine if impacts are related to mining and greater than neglible environmental consequences.		range for the site.	
	Trigger Level 2 As per Seagrass and Benthic Community Management Plans Monitoring Level 2 triggers >780mm subsidence	Incident Report to be completed and distributed to relevant agencies	Notify immediately DPIE if incident and within 7 days for non- compliance Notify DPIE-Fisheries and LMCC	Initiate ecological monitoring program to assess the impacts to ecological communities and threatened species. Consult with relevant authorities about monitoring and management controls	Consult with relevant authorities to identify if offsets or reh required and how this is to be implemented.



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	CHAIN VALLEY COLLIERY- SUBSIDENCE MANAGEMENT TRIGGER ACTION RESPONSE PLAN (TARP 00136) SUBSIDENCE MANAGEMENT NORTHERN MINING AREA DOMAIN (S5 and Northern Pillar Area)	Revision 4 - 10/08/20
Environment Compliance Coord		
Mine Surveyo	Coordinate subsidence monitoring as outlined in TARP Review subsidence monitoring results against TARP triggers Inform relevant stakeholders as to subsidence monitoring trends and exceedances Ensure adequate financial and personnel resources are made available for implementation of this plan	



Appendix 10: Chain Valley Colliery Independent Environmental Audit

Review Date	Next Review Date	Revision No	Document Owner	Page
		1	Environmental Compliance Coordinator	Page 111 of 114
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GHD Pty Ltd | ABN 39 008 488 373

GHD Tower, Level 3, 24 Honeysuckle Drive

Newcastle, New South Wales 2300, Australia

T +61 2 4979 9999 | F +61 2 9475 0725 | E ntlmail@ghd.com | ghd.com

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1. Introduction

1.1 Introduction and purpose of this report

The Chain Valley Colliery (CVC) is an underground coal mine located at the southern end of Lake Macquarie, approximately 60 km south of Newcastle, New South Wales (NSW). CVC is owned and operated by Great Southern Energy Pty Ltd (trading as 'Delta Coal').

The mine operated under existing use rights until 23 January 2012 when major project approval (MP 10_0161) was issued under the *Environmental Planning and Assessment Act 1979* (EP&A Act). The approval was subsequently modified on 30 August 2012, to permit a revised mine layout associated with the introduction of wider miniwalls within the Domain 1 and 2 areas.

In 2013 the mine lodged an application for the Chain Valley Colliery Mining Extension 1 Project (SSD-5465) under Part 4 of the EP&A Act, which was approved on 23 December 2013.

This audit covers a period of time from 10 April 2019 to 12 April 2022. The site inspection component of the IEA was conducted on 12 April 2022. This report provides an outline of the audit methodology and results and provides recommended actions for achieving full compliance with environmental approvals.

The audit was led by *Elliot Holland*, Lead Auditor – Environmental Management Systems (number: 115351) with assistance from *Lachlan Taylor*. A technical review was completed by *Michelle Kiejda* - Technical Director – Environment.

Schedule 6, Condition 9 of SSD-5465 requires an IEA to be commissioned by the end of February 2022, and every three years thereafter. Schedule 6, Condition 9 constitutes the audit scope and requires that:

By the end of February 2022, and every three years after, unless the Planning Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development. The audit must:

- (a) led by a suitably qualified, experienced and independent auditor whose appointment has been endorsed by the Planning Secretary;
- (b) be led and conducted by a suitably qualified, experienced and independent team of experts (including any be expert in field/s specified by the Planning Secretary) whose appointment has been endorsed by the Planning Secretary;
- (c) be carried out in consultation with the relevant agencies and the CCC;
- (d) assess the environmental performance of the development and whether it is complying with the relevant requirements in this consent, water licences and mining leases for the development (including any assessment, strategy, plan or program required under these approvals);
- (e) review the adequacy of any approved strategy, plan or program required under the abovementioned approvals and this consent;
- (f) recommend appropriate measures or actions to improve the environmental performance of the development and any assessment, strategy, plan or program required under the abovementioned approvals and this consent; and
- (g) be conducted and reported to the satisfaction of the Planning Secretary.

As required by Schedule 6, Condition 9 of SSD-5465 the audit team was approved by the Department of Planning and Environment (DPE) to undertake the audit on 23 February 2022 (see Appendix A).

1.2 Scope of the audit

The audit took the following form:

- An initial start-up teleconference was held with relevant Delta Coal representatives to discuss the audit methodology, identify relevant personnel involved in the project, key activities and systems occurring on the Mine, documentation for review and to schedule a date for the Mine inspection.
- Relevant agencies and the Community Consultative Committee chair (CCC chair), including the Department of Planning and Environment (DPE), DPE Water, Department of Primary Industries Fisheries (DPI Fisheries), Environment Protection Authority (EPA), Biodiversity Conservation Division (BCD), the NSW Resources Regulator, Lake Macquarie City Council (LMCC), and Central Coast Council (CC Council) were requested to provide comment on the performance and/or compliance of the project with relevant requirements and/or approvals.
- A review of available key documentation including the Environmental Assessment (EA) documentation,
 Development Consent, Environment Protection Licence (EPL) and other relevant site and environmental
 information (such as correspondence with relevant agencies and management plans and/or monitoring
 results) was undertaken prior to interviews with Delta Coal representatives and the Mine inspection.
 Additional documents were reviewed during and following the interviews with Delta Coal representatives and
 the Mine inspection.
- A one-day site inspection, including interviews, to assess the general environmental performance of site and discuss Development Consent and EPL compliance with key site-based personnel.
- Preparation of a draft audit report for Delta Coal to review.
- Finalisation of the audit report and submission to Delta Coal.

1.3 Audit participants

The personnel listed in Table 1.1 were involved over the course of the audit.

Table 1.1 Audit team members

Audit team members	Organisation	Role
Michelle Kiejda	GHD	Technical Review
Elliot Holland	GHD	Lead Auditor
Lachlan Taylor	GHD	Assistant auditor
Lachlan McWha	Delta Coal	Environmental Compliance Coordinator

1.4 Limitations

This report: has been prepared by GHD for Delta Coal and may only be used and relied on by Delta Coal for the purpose agreed between GHD and Delta Coal as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Delta Coal arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

2. Methodology

2.1 Audit inception

An initial start-up teleconference for the audit was held on 11 March 2022 with relevant Delta Coal representatives to discuss the audit methodology, identify relevant personnel involved in the project, key activities and systems occurring on site, documentation for review and to schedule a date for the site inspection.

2.2 Document review

Environmental documentation associated with the Mine was reviewed by the auditors prior to site visit. Delta Coal personnel provided a number of documents for review including:

- Road Transport Protocol, including Traffic Management Plan (TMP) and Code of Conduct
- Noise Management Plan (NMP)
- Air Quality Management Plan (AQMP)
- Water Management Plan, including Surface Water Management Plan (SWMP) and Groundwater Monitoring Program (GWMP)
- Biodiversity Management Plan (BMP)
- Biodiversity Enhancement Strategy
- Heritage Management Plan (HMP)
- Rehabilitation Management Plan (RMP)
- Pollution Incident Response Management Plan (PIRMP)
- Environmental Management Strategy (EMS)
- Mining Operations Plan (MOP)
- Extraction Plan, including Built Features Management Plan, Benthic Communities Management Plan,
 Seagrass Management Plan, Pubic Safety Management Plan, and Subsidence Monitoring Program
- SSD-5465
- EPL 1770
- Consolidated Coal Lease (CCL) 706, 707; Mining Lease (ML) 1051, 1052, 1308, 1370, 1632 and 1992; and Mining Production lease (MPL) 1349, 1389, 1400 and 337
- EA documentation
- Correspondence to/from relevant agencies and CCC Chairperson

Additional documents were provided during and following the audit as evidence of compliance with SSD-5465, the EPL, and relevant lease(s).

2.3 Agency consultation

As part of the audit process, the following agencies were invited to provide comment in regard to Development Consent conditions requiring specific consultation with the particular agencies, including:

- DPE
- NSW Resources Regulator
- DPE Water
- BCD
- EPA
- LMCC
- CC Council
- DPI Fisheries
- The CCC Chairperson

Letters requesting comment from the agencies were emailed on 23 March 2022. Correspondence was received from DPE, NSW Resources Regulator, EPA, and CCC Chairperson.

Copies of this correspondence are provided in Appendix B. A summary of the auditors response to issues raised by the agencies is included in Section 4.7.

2.4 Site inspection and interviews

2.4.1 Opening and closing meeting

GHD undertook a site visit of CVC on 12 April 2022. The audit team used the site inspection to review compliance with various environmental requirements of the Mine.

Conditions on the day of the site inspection were noted to be up to 23.9 degrees Celsius (°C), with slight winds up to 22 km/hr, from the south-east.

The opening and closing meetings were held at the CVC offices. The list of participants is provided in Table 2.1.

Table 2.1 Opening and closing meeting attendees

Audit team members	Organisation	Role
Elliot Holland	GHD	Lead Auditor
Lachlan Taylor	GHD	Assistant auditor
Lachlan McWha	Delta Coal	Environmental Compliance Coordinator
Pieter Van Rooyen	Delta Coal	Technical Services Manager

Following the opening meeting, a site inspection was undertaken of the Mine and operations.

The objectives of the closing meeting were to discuss any outstanding matters, present preliminary findings and outline the process for finalising the audit report.

2.4.2 Audit interviews

During the on-site component of the audit, interviews were conducted with the Delta Coal staff identified in Table 2.1.

2.4.3 Data collection and verification

Where possible, documents and data collected during the audit process were reviewed whilst on-site. A number of documents were provided to the audit team prior to the on-site component of the audit. Several documents that were not available during the on-site component were provided following the audit.

All information obtained during the audit process was verified by the audit team where possible. For example, statements made by site personnel were verified by viewing documentation and/or via visual observations made during the site inspection. Where suitable verification was unable to be obtained, this has been identified.

2.4.4 Site inspection

A detailed site inspection of CVC was undertaken on 12 April 2022. The following locations were inspected:

- Sewage treatment discharge area
- Above ground tanks and bunding
- Oily water separator
- Workshop
- Hazardous and dangerous goods storage area
- Coal stockpile area
- CCP facilities
- Water storage dams
- EPL licensed discharge locations
- Ventilation fan compound

2.5 Reporting

This report has been prepared on an exception basis, highlighting the compliance issues identified along with any areas where action or improvement is required. The IEA has been prepared in accordance with the *NSW Government Independent Audit Guideline* (NSW Government, 2015).

Table 2.2 details where the key requirements of the guidelines have been addressed.

Table 2.2 Independent Audit Guideline Requirements

Section	Description	Where addressed
2	Assess the operator's compliance with the requirements of regulatory approvals, including (as applicable): The Development Consent The Environment Protection Licence The Mining Lease Water licences and approvals	Section 4
2, 3	The scope of the audit and the audit team (including any technical specialists) to be determined by the lead regulator.	Sections 1.2 and 1.3
3.3	The auditor must be independent of the development being audited and audit findings must be based on verifiable evidence.	Appendix C
4.2	The compliance status of each requirement or commitment should be assessed in accordance with the compliance assessment criteria and risk levels in the audit guidelines.	Section 4. However, compliance assessment criteria is in accordance with DPE's audit team approval letter (see Appendix A).
5.1	The audit outcomes to be documented in a thorough, accessible and accurate audit report that is written in a neutral tone reflecting facts gathered by the audit team.	This audit report
5.1	 The audit report should include the following sections: Introduction, providing a brief overview of the development, audit scope and objectives. Methodology, describing the audit team, methodology applied, document reviews, site inspections and interviews. Audit findings, including documentation of consultation, outcome of actions from the previous audit, assessment of compliance status against the conditions and commitments in relevant documents and discussion of environmental incidents and performance. Recommendations, identifying any opportunities for improvement identified in the audit. 	This audit report

Section	Description	Where addressed
5.2	Audit reports submitted to the lead regulator must be certified by the lead auditor on an attached 'Independent Audit Submission Form'	See Appendix D
5.3	Copies of the final audit report to be distributed to regulator agencies within two weeks of finalisation and placed on the development's website	Delta Coal to complete
6	The operator of the development to response to the lead regulator responding to the audit findings and recommendations with an action plan within four weeks of receiving the final audit report.	Delta Coal to complete

2.6 Definitions

Reporting results from the 2020 IEA was generally based on *NSW Government Independent Audit Guideline* (NSW Government, 2015); however, as per the request of DPE (see Appendix A), only the following descriptors have been used.

Compliant

Where sufficient verifiable evidence has been gathered to demonstrate that the intent and all elements of the requirement of the regulatory approval have been complied with within the scope of the audit.

Non-Compliant

Where sufficient verifiable evidence has been gathered to demonstrate that the intent of one or more specific elements of the regulatory approval have not been complied with within the scope of the audit.

Table 2.3 details the risk levels for non-compliances.

Table 2.3 Risk level for non-compliances

Risk level	Colour code	Description
High		Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence.
Medium		Non-compliance with: - Potential for serious environmental consequences, but is unlikely to occur, or - Potential for moderate environmental consequences, but is likely to occur.
Low		Non-compliance with: - Potential for moderate environmental consequences, but is unlikely to occur, or - Potential for low environmental consequences, but is likely to occur.
Administrative Non- compliance		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).

Not triggered

A regulatory approval requirement has an activation or timing trigger that had not been met at the time of the audit inspection, therefore a determination of compliance could not be made.

Note

A statement or fact, where no assessment of compliance is required.

Note: while 'note' was not identified as a relevant descriptor, a number of conditions of SSD-5465, EPL 1770, and relevant leases do not have any relevant compliance requirements. Therefore, note has been used to identify these conditions where no assessment of compliance is applicable.

3. Previous independent audit and status

The recommendations made in the 2019 IEA prepared by SLR Consulting Australia Pty Ltd (2019), and the status of recommendations as at 12 April 2022 are detailed in Table 3.1 below.

Table 3.1 2019 IEA findings/recommendations

Reference	2019 findings/recommendations	2022 status	Status (closed/open)
EPL 1770 – Condition L2.1	2019 Audit recommendation: The Annual Reviews need to provide a clear statement regarding whether discharge criteria have been met.	In regard to recommendation from the previous audit, the Annual Review includes a statement whether the discharge criteria have been met. This recommendation has been closed out.	Closed
EPL 1770 – Condition O1.1 & O7.2	 audit are rectified: Improve bin labelling Ensure all hydrocarbon containers (empty or full) are stored within bunds 	While bin labelling and availability of appropriate receptacles was identified. A non-compliance with this condition in relation to on-site waste disposal has been found. Refer to findings for Condition O1.1 in Section 4.4.	Open
		In regard to hydrocarbon containers, all hydrocarbon waste containers were stored within a bund. As a result, Corrective action 2 has been made in this audit.	
EPL 1770 – Condition O3.1	Ensure exceedances and other incidents are reported as per this condition (Detailed Incident Report within 7 days).	Several incident reports were viewed during the audit. Appropriate action was taken by Delta Coal in responding to incidents.	Closed
	Ensure TEOM is setup with alarms/notifications for when results are approaching or have exceeded the short term criterion for particulate matter. This will ensure exceedances are immediately detected and reported as soon as possible to the EPA and DPE.	Delta Coal provided evidence that the TEOM is set up with alarms and notifications when the short-term criterion for particulate matter is approached or exceeded, and this recommendation is considered closed out.	Closed
EPL 1770 – Condition O5	Update PIRMP to include: - Current site contacts; - Email details for government contacts; and	A review of the PIRMP found that the recommendations of the 2019 IEA have been incorporated and are closed out.	Closed
	 Figures that clearly show the location of hazardous substances and where pollution response equipment is stored. 		

Reference	2019 findings/recommendations	2022 status	Status (closed/open)
EPL 1770 – Condition O8.2	 Include additional detail in the Water Management Plan regarding sewage management. Include an update of sewage system during the audit period in the Annual Review. Ensure servicing is completed and records kept onsite. 	Review of relevant documentation verifies the relevant recommendations have been addressed. However, a non-compliance with Condition O8.4 has been identified in Section 4.4, with it noted by the auditors that the servicing for Q4 2020 was not completed on time, therefore constituting an administrative non-compliance. However, the servicing event occurred seven days following the end of Q4 2020 and has subsequently been completed as per Condition O8.4. Therefore, no corrective action is proposed.	Closed
EPL 1770 – Condition M2.2 & SSD-5465, Schedule 3, Conditions 11, 12 & 13, and Schedule 6, Condition 6	Improve data capture for PM10. Review possibilities of backup power supply. Ensure issues with data capture are reported in Section 1 and 7 of the Annual Review. Ensure TEOM is setup with alarms/notifications for when results are approaching or have exceeded the short term criterion for particulate matter. This will ensure exceedances are immediately detected and reported as soon as possible to the EPA and DPE.	With the exception of back-up power supply for capture of PM10 data, these recommendations have been closed out. Therefore, the recommendation for back-up power supply has been re-produced in Section 5. This forms Recommendation 3 of this audit.	Open
EPL 1770 – Condition M4.1	Update Noise Management Plan. Ensure monitoring is completed in accordance with Noise Management Plan.	While this was addressed at the time of the site inspection, it is understood an updated NMP was approved by DPE in mid-April 2022, which addresses this recommendation.	Closed.
EPL 1770 – Condition M4.2	For future Annual Returns a single noise monitoring report should be prepared and attached to the Annual Return.	Consolidated noise reports were completed for 2019, 2020 and 2021 over the reporting period.	Closed
EPL 1770 – Condition M6.2	Ensure all complaints are recorded in the internal database on site and the relevant details required under this condition are outlined in the Annual Review.	The auditor viewed the complaints and incidents register on the website and the internal complaints database and was found to be compliant.	Closed
EPL 1770 – Condition M7.2	With the new ownership an advertisement should be placed in the paper/newsletter providing a link to the Delta Coal website and outlining the complaint management details.	The Community Newsletter from July 2019 fulfilled the 2019 IEA recommendation.	Closed
EPL 1770 – Condition M7.4	Update the details of designated representatives of the company in the PIRMP.	The PIRMP has been updated within the reporting period. Designated representatives are nominated in Table 3 of the PIRMP.	Closed
EPL 1770 – Condition R1.3	LakeCoal and Delta Coal to prepare Annual Returns based on the period of the Annual Return and dates of the sale of Chain Valley.	The licence was transferred from LakeCoal to Delta Coal on 1 April 2019, which is outside the reporting period.	Closed
EPL 1770 – Condition R1.5	Ensure Annual Returns are completed as per the EPA requirements and submitted within the due date.	Review of relevant data indicates compliance with the requirements of this condition.	Closed
EPL 1770 – Condition R4.1	Send a combined noise report for the Annual Return period to the EPA.	Consolidated noise reports were completed for 2019, 2020 and 2021 over the reporting period via the EPA eConnect portal.	Closed

Reference	2019 findings/recommendations	2022 status	Status (closed/open)
EPL 1770 – Condition U1.1	Liaise with the EPA regarding the current status of the Sewage System Project. Implement any agreed actions in terms of timing.	This upgrade is in the process of being completed and is on track to be completed by 26 August 2022, as per the requirements of this condition. Corrective action 1 and Recommendation 5 have been made in relation to these works.	Open
SSD-5465 – Schedule 2, Conditions 7, 8, 9 & 10 Schedule 3, Condition 1	Ensure detailed records of coal transportation are recorded and able to be provided to auditors upon request. The spreadsheets should cover the requirements of the key conditions of the Development Consent.	Review of relevant data indicates this recommendation is closed out, with coal generally transferred to Vales Point Power Station via conveyor. Some haulage trucks were used over the reporting period to supplement the conveyor transport.	Closed
SSD-5465 – Schedule 2, Condition 23 and Schedule 6 Condition 3	All management plans require updating due to the length of time since the previous reviews. All should be in a Delta Coal template. Ensure there is a cross referencing table covering this condition in management plans. Additional detail including TARPs (contingency plan) should be developed in the next round of management plan updates.	The recommendation of the previous audit to ensure that Trigger Action Response Plans (TARPs) are added into the management plans has not been followed though in the audit for the AQMP, HMP, Seagrass Management Plan, Benthic Communities Management Plan and WMP. A non-compliance with clause (c) of this condition is recorded in Section 4.3. Therefore, the recommendation for TARPs to be included in management plan updates has been reproduced in Section 5. This has been reproduced as Corrective action 4 of this audit.	Partially open
SSD-5465 – Schedule 3, Condition 1	Ensure transport records from this Audit period (January 2016) onwards are recorded on the website. This could be appended to the Annual Review summarising the weekly transport.	Weekly Coal Haulage has been reported on the website adequately over the reporting period.	Closed
SSD-5465 – Schedule 3, Condition 3	Ensure Coal Haulage TMP is reviewed as per the requirements of the consent and commitments in the management plan. Attach Driver Code of Conduct to the management plan.	The recommendation of the previous audit has been incorporated into the plan.	Closed
SSD-5465 – Schedule 3, Condition	Ensure Traffic Audits are completed annually in accordance with this condition.	The independent traffic audits were undertaken on an annual basis over the reporting period and were in compliance with the requirements of this condition.	Closed
SSD-5465 – Schedule 3, Condition 5	Ensure the report is submitted to the DPE.	The recommendation of the previous audit has been closed out.	Closed
SSD-5465 – Schedule 3, Condition 6	Ensure the Alternative Transport Options Report is completed as per the frequency in this condition.	Delta Coal received correspondence from DPE on 15 December 2020 granting an exception from conducting the Alternative Coal Transport Options Assessment. The exception applies until such time coal haulage via public roads is	Closed
		proposed to re-commence.	

Reference	2019 findings/recommendations	2022 status	Status (closed/open)
SSD-5465 – Schedule 3, Condition 7	Continue investigations of any noise issues and, where practicable, implement reasonable and feasible mitigation measures. Ensure accurate/consistent monitoring results are presented in Annual Reviews.	The recommendation of the previous audit has been closed out.	Closed
SSD-5465 – Schedule 3, Condition 8	The real-time noise monitor should be re-established for the site. Liaise with the DPE regarding the best location, as the majority of noise complaints have resulted from Mannering Colliery operations, not CVC. Mannering Colliery is also owned by Delta Coal. Update the Noise Management Plan.	The real – time noise monitor was re-established on site in October 2019. Photographic evidence was provided for its installation. Data was also provided to show its implementation. Therefore, the recommendation of the previous audit is considered closed.	Closed.
SSD-5465 – Schedule 3, Condition 17	Include additional detail in the WMP regarding sewage management. Include an update of sewage system during the audit period in the Annual Review. Ensure servicing is completed and records kept onsite.	Additional details have been included in the WMP regarding the wastewater system. The proposed upgrades are not discussed as at the time of audit they have not been constructed. However, update on the progress of this project is included in Section 12.2 of the Annual Reviews.	Closed
SSD-5465 – Schedule 3, Condition 18	Update the water balance or justify why the current water balance is still applicable to the current operations.	The WMP includes a Water Balance that adequately fulfils the requirements of clause (a). The Water Balance has been updated since the previous IEA fulfilling the recommendation.	Closed
	Ensure dams and drainage lines are free on silt. Establish a maintenance schedule.	The implementation of the plan on site was generally adequate. It is noted that maintenance schedules are currently not established for desilting dams on site. Therefore, the recommendation of the previous IEA is still applicable.	Open
SSD-5465 – Schedule 3, Conditions 19 & 20	Include the biodiversity monitoring reports as appendices to the Annual Review. The current monitoring is provided in a spreadsheet with an email summary. Prepare a small Biodiversity Monitoring Report outlining results, a comparison against trigger levels and potential reasons for changes.	This has been reproduced as Recommendation 6 of this audit. The recommendations of the 2019 IEA have been closed out, whereby a standalone annual Biodiversity Report is appended to the Annual Review.	Closed
SSD-5465 – Schedule 3, Condition 20	Prepare a separate section with short, medium and long-term measures in the BMP.	Short, medium and long term measures are described adequate within the BMP. Therefore, the recommendation of the previous IEA is closed.	Closed
SSD-5465 – Schedule 3, Condition 21A	Update the HMP, including the removal of Site #45-7-0154.	Review of the current HMP indicates the recommendation of the previous IEA is closed.	Closed

Reference	2019 findings/recommendations	2022 status	Status (closed/open)
SSD-5465 – Schedule 3, Condition 22	Complete a visual and lighting assessment against the Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting.	Delta Coal undertook a lighting survey to assess the sites compliance with this condition and Australian Standards. The survey found that the development is being carried out in compliance with this condition.	Closed
SSD-5465 – Schedule 3, Condition 27	Ensure a copy of the approved Rehabilitation Management Plan is put on the website.	The RMP was updated in 2020 following the 2019 IEA. The RMP is available on the project website, therefore closing out the 2019 IEA Recommendation.	Closed
SSD-5465 – Schedule 4, Conditions 1, 2, 3 & 4	A more conservative approach to assessing future impacts from further mining is recommended to build confidence that the subsidence processes in play are understood and impacts that rely on the subsidence impacts can be suitably assessed prior to mining. A significant upgrade of subsidence monitoring systems and reporting protocols at CVC is recommended. The use of three dimensional surveying with total station survey and high quality global positioning system (GPS) control is recommended. This technology is readily available and widely used for subsidence monitoring in NSW.	Review of relevant documentation indicates this recommendation has been addressed.	Closed
	For sensitive high value features such as the marina or similar features, real-time continuous GNSS monitoring is available at relatively low cost and can be used to provide high confidence subsidence monitoring in three dimensions.	Review of relevant data indicates this recommendation for improvement has not been adopted. It is noted this is a recommendation for improvement and not a corrective action, as this recommendation is beyond the requirements of relevant conditions of SSD-5465. Therefore, while the recommendation is still open, it has not been reproduced in this audit report.	Open
	A thorough review of the survey data and monitoring approach for Line 23 along the northern lakeshore of CVC Bay is recommended.	Review of relevant data indicates this recommendation is closed.	Closed
	A review of benthic and seagrass community monitoring systems is recommended to confirm that the monitoring is capable of discriminating minor and negligible impacts as required by the development consent conditions.	Review of the 2019 IEA does not provide a justification for this recommendation, there is simply the recommendation without any discussion as to why the auditor felt the recommendation was necessary or relevant. Review of relevant documentation for the audit period does not indicate this recommendation is necessary. Therefore, this recommendation has not been reproduced in this audit report.	Closed

Reference	2019 findings/recommendations	2022 status	Status (closed/open)
	A separate subsidence impact assessment report should be prepared annually and appended to the Annual Review. Presentation of all future survey data in Annual Reviews would benefit from a thorough and comprehensive analysis of the subsidence monitoring being undertaken by an external consultant so that the data can be meaningfully interpreted and is comprehensible by anyone with an interest in the outcomes. The report should:	An annual subsidence report is appended to Annual Reviews for the audit period, addressing the requirements of this recommendation.	Closed
	 Assess performance against subsidence impact performance measures from the Development Consent as well as any other commitments, triggers and management measures from Extraction Plans. Assess how the Extraction Plans tracked against Trigger Action Response Plan (TARP's). 		
	Include how the site is tracking against subsidence performance criteria (Schedule 4 Condition 4) in the Biodiversity Monitoring Reports, Annual Seagrass Monitoring Report and the Annual Review. This should include a table outlining if performance criteria have been met and where further information can be found.	Reporting in relation to subsidence performance and the inclusion of Biodiversity Monitoring Reports, Annual Seagrass Monitoring Report in Annual Reviews was observed during document review for the audit.	Closed
	Develop a TARP when updating the Benthic Communities Management Plan. This should address the wording of Schedule 4 Condition 2 SSD 5465. A series of triggers should be developed based on quantitative data and this should be reported in the bi-annual monitoring reports and the Annual Review. An example of a trigger would be '% change in organisms between monitoring events'.	This recommendation has not been addressed during the audit period, as noted in Section 4.3. This forms Recommendation 10 of this audit.	Open
	Assess the triggers from the Extraction Plans e.g. ANOVA/ANOSIM level is approaching 5% in the bi-annual monitoring reports.	Review of relevant document indicates this comment has not been closed during the audit period. This forms Recommendation 9 of this audit.	Open
SSD-5465 – Schedule 5, Condition 1	Define who are potentially 'affected landowners' in the Air Quality Management Plan. Affected landowners should be contacted when there is a non - compliance relating to dust or noise. This should be completed even if it is a regional dust event as Delta Coal are still recording it as a non-compliance in the Annual Review.	In response to the recommendations of the previous IEA, the updated AQMP adequately defines 'potentially affected landowners' in Section 6.3. The auditor disagrees with the 2019 recommendation to contact landowners affected by regional dust events. Regardless of how it is reported in Annual Reviews, Schedule 3, Condition 11 of SSD-5465 specifically notes that exceedances at any residence on privately-owned land do not apply in relation to extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary of DPE.	Closed

Reference	2019 findings/recommendations	2022 status	Status (closed/open)
SSD-5465 – Schedule 6,	Prepare a cross referencing table outlining where sub conditions have been covered.	Cross referencing tables are provided in Appendix 3 and Appendix 4 of the EMS.	Closed
Condition 1	Ensure plans are reviewed as per Schedule 6 Condition 5.	The EMS has been reviewed within the reporting period and is compliant with the required revision timeframe.	Closed
	Include Schedule 5 Condition 2 requirement in the EMS to notify landowners of exceedances 'as soon as practical'. Define a time period for as soon as practical.	The recommendation from the previous audit to notify land owners has not been incorporated into the EMS. This therefore remains outstanding.	Closed
SSD-5465 – Schedule 6,	The Annual Reviews are set out differently to the DPE Annual Review Guidelines (2015).	The form of the Annual Reports has been updated since the previous IEA and is consistent with DPE Annual Review Guidelines (2015).	Closed
Condition 8	Ensure table of contents matches the guidelines. Include the biodiversity monitoring reports as appendices to the Annual Review.	The recommendations of the 2019 IEA have been closed out, whereby a standalone annual Biodiversity Report is appended to the Annual Review.	
SSD-5465 – Schedule 6, Condition 13	Ensure all relevant information is brought across to the Delta Coal website.	A review of the documentation on the website found that it generally contained the information listed in this clause. The information was up to date, and generally easy to find.	Open
		There were however some documents on the website that were not the most up to date versions available, as discussed in Section 4.3, with Corrective action 8 identified.	
Statement of Commitments recommendations	A separate report should be completed for Stream Health Channel Flow and Riparian Vegetation Monitoring. This should compare results from previous inspections. Information to be included in the Annual Review.	This data is presented in Annual Reviews. It is noted the requirement for this information to be presented in a separate report is not a commitment or requirement of the project, but rather a component of the previous auditor's recommendation. Therefore, this component of the recommendation has not been considered and this recommendation is considered closed.	Closed
	The real - time noise monitor should be re-established for the site. Liaise with the DPE regarding the best location as the majority of noise complaints have resulted from Mannering Colliery operations, not CVC. Mannering Colliery is also owned by Delta Coal. Update the Noise Management Plan.	The real-time monitor was re-established in October 2019, addressing the requirements of this recommendation.	Closed
CCL 721	Report against compliance with the MOP in future Annual Reviews.	Review of Annual Reviews for the reporting period verifies this recommendation has been closed.	Closed
Additional recommendation	The Annual Reviews need to provide a clear statement regarding whether discharge criteria have been met	Review of Annual Reviews for the reporting period verifies this recommendation has been closed.	Closed

4. Audit findings

4.1 Context of compliance assessment

CVC operates under SSD-5465, which initially provided approval for:

- An extension of the currently approved extraction area to allow underground mining to continue within the Fassifern Seam.
- The increase of the approved maximum rate of production from 1.2 million tonnes per annum (Mtpa) to
 1.5 Mtpa of run-of-mine (ROM) coal.
- An increase in the approved hours for haulage of coal from the Colliery on private roads to Delta Electricity's VPPS.
- Minor upgrades and modifications to existing approved infrastructure.
- An extension of the approved mining by a period of approximately 14 years (i.e. to around 2027).
- The consolidation of the above with all the operations and environmental activities currently approved under MP10_0161, as modified, within a single development consent.

SSD-5465 has been modified five times during the operation of the mine:

- Modification 1 (approved 27 November 2014): Development of an underground linkage between Chain Valley Colliery and Mannering Colliery.
- Modification 2 (approved 16 December 2015): The modification approved the following changes to the CVC operations:
 - An increase in the maximum rate of ROM coal extraction at the mine from 1.5 Mtpa to 2.1 Mtpa.
 - Mine design changes, primarily the re-orientation of miniwall panels in the mine's northern area.
 - An increase in full-time personnel from approximately 160 to approximately 220.
 - Construction of asset protection zones (APZs) around critical infrastructure to protect from bushfires.
- Modification 3 and Modification 5 (approved 26 June 2020): Allowed for the following changes to the CVC operations:
 - The use of alternate bord and pillar mine designs.
 - An extension of allowed operations until 31 December 2027.
- Modification 4 (approved 5 August 2021): Allowed for the following changes in CVC operations:
 - Extend the currently approved underground mining area by approximately 117 hectares (ha) into an area termed the Northern Mining Area, which is located under the suburbs of Brightwater, Mirrabooka and Sunshine, to extract an additional 2.6 Mt of ROM coal from the Fassifern Seam.
 - Access the proposed extension area via existing Chain Valley Colliery underground workings.
 - Undertake first workings coal extraction using herringbone bord and pillar underground mining methods.
 - Transport ROM coal extracted from the Northern Mining Area via underground workings to either the Chain Valley Colliery or Mannering Colliery surface facilities for processing.
 - Increase the maximum number of employees reporting to the Chain Valley Colliery pit top by 110 to 330 FTE.

The site is regulated by EPL1770, with the current version last varied on 21 February 2022.

Operations at CVC currently takes place in accordance with CCL 706, CCL 707, CCL 719, CCL 1721, ML 1051, ML 1052, ML 1308, ML 1632, MPL 1370, MPL 1349, MPL 1389, MPL 1400, and MPL 337.

4.2 Summary of compliance

Review of compliance with the requirements of relevant SSD-5465 identified:

- 12 non-compliances associated with SSD-5465, including:
 - Two deemed to represent a low risk
 - 10 deemed administrative non-compliances (ANC)
- 14 non-compliances associated with EPL 1770, including:
 - Eight (8) deemed to represent a low risk
 - Six (6) deemed ANC

4.2.1 General environmental compliance

Delta Coal was generally compliant in terms of environmental performance during the audit period and site inspection. The site did not have any serious incidents or non-compliances deemed medium risk or higher.

4.2.1.1 Air quality

The AQGGMP was revised in January 2022, with review of the indicating monitoring is in accordance with the requirements of EPL 1770 and SSD-5465. During the audit period, CVC experienced a number of exceedances of air quality criteria, all noted to be as a result of contamination of samples or extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents, etc.

These exceedances are therefore not considered non-compliances. This notwithstanding, they were reported as incidents and are covered in Section 4.2.3.

During 2020, the TEOM had a short period of not recording data in December 2020 due to severe thunderstorms. The gap in monitoring were recorded as a non-compliance against EPL 1770 Condition M2.2. Delta Coal have since rectified the system; however, the 2019 IEA recommendation to investigate back-up power supply for the TEOM is deemed as still relevant to this audit also.

4.2.1.2 Noise

With the exception of administrative non-compliances, the auditor found noise generated on-site is compliant with the requirements of EPL 1770.

In relation to SSD-5465, noise monitoring results over the audit period indicate that the premises is operating within the limits of this condition. The noise monitoring reports note a technical non-compliance for ATN007 for every monitoring event due to access issues. Noise monitoring for ATN007 was conducted at representative locations. Total noise levels shown were measured at the representative and site contributions were calculated back to ATN007. The use of representative locations is allowed via operation of Schedule 6, Condition 12 of SSD-5465.

Review of relevant documentation during conduct of the audit, including complaints and incident data (see Sections 4.2.2 and 4.2.3 respectively) would indicate appropriate noise management is undertaken on-site. While only one noise complaint received in the audit period, the response in this instance was proactive and resulted in a positive community response.

It is understood Delta Coal are currently in the process of undertaking a noise mitigation study in consultation with DPE – Compliance, the results of which should assist in further mitigating and managing noise from the site, particularly during adverse meteorological conditions. The outcomes of this study should be captured in a revised noise management plan and reflect any changes to monitoring, as relevant.

4.2.1.3 Water management

Several non-compliances with EPL 1770 discharge criteria and volume limits, including simultaneously on a number of occasions, were recorded during the audit period. In addition, volumetric monitoring ceased between 26 December 2021 and 10 January 2022 due to vandalism and damage sustained to the discharge flow monitor. This has since been fixed and monitoring has recommenced. These incidents are discussed in Section 4.2.3.

As per the findings of the 2019 IEA, the site inspection observed siltation of on-site water storage dams, some of which were observed to be overgrown with bullrush. A recommendation to establish a maintenance schedule to ensure dams and drainage lines are free of silt was made in the 2019 IEA.

The auditor believes completing this recommendation may address the exceedances of combined daily discharge volume limits by ensuring water storage in dams is maximised.

The exceedances of faecal coliform may be related to on-site septic systems covered by EPL 1770. A temporary chlorine dosing unit was added to this septic in June 2020 (though exceedances are noted to have continued). This system would be decommissioned once works under CC Council approval DA 845-2020 are completed, which allows connection to the CC Council sewer network and decommissioning of on-site septics.

In relation to the above, the auditor notes the following:

- Review of relevant data indicates elevated faecal coliforms are observed at upstream baseline locations. The
 draft surface water impact assessment for the Chain Valley Colliery Consolidation Project identifies elevated
 faecal coliforms and Enterococci are highest at upstream baseline background monitoring locations and does
 not appear to be site related; however, could indicate an influence on water sampling results from the
 EPL 1770 licensed discharge point located downstream.
- The Australian Drinking Water Guidelines 6 (Version 3.7, updated January 2022) and the Guidelines for Managing Risks in Recreational Water (2008) state faecal coliforms:
 - May be derived from sewage effluents. However, it may also be derived from livestock, industrial
 processes, farming activities, domestic animals and wildlife. Furthermore, they note faecal coliforms may
 include organisms not faecally derived.
 - Are unsuitable as regulatory parameters.
- NSW Health notes monitoring of faecal coliforms are no longer recommended by the Australian Drinking
 Water Guidelines, as updated in January 2022. They note this is because members of this bacteria can occur
 naturally in soil and water in the absence of faecal contamination.

The above points notwithstanding, a non-compliance has been found in relation to these exceedances. It is considered works under DA 845-2020 would address the potential for site contribution to elevated faecal coliform downstream of the discharge point once works are completed by 26 August 2020. **Corrective action 1** and **Recommendation 5** have been made in relation to these works.

Delta holds a groundwater bore license WAL41508 under the *Water Act, 1912*, which permits the industrial dewatering of groundwater up to volume of 4,443 megalitres (ML) per year. Based on the information in the Annual Reviews for the audit period, the site was within extraction licence limits allowed by WAL41508.

4.2.1.4 Biodiversity

The recommendations of the 2019 IEA to include a Biodiversity Monitoring Report in the Annual Reviews have been closed out. The results of these monitoring reports for 2019, 2020 and 2021 indicate vegetation and habitat values have remained generally consistent across the audit period and indicated no need for remedial actions. However, the monitoring reports, while noting successful weed control each year, did also note the need to continue weed control activities to prevent re-establishment.

4.2.1.5 Heritage

During the 2020 reporting period two previously unidentified Aboriginal Heritage Sites were disturbed during the demolition of former mine cottages. An incident report was submitted to DPE-compliance, BCD, the EPA and to Registered Aboriginal Parties (RAPs) on 22 October 2020. An independent heritage consultant inspected the site to provide further management recommendations. The sites were added to the AHIMS register as CV002 (AHIMS Site ID 45-7-0412) and CV003 (45-7-0413), with access to the sites prevented by locked gates and fencing to prevent further damage.

Review of relevant documentation indicates appropriate management of this issue was undertaken. It is noted the HMP was revised to cover these additional sites; and has been approved.

4.2.1.6 Visual

No new structures or works have occurred within the reporting period that would negatively impact visual amenity, and therefore no changes to visual factors have occurred.

4.2.1.7 Waste

Remondis manages waste streams on-site, providing waste receipts which identify the types and quantities of wastes generated and where they are disposed.

Waste systems were viewed on site during the site inspection. There were adequate, clearly marked receptacles placed around the site for waste; however, it was observed that staff were not segregating waste appropriately (see Plate 4.3, Plate 4.4 and Plate 4.14). This therefore constitutes a non-compliance with a number of conditions of EPL 1770 and SSD-5465, with **Corrective action 2** identified to address.

Therefore, a low risk non-compliance has been identified and corrective action 2 has been identified.

4.2.1.8 Rehabilitation

Review of the current approved MOP indicates minimal rehabilitation is proposed during the MOP period, with rehabilitation goals generally related to mine closure and addressing subsidence impacts, the consent allows operation up to 31 December 2027; therefore, closure planning in accordance with SSD-5465 is not required to commence until 31 December 2022.

The site is currently in the process of preparing a Rehabilitation Management Plan (RMP) and Annual Rehabilitation Report and Forward Program (as now required by the NSW Resources Regulator instead of a MOP from 2 July 2022). As part of the RMP preparation, it is also recommended that this document discuss topsoil storage and estimated volumes required for rehabilitation.

Review of relevant documentation indicates minor rehabilitation has been undertaken in relation to demolition works undertaken during 2021 (i.e. demolition of former mine cottages and infrastructure pertaining to coal conveyors & ROM coal handling facilities).

4.2.2 Complaints

Review of complaints records for CVC identified complaints as follows:

- 9 October 2020 The complainant noted noise from the CVC. At the time of the complaint, demolition of redundant site infrastructure was being undertaken. The Environmental Compliance Coordinator attended the residence and met with the complainant, who was satisfied knowing the works were temporary and the noise was not related to on-going mining operations at the CVC.
- 6 June 2021 The complainant noted suspected damage sustained to the property. The complainant was issued a letter response on 8 June 2021, noting no active or former CVC mining was occurring beneath the property. A review of mine plans indicated the property was underlain by former Wallarah Colliery workings, progressed in the late 1970's. The complainant was referred to Subsidence Advisory NSW to make a claim for damages suspected to be caused by 1970's mine workings.

4.2.3 Incidents

Review of incidents records for CVC identified incidents is summarise in Table 4.1 below.

Table 4.1 Summary of incidents during the audit period

Issue	Date(s)	Description
Licensed water discharge	30/08/2019	Exceedance of EPL 1770 – Volumetric Discharge Limit. The incident was reported to relevant authorities.
	18/09/2019 and 17/12/2019	Exceedance of EPL 1770 – Faecal Coliform Concentration Limit. The incident was reported to relevant authorities.
	09/02/2020, 18/03/2021, 21/03/2021	Exceedance of EPL 1770 – Volumetric Discharge Limit, and Total suspended solids (TSS) & Faecal Coliform Concentration Limits.
		The exceedances were noted to have all occurred during significant rainfall events.
		The incident was reported to relevant authorities.
	26/07/2020	Exceedance of EPL 1770 – Volumetric Discharge Limit. The exceedance was noted to have occurred during a significant rainfall event (131.2 mm in 24hr). The incident was reported to relevant authorities.
	24/12/2021	Telemetry for LDP1 went offline, with an inspection indicating vandalism of the meter, damaging the MACE FloPro unit and solar panel.
		This incident was reported to relevant authorities, repairs were undertaken to the unit on 10/01/2022 when replacement parts became available. The unit resumed functionality on the date of repairs.
	18/01/2022	Exceedance of EPL 1770 Faecal Coliform Limit at CVC LDP1.
		The incident was reported to relevant authorities, with Delta reviewing and updating its chlorine dosing units for the bathhouse and shower septic, including consideration of dosage, timing, and volume of CVC effluent.
	30/03/2022	Exceedance of EPL 1770 Faecal Coliform Limit (200 CFU/100ml) at LDP 27 (CVC spillway) during a significant rainfall event.
		The incident was reported to relevant authorities, with Delta reviewing the chlorine dosing system for the bathhouse and shower septic, noting it had recently increased dosage volumes, with field testing identifying chlorine presenting in concentrations that would disinfect water during routine monthly sampling.
Heritage	21/09/2020	This incident is discussed in Section 4.2.1.5.

Issue	Date(s)	Description
Air quality exceedances	10/12/2019	Exceedance of depositional dust criteria, reported to relevant authorities. The exceedance was identified as contaminated, with no need for an incident report.
	2019: 26/10/2019, 30/10/2019, 31/10/2019, 7/11/2019, 12/11/2019, 19/11/2019, 22/11/2019, 28/11/2019, 29/11/2019, 30/11/2019, 2/12/2019, 3/12/2019, 4/12/2019, 5/12/2019, 6/12/2019, 10/12/2019, 19/12/2019 & 31/12/2019 2020: 4/01/2020, 5/01/2020, 8/01/2020, 24/01/2020,	Exceedances of PM10 air quality criteria during the audit period, all of which were reported to relevant authorities. All exceedances were identified as extraordinary events, with no need for an incident report.
	9/04/2020, 5/06/2020, 7/07/2020, 7/09/2020, 18/11/2020, 11/12/2020, 31/12/2020, 18/02/2021 & 21/04/2021	Exceedance of depositional dust criteria, with each incident reported to relevant authorities. The formal incident reports to DPE for each incident identified the exceedances as being due to contamination. Consultation from DPE to Delta during the audit period noted DDG005 (which was installed in February 2020 at the same general location as DDG005) provided better representation of potential emissions from the CVC ventilation fan site. The AQMP was revised during the audit period to replace monitoring at DDG005 with DDG006.
	3, 6, 16, 18, 19, 20 and 24 January 2022	PM2.5 daily average exceedances, with Delta determining, based on operations at the time and meteorological conditions that its operations did not contribute with any significance to the non-compliances recorded at Tingley Road, Wyee. Further calibration and replacement of filters was undertaken by the maintenance contractor and the unit's performance to be monitored. Delta has committed to developing a TARP to further detail the management procedures for the newly established PM2.5 alarms, see Corrective action 4 .

4.2.4 Site inspection observations



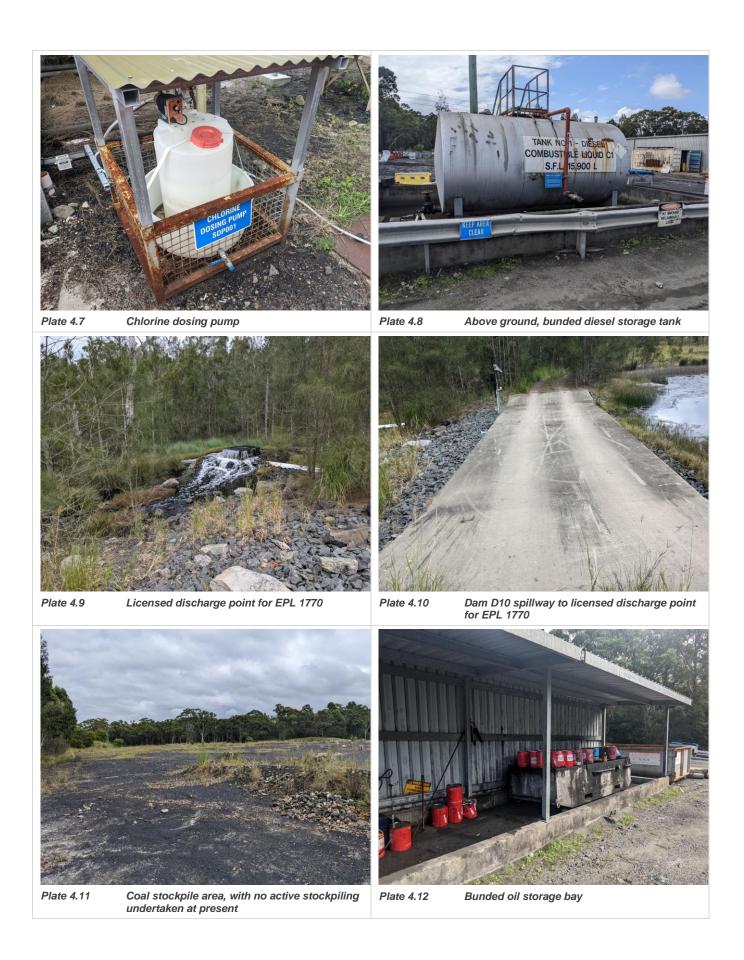




Plate 4.13 Oil water separator capturing runoff from the oil storage facilities, diesel tank storage, workshop / maintenance areas and wash bay



Plate 4.14 Inappropriate waste disposal within the diesel particulate filters bin



Plate 4.15 Grouted drain valve, removing ability to drain diesel storage bund, in accordance with the EPL



Plate 4.16 Oily water separator for compressors

4.3 Compliance with SSD-5465

4.3.1 Summary of non-compliances

The review of compliance with SSD-5465 identified 12 non-compliances. Two non-compliances were deemed to represent a low risk, while 10 were deemed administrative in nature.

A summary of non-compliances is detailed in Table 4.2.

Table 4.2 Summary of SSD-5465 non-compliances

Condition	Reason for non-compliance	Risk rating
Schedule 2, Condition 2	The following conditions of this licence were identified as being non-compliant over the reporting period: Schedule 2, Condition 2 Schedule 3, Condition 5 Schedule 3, Condition 9 Schedule 3, Condition 17 Schedule 3, Condition 18 Schedule 3, Condition 23 Schedule 6, Condition 3 Schedule 6, Condition 5 Schedule 6, Condition 14 Schedule 6, Condition 15 Schedule 6, Condition 12 Schedule 6, Condition 13 As these conditions of the licence have not been complied with, this condition is also non-compliant. Refer to corrective actions and recommendations on each condition.	Low
Schedule 2, Condition 23	As the recommendation of the 2019 IEA audit to ensure that Trigger Action Response Plans (TARPs) are added into the management plans has not been followed though in the audit for the following plans: AQGGMP HMP Seagrass Management Plan Benthic Communities Management Plan WMP A non-compliance with clause (c) of this condition is recorded and Corrective action 4 has been made.	Administrative
Schedule 3, Condition 5	A summary of the Independent Traffic Audit findings are not included in the annual review documentation. This constitutes and administrative non-compliance. Therefore, Corrective action 5 has been made.	Administrative
Schedule 3, Condition 9	A review of the approved NMP for the site found it generally compliant with the requirements of this condition. The plan however has not been updated since 2014, and therefore does not accurately reflect the activities and conditions occurring on site (including relevant monitoring locations), therefore an administrative non-compliance has been identified. The auditor notes a revised NMP was approved by DPE following conduct of the site inspection, addressing this non-compliance.	Administrative
Schedule 3, Condition 17	The wastewater system was generally being operated in accordance with this condition and of the conditions of the EPL. However, quarterly servicing regimes were not followed at times during the reporting period, constituting a non-compliance against the condition of the EPL (refer to discussion for Condition O8.4)	Administrative

Condition	Reason for non-compliance	Risk rating
Schedule 3, Condition 18	As above, the wastewater system was generally being operated in accordance with this condition and of the conditions of the EPL. However, quarterly servicing regimes were not followed at times during the reporting period, constituting a non-compliance with the approved WMP. Quarterly servicing was missed due to scheduling and contractor delay.	Administrative
Schedule 3, Condition 23	Waste systems were viewed on site during the site inspection. There were adequate, clearly marked receptacles placed around the site for waste; however, it was noticed that staff were not segregating waste appropriately. This therefore constitutes a noncompliance with clause (b).	Low
	Therefore, a low risk non-compliance has been identified and corrective action 2 has been identified.	
Schedule 6, Condition 3	Refer to discussion for Schedule 2, Condition 23 and Schedule 3, Condition 9.	Administrative
Schedule 6, Condition 4	Refer to discussion for Schedule 2, Condition 23 and Schedule 3, Condition 9. Failure to complete a review and (as necessary) a revision of the relevant plans has resulted in an	Administrative
Schedule 6, Condition 5	administrative non-compliance with Schedule 6, Condition 4 and clauses (c) and (d) of Schedule 6, Condition 5, with Corrective action 6 made.	
Schedule 6, Condition 12	Refer to discussion for Schedule 3, Condition 9.	Administrative
Schedule 6, Condition 13	A review of the documentation on the website found that it generally contained the information listed in this clause. The information was up to date, and generally easy to find.	Administrative
	There were however some documents on the website that were not the most up to date versions available. These were:	
	 Benthic Communities Management Plan, with the website revision dated 17 June 2019, but the current revision dated 6 April 2021. 	
	 Seagrass Management Plan, with the website revision dated 10 July 2020, but the current revision dated 6 April 2021. 	
	 Built Features Management Plan, with the website revision dated 12 May 2020, but the current revision dated 6 April 2021. 	
	This therefore constitutes a non-compliance against clause (b) of this condition and Corrective action 7.	

4.4 Compliance with EPL 1770

4.4.1 Summary of non-compliances

A review of compliance against EPL 1770 identified 14 non-compliances. Eight (8) non-compliances were deemed to represent a low risk, while six (6) were deemed administrative in nature.

A summary of non-compliances are detailed in Table 4.3 below.

Table 4.3 Summary of EPL 1770 Non-Compliances

Condition	Reason for non-compliance	Risk rating
P1.4	Monitoring locations are shown in Figure 2 of the Noise Management Plan and are described in Section 5.2. These locations are generally consistent with the requirements of this condition; however, point 13 (R12) and point 14 (R13) are not shown, thus forming an administrative non-compliance.	
	The auditor notes that a revision to the NMP was approved by DPE following the site inspection on 12 April 2022, which adequately describes the monitoring locations. Therefore, no corrective action is required.	
L1.1	Several incidents related to water pollution occurred over the reporting period. These are described below in L2.4, L3.1 and L3.2	Low
L2.1	Several non-compliances have occurred within the reporting period. Refer to condition L2.4, L3.1 and L3.2	Low

Condition	Reason for non-compliance	Risk rating
L2.4	Several non-compliances were recorded against this condition over the reporting period:	Low
	Exceedance of faecal coliform limit at LDP01 on 31 August 2019	
	Exceedance of faecal coliform limit at LDP01 on 18 September 2019	
	Exceedance of faecal coliform limit at LDP01 on 17 December 2019	
	 Exceedance of faecal coliform and TSS limit at LDP27 on 7 February 2020 	
	 Exceedance of faecal coliform and TSS limit at LDP27 on 26 July 2020 	
	Exceedance of faecal coliform and TSS limit at LDP27 on 9 September 2020	
	 Exceedance of faecal coliform and TSS limit at LDP27 on 18 March 2021 	
	 Exceedance of faecal coliform and TSS limit at LDP27 on 21 March 2021 	
	Exceedance of faecal coliform limit at LDP01 on 18 January 2022	
	Exceedance of faecal coliform limit at LDP27 on 31 March 2022	
	These exceedances therefore form a non-compliance against this condition, with Corrective Action 1 made address the non-compliance.	
L3.1	Exceedance of the daily volume limit at LDP01 on 30 August 2019. This exceedance therefore forms a non-compliance against this condition, with Recommendation 6 made to address.	Low
L3.2	Several non-compliances were recorded against this condition over the reporting period:	Low
	 Exceedance of combined daily volume limit at LDP1 and LDP27 on 9 February 2020. 	
	 Exceedance of combined daily volume limit at LDP1 and LDP27 on 26 July 2020 – there was also an exceedance of faecal coliforms and TSS at LDP27 on this day. This forms a medium risk non-compliance. 	
	 Exceedance of combined daily volume limit at LDP1 and LDP27 on 18 March 2021 – there was also an exceedance of faecal coliforms and TSS at LDP27 on this day. This forms a medium risk non-compliance. 	
	 Exceedance of combined daily volume limit at LDP1 and LDP27 on 21 March 2021- there was also an exceedance of faecal coliforms and TSS at LDP27 on this day. This forms a medium risk non-compliance. 	
	 Volumetric monitoring also ceased between 26 December 2021 and 10 January 2022 due to the volumetric flow met. This has been fixed and monitoring has recommenced. 	
	Corrective Action 1 has therefore been made to address the non-compliance.	
L5.1	A review of the data presented in the quarterly noise monitoring reports and the annual compliance assessments found that Chain Valley Colliery is operating within the noise limits defined by this condition, with the exception of Point 23 (ATN007).	Administrative
	It was noted that there appears to be a typographical error in the limits for Point 23 (ATN007) and that the noise limits of the EPL were not consistent with the noise limits in SSD-5465.	
	The EPL was modified on 30 September 2021 so that the noise limits for Point 23 (ATN007) were consistent with those presented in SSD-5465. Even so, noise monitoring results did not compare findings against previous EPL criteria, thus constituting an administrative non-compliance.	
	As this issue with the EPL has been resolved, no corrective actions are required.	
L5.7	Monitoring for LA1(1minute) noise levels is not completed at 1 m from a façade; however, such noise monitoring is generally not practical due to disturbance to residents during the sensitive night-time period. Furthermore, operation of Schedule 6, Condition 12 of SSD-5465 allows monitoring from representative locations.	Administrative
O1.1	Waste tracking sheets were viewed during the audit and were found to be adequate and in compliance with this condition.	Low
	During the site inspection, the auditor noted that waste disposal was generally non-compliant with the requirements of this condition, with inappropriate waste disposal identified at a number of waste storage locations (see Section 4.2.4). As a result Corrective action 2 has been made.	
O7.2	The site inspection identified that there were adequate vessels for recycling on site; however, recycling was not adequately implemented by staff. There were several instances of incorrect waste being placed into a clearly labelled waste stream bin.	Low
	As a result Corrective action 2 has been made.	

Condition	Reason for non-compliance	Risk rating
O8.4	Servicing records were provided showing evidence of regular servicing. It was noted by the auditors that the servicing for Q4 2020 was not completed on time, therefore constituting an administrative non-compliance. However, the servicing event occurred 7 days following the end of Q4 2020 and subsequent servicing has been undertaken at quarterly intervals.	Administrative
	Therefore, no corrective action is proposed.	
M1.3	Review of air quality monitoring sheets were found to be generally compliant with the requirements of this condition; however, they did not include a sample time, thus a non-compliance against clause (b) is recorded.	Administrative
	Therefore, Corrective action 3 has been made.	
M2.2	The TEOM stopped recording data for a short period in December 2020 due to severe thunderstorms. The gap in monitoring is recorded as a non-compliance against this condition. Delta Coal have since rectified the system and no corrective action is required.	Low
	The 2019 IEA recommended that the TEOM is set up with alarms and notifications when the short term criterion for particulate matter is approached or exceeded. Delta Coal provided evidence that this has occurred, and this recommendation is considered closed out.	
	The 2019 IEA recommendation to investigate back up power supply for the TEOM has not been carried out in the reporting period. Therefore, this recommendation has been reproduced as part of this audit.	
M8.1	A review of the Annual Review and monitoring data has found that monitoring of discharge points was generally adequate over the reporting period.	Administrative
	The exception being volumetric monitoring also ceased between 26 December 2021 and 10 January 2022 due to the vandalism of the volumetric flow measuring equipment. This constitutes a non-compliance against condition (a).	
	This has been fixed and monitoring has recommenced. As Delta Coal have been prompt in addressing this issue, no corrective action is recommended.	

4.5 Compliance with relevant leases

4.5.1 Summary of non-compliances

The review of compliance with the relevant leases (CCL 706, CCL 707, CCL 719, CCL 1721, ML 1051, ML 1052, ML 1308, ML 1632, MPL 1370, MPL 1349, MPL 1389, MPL 1400, and MPL 337) did not identify any non-compliances during the audit period.

4.6 Adequacy of any strategies/plans and programs

A number of strategies, plans and programs have been developed for the Mine in accordance with SSD-5465 and EPL 1770. Table 4.4 provides a summary of the key monitoring and management practices on site and areas recommended for improvement.

Table 4.4 Status of key monitoring and management

Environmental aspect	Reference	Implementation	Recommendation
General compliance	EMS Management plans listed in this table	Management plans prepared for the site are generally compliant with the requirements of the project approval and the EPL. The EPL was reissued in February 2022 to reflect current mining operations and minor changes to the requirements of the EPL. The EMS was generally compliant with the requirements of SSD-5465; however, the recommendation from the previous audit to notify land owners has not been incorporated into the EMS. This therefore remains outstanding and has been reproduced as a recommendation in this audit.	
Traffic and transport	Road Transport Protocol, including TMP and Code of Conduct	Review of relevant data indicates negligible impacts on traffic and transport as a result of CVC operation, with independent traffic audits undertaken on annual basis over the audit period and in compliance with the requirements SSD-5465. Relevant recommendations from the 2019 IEA relating to this plan were also noted to have been closed out. However, it is noted independent traffic audits are not reported in annual reviews in accordance with Schedule 3, Condition 5. Therefore, corrective action 5 has been made.	Corrective action 5
Noise management plan	NMP	Review of relevant documentation indicated the 2014 NMP was still the relevant management plan for the site during the audit period, with non-compliances consistent with the 2019 IEA. However, it is noted a 2022 version was approved by DPE following the conduct of the site inspection on 12 April 2022, addressing relevant non-compliances and recommendations associated with the 2014 NMP. A review of the complaints register found that one noise complaints was received over the reporting period. This complaint occurred in October 2020 and did not occur again over the reporting period. This indicates that adaptive noise management is being undertaken by Delta Coal.	N/A
AQMP	AQMP	A review of the AQMP prepared for the site found it to be generally compliant with SSD-5465 and EPL 1770.	N/A
Water management	WMP, including The implementation of the WMP on site was generally considered adequate. However, as discussed in Section		Corrective actions 1 and 4
		As per the findings of the 2019 IEA, the site inspection observed siltation of on-site water storage dams, some of which were observed to be overgrown with bullrush. A recommendation to establish a maintenance schedule to ensure dams and drainage lines are free of silt was made in the 2019 IEA. The auditor believes completing this recommendation may address the exceedances of combined daily discharge volume limits and TSS by ensuring water storage in dams is maximised.	Recommendations 5 and 6
		Furthermore, a non-compliance a non-compliance has been found in relation to exceedances of faecal coliform criteria in EPL 1770. It is considered works under DA 845-2020 to connect to the CC Council sewer network rather than relying on on-site septics would address the potential for site contribution to elevated faecal coliform downstream of the discharge point once works are completed by 26 August 2020.	

Environmental aspect	Reference	Implementation	Recommendation
Biodiversity	ВМР	A review of the BMP prepared for the site found it to be generally compliant with SSD-5465 and EPL 1770.	N/A
	Biodiversity Enhancement Strategy	A review of the Biodiversity Enhancement Strategy prepared for the site found it to be generally compliant with SSD-5465.	N/A
Heritage HMP		During the 2020 reporting period, two previously unidentified Aboriginal Heritage Sites were disturbed during the demolition of former mine cottages. An incident report was submitted to DPE-compliance, BCD, the EPA and to Registered Aboriginal Parties (RAPs) on 22 October 2020.	N/A
		Review of relevant documentation indicate appropriate management of this issue was undertaken. It is noted the HMP was revised to cover these additional sites and has been approved.	
Rehabilitation	RMP	A review of the MOP found them compliant with the requirements of SSD-5465. The RMP was also found to be generally compliant with the requirements of SSD-5465.	Recommendation 8
		There were no areas of the site under active rehabilitation over the reporting period. General maintenance vegetation maintenance and weed management have been undertaken.	
		It is noted Delta are in the process of preparing a Rehabilitation Management Plan (RMP) and Annual Rehabilitation Report and Forward Program (as now required by the NSW Resources Regulator instead of a MOP from 2 July 2022). This RMP is recommended to ensure to discuss topsoil storage and estimated volumes required for rehabilitation.	
Pollution	PIRMP	A review of the PIRMP found that the recommendations of the 2019 IEA have been incorporated and are closed out.	N/A
incident		The PIRMP was tested three times in the audit period:	
response		- 17 December 2019	
		- 22 December 2020	
		- 22 December 2021	
		The PIRMP was produced in the site inspection.	

4.7 Auditor's response to any matters raised by agencies/stakeholders

4.7.1 DPE

A consultation letter was provided to the DPE Compliance Team on 23 March 2022, with a subsequent response received 28 March 2022 and is summarised in Table 4.5.

Table 4.5 DPE comments and auditor's response

NSW Resource Regulator comments	Auditor response
Implementation of approved management plans	Sections 4.2 and 4.6
Noise management and monitoring – in particular, is the current monitoring regime adequate for the surrounding receivers and are the monitoring locations most representative of the nearest residential receivers?	Section 4.2.1.2
Surface water management and discharge events	Section 4.2.1.3
Complaints management and responses	Section 4.2.2

4.7.2 NSW Resources Regulator

A consultation letter was provided to the NSW Resources Regulator on 23 March 2022, with a subsequent response received 23 March 2022 and is summarised in Table 4.6.

Table 4.6 NSW Resources Regulator comments and auditor's response

NSW Resource Regulator comments	Auditor response	
Review relevant mining leases and exploration licences as agreed with Resources Regulator.	Noted	
Undertake an assessment of compliance against the conditions of title related to environmental management.	Noted	
Verify that there is a current Mining Operations Plan (MOP) in place and it has been approved by the Regulator – review compliance against any conditions of approval of the MOP.	The existing MOP which applies to CVC is Amendment 2 dated 12 August 2021. However, it is noted while the current MOP period ends in 2023, the new RMP and Annual Report & Forward Program are in the process of being prepared for submission by 2 July 2022.	
Undertake a critical review of the MOP, including an assessment of its compatibility with the description of operations contained in the planning approval. In	Review of the existing MOP indicates consistency with the requirements of SSD-5465 and the associated EA, including subsequent modification EAs.	
Review the rehabilitation strategy as outlined in the MOP to determine if it is consistent with the Project Approval in terms of progressive rehabilitation schedule; and proposed final land use(s).	Review of these documents indicate relevant rehabilitation commitments and objectives for CVC relate to addressing any potential subsidence impacts, for which relevant performance measures detailed under Schedule 5, Conditions 2 and 4 of SSD-5465 have been met during the audit period.	
Review the rehabilitation objectives and completion criteria as outlined in the MOP to determine if they have been developed in accordance with the proposed final land use(s) as outlined in the Project Approval.	Otherwise, relevant rehabilitation committed to in the EA relates to rehabilitation to be undertaken at completion of mining activities, which is not relevant to the audit period. Review of relevant documentation for the audit period otherwise indicates compliance with the rehabilitation objectives and completion criteria identified in the existing MOP.	
Review the development and implementation of any rehabilitation monitoring programs to assess performance against the nominated objectives and completion criteria – verified by reviewing monitoring reports and rehabilitation inspection records.	As above	

NSW Resource Regulator comments	Auditor response	
Determine if a rehabilitation care and maintenance program has been developed and implemented	A rehabilitation care and maintenance program has not been developed as part of the existing MOP.	
based on the outcomes of monitoring program – verified by reviewing Annual Rehabilitation Programs or similar documentation.	It has been recommended Delt include a rehabilitation care and maintenance program as part of the RMP and Annual Rehabilitation Report and Forward Program currently being prepared (as now required by the NSW Resources Regulator instead of a MOP).	
Confirm that mining operations are being conducted in accordance with the approved MOP (production, mining sequence etc.), including within the designated MOP approval boundary – to be verified by site plans and site inspection.	Review of relevant documentation and conduct of the site inspection on 12 April 2022 indicates operations at CVC are being undertaken in accordance with the existing MOP.	
Confirm that rehabilitation progress is consistent with the approved MOP as verified by site plans and a site inspection. This should include an evaluation against rehabilitation targets and whether the final landform is being developed in accordance with conceptual final landform in the Project Approval.	As discussed, review of the existing MOP indicates minimal rehabilitation is proposed during the MOP period (noting that it will be superseded in July 2022), as an underground mine site there is minimal surface area requiring progressive rehabilitation. Subsidence issues would be the primary requirement for rehabilitation during the audit period, with no subsidence occurring	
Based on a visual inspection, determine if there are any rehabilitation areas that appear to have failed or that have incurred an issue that may result in a delay in achieving the successful rehabilitation outcomes.	during the audit period requiring rehabilitation. This notwithstanding, review of relevant documentation indicates minor rehabilitation in relation to demolition works undertaken during 2021 (i.e. demolition of former mine cottages and infrastructure pertaining to coal conveyors & ROM coal handling facilities). This area has been rehabilitated to open grasslands, with ongoing priority weed management. Delta notes they do not intend to relinquish these rehabilitated areas from the mining lease.	

4.7.3 CCC Chair

A consultation letter was provided to the CCC Chair on 23 March 2022, with a response (including input of CCC members) received on 1 April 2022. This response indicated no one raised any matters of concern for the auditor to investigate.

The CCC Chair noted general consensus that CVC operations and performance are in accordance with the relevant approvals.

4.7.4 EPA

A consultation letter was provided to the EPA on 23 March 2022, with a response received 25 March 2022 noting the EPA did not have any comments.

4.7.5 Other agencies

A consultation letter was provided to the BCD, DPI – Fisheries, Heritage NSW, DPI – Water, CC Council and LMCC on 23 March 2022, with no response received to date.

5. Corrective actions and recommendations

Table 5.1 and Table 5.2 summarise the corrective actions and recommendations respectively made based on the findings of the audit.

Table 5.1 Corrective actions

Number	Condition	Corrective action	
EPL 1770			
1	L2.4 and L3.2	Keep DPE up-to-date on the progress of works under DA 845-2020 to address exceedances associated with licensed discharges.	
2	O1.1 & O7.2	As bins are clearly labelled and adequate disposal facilities are available across the site, Delta should investigate means to address the workforce culture in relation to inadequate disposal of waste that has persisted across this, and the previous, audit.	
3	M1.3	Ensure contractors record sample time when recording air quality monitoring data in accordance with the requirements of Condition M1.3.	
SSD-546	5		
4	Schedule 2, Condition 23	Ensure that TARPs are included in the AQMP, HMP, Seagrass Management Plan, Benthic Communities Management Plan and WMP in the next update. This includes developing a TARP to further detail the management procedures for the newly established PM2.5 alarms within the AQMP.	
5	Schedule 3, Condition 5	Ensure a summary of the results of Independent Traffic Audits are included in Annual Reviews.	
6	Schedule 6, Condition 5	Ensure plans are updated within three months of submission of this IEA and otherwise in accordance with the requirements of Schedule 6, Condition 5.	
7	Schedule 6, Condition 13	Ensure that the most up to date management plans are uploaded onto the website.	

Table 5.2 Recommendations

Number	Condition	Recommendation			
EPL1770	EPL1770				
1	P1.1	As part of updates required to the AQMP, update Figure 3 to show the location of the meteorological station.			
2	L2.4	There is an inconsistent naming convention for the discharge locations between sites. It is recommended that they are consistently referenced across management plans and annual reviews.			
3	M2.2	To improve data capture for PM10, review possibilities of backup power supply for the system.			
SSD-5465					
4	Schedule 2, Condition 22	The outcome of consultation is not included in the BMP, it is recommended a statement be added to indicate no comments were received to be included in the plan.			
5	Schedule 3, Condition 17 and Condition 18	The WMP has not been implemented as approved in relation to sewage management. Ensure the WMP is updated to reflect the changes to on-site sewage management, which are scheduled to be completed by 26 August 2022.			
6	Schedule 3, Condition 18	Ensure a maintenance schedule is established to ensure dams and drainage lines are free of silt and water storage is maximised.			
7	Schedule 6, Condition 1	Include a requirement in the EMS to notify landowners of exceedances 'as soon as practical'. Define a time period for as 'soon as practical'.			

Number	Condition	Recommendation	
8	Schedule 3, Condition 27	Ensure the RMP required by SSD-5465 is updated to consider the requirements of the RMP and Annual Rehabilitation Report and Forward Program currently being prepared (as now required by the NSW Resources Regulator instead of a MOP) and documents where topsoil will be stored and the estimated volumes required for rehabilitation.	
9	Schedule 3, Condition 9	The outcomes of the noise mitigation study currently being completed should be captured in a revised noise management plan and reflect any changes to monitoring, as relevant.	
Still relevant 2019 IEA recommendations			
10	Schedule 4, Condition 1-4	Assess the triggers from the Extraction Plans e.g. ANOVA/ANOSIM level is approaching 5% in the bi-annual monitoring reports.	
11	Schedule 4, Condition 2	Develop a TARP when updating the Benthic Communities Management Plan. This should address the wording of Schedule 4 Condition 2 SSD 5465. A series of triggers should be developed based on quantitative data and this should be reported in the bi - annual monitoring reports and the Annual Review. An example of a trigger would be '% change in organisms between monitoring events'.	

Appendices

Appendix A

Audit team approval letter



Department of Planning and Environment

Mr Lachlan McWha
Environmental Compliance Coordinator
Great Southern Energy Pty Ltd (t/a Delta Coal)
Chain Valley Colliery
Awabakal Country
PO Box 7115
Mannering Park NSW 2259

23/02/2022

Dear Mr McWha

Chain Valley Extension - IEA Auditor Endorsement Request (SSD-5463 and MP 06_0311)

I refer to your request (SSD-5465-PA-70) submitted to the Department of Planning and Environment (the Department) on 17 February 2022 requesting the Secretary's endorsement of suitably qualified persons to prepare the Independent Environmental Audit (IEA) for the Chain Valley Colliery in accordance with Schedule 6 Condition 9 of SSD-5465, as modified and Schedule 5 Condition 9 of MP 06 0311, as modified (the consents).

The Department has reviewed the nominations and information you have provided and is satisfied that these experts are suitably qualified and experienced. Consequently, I can advise that the Secretary endorses the appointment of the following audit team to prepare the IEA for the Chain Valley Colliery:

- Mr Elliot Holland (Lead Auditor); and
- Ms Michelle Kiejda (Technical Review).

Please ensure this correspondence is appended to the Independent Audit Report.

The Independent Audit must be prepared, undertaken and finalised in accordance with the Department's *Independent Audit Guideline – Post approval requirements for state significant developments* (October 2016). Failure to meet these requirements will require revision and resubmission.

The Department reserves the right to request an alternate auditor or audit team for future audits.

Notwithstanding the agreement for the above listed audit team, each respective project approval or consent requires a request for the agreement to the auditor or audit team be submitted to the Department, for consideration of the Secretary. Each request is reviewed and depending on the complexity of future projects, the suitability of a proposed auditor or audit team will be considered.

Should you wish to discuss the matter further, please contact James Epstein, Senior Compliance Officer, on (02) 6575 3419 or via email compliance@planning.nsw.gov.au

Yours sincerely

Heidi Watters

Team Leader Northern

Compliance

As nominee of the Planning Secretary



Department o	f Planning	and Environment
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Appendix B

Agency consultation

GHD Tower, Level 3, 24 Honeysuckle Drive Newcastle, New South Wales 2300 Australia www.ghd.com



Your ref: 0001 Our ref: 12572751

23 March 2022

James Epstein Senior Compliance Officer Locked Bag 5022 Parramatta, NSW, 2124

Chain Valley Colliery (SSD-5465) and Mannering Colliery (PA06_0311) Independent Environmental Audit

Dear James

Great Southern Energy Pty Ltd (trading as 'Delta Coal') has engaged GHD to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery. These audits would be prepared in accordance with Schedule 6, Condition 9 of SSD-5465 (as modified) and Schedule 5, Condition 9 of PA06 0311 (as modified, respectively. The scope of the audit is to:

- Assess the environmental performance of the development and whether it is complying with the relevant requirements of the consent and any relevant EPLs or Mining Leases (including any assessment, plan or program required under these approvals)
- Review the adequacy of strategies, plans or programs required under the Development Consent
- Recommend measures or actions to improve the environmental performance of the project and/or any assessment, plan or program required under the approval

I am writing to you to invite comment from yourself in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06_0311)), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

It would be appreciated if you could provide your comments in regard to the performance of Delta Coal's in meeting these obligations under the following headings:

- Compliance with requirements
- Progress to meeting requirements
- Details of incidents of non-compliance
- Adequacy of actions taken
- Adequacy of the requirements of the licence

I also invite you to comment on Delta Coal's performance with other requirements, as you may deem appropriate.

The site visit for the audit is currently scheduled to be conducted the Thursday/Friday, 7 and 8 April 2022. We wish to invite you to provide comment on Delta Coal's compliance/performance so that we may adequately address any concerns during the audit.

It would be appreciated if you could submit your written comments by close of business Wednesday, 6 April 2022.

All correspondence in relation to this matter should be directed to Elliot Holland, GHD Lead Auditor on 02 4979 9923 or elliot.holland@ghd.com.

Regards

Elliot Holland

Exemplar Global – Lead Auditor: EMS

(02) 4979 9923

elliot.holland@ghd.com

GHD Tower, Level 3, 24 Honeysuckle Drive **Newcastle, New South Wales 2300** Australia www.ghd.com



Your ref: 0001 Our ref: 12572751

23 March 2022

Biodiversity Conservation Division Locked Bag 1002 Dangar, NSW, 2259

Chain Valley Colliery (SSD-5465) and Mannering Colliery (PA06_0311) Independent Environmental Audit

To whom it may concern

Great Southern Energy Pty Ltd (trading as 'Delta Coal') has engaged GHD to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery. These audits would be prepared in accordance with Schedule 6, Condition 9 of SSD-5465 (as modified) and Schedule 5, Condition 9 of PA06 0311 (as modified, respectively. The scope of the audit is to:

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- Review the adequacy of strategies, plans or programs required under the Development Consent
- Recommend measures or actions to improve the environmental performance of the project and/or any assessment, plan or program required under the approval.

I am writing to you to invite comment from the Biodiversity Conservation Division (BCD) in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06 0311)), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

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Upon receipt of this letter, please advise GHD of the primary contact within your organisation that will be coordinating this request. It would be appreciated if you could submit your written comments by close of business Wednesday, 6 April 2022.

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Regards

Elliot Holland

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Elliot.holland@ghd.com

Mollend.

GHD Tower, Level 3, 24 Honeysuckle Drive **Newcastle, New South Wales 2300** Australia www.ghd.com



Your ref: 0001 Our ref: 12572751

23 March 2022

Margaret MacDonald-Hill Committee Independent Chair

Chain Valley Colliery (SSD-5465) and Mannering Colliery (PA06_0311) Independent Environmental Audit

Dear Margaret

Great Southern Energy Pty Ltd (trading as 'Delta Coal') has engaged GHD to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery. These audits would be prepared in accordance with Schedule 6, Condition 9 of SSD-5465 (as modified) and Schedule 5, Condition 9 of PA06 0311 (as modified, respectively. The scope of the audit is to:

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- Recommend measures or actions to improve the environmental performance of the project and/or any assessment, plan or program required under the approval.

I am writing to you to invite comment from yourself in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06 0311), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

It would be appreciated if you could provide your comments in regard to the performance of Delta Coal's in meeting these obligations under the following headings:

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Mollerd.

GHD Tower, Level 3, 24 Honeysuckle Drive **Newcastle, New South Wales 2300** Australia www.ghd.com



Your ref: 0001 Our ref: 12572751

23 March 2022

General Manager **Central Coast Council** PO Box 20 Wyong, NSW, 2259

Chain Valley Colliery (SSD-5465) and Mannering Colliery (PA06_0311) Independent Environmental Audit

To whom it may concern

Great Southern Energy Pty Ltd (trading as 'Delta Coal') has engaged GHD to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery. These audits would be prepared in accordance with Schedule 6, Condition 9 of SSD-5465 (as modified) and Schedule 5, Condition 9 of PA06 0311 (as modified, respectively. The scope of the audit is to:

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- Recommend measures or actions to improve the environmental performance of the project and/or any assessment, plan or program required under the approval.

I am writing to you to invite comment from Central Coast Council in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06_0311), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

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Mollend.

GHD Tower, Level 3, 24 Honeysuckle Drive Newcastle, New South Wales 2300 Australia www.ghd.com



Your ref: 0001 Our ref: 12572751

23 March 2022

James Epstein Senior Compliance Officer Locked Bag 5022 Parramatta, NSW, 2124

Chain Valley Colliery (SSD-5465) and Mannering Colliery (PA06_0311) Independent Environmental Audit

Dear James

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- Review the adequacy of strategies, plans or programs required under the Development Consent
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I am writing to you to invite comment from yourself in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06_0311)), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

It would be appreciated if you could provide your comments in regard to the performance of Delta Coal's in meeting these obligations under the following headings:

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I also invite you to comment on Delta Coal's performance with other requirements, as you may deem appropriate.

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Elliot Holland

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Elliot.holland@ghd.com

Mollerd.



Your ref: 0001 Our ref: 12572751

23 March 2022

Department of Planning and Environment - Water Locked Bag 5022 Parramatta, NSW, 2124

Chain Valley Colliery (SSD-5465) and Mannering Colliery (PA06_0311) Independent Environmental Audit

To whom it may concern

Great Southern Energy Pty Ltd (trading as 'Delta Coal') has engaged GHD to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery. These audits would be prepared in accordance with Schedule 6, Condition 9 of SSD-5465 (as modified) and Schedule 5, Condition 9 of PA06 0311 (as modified, respectively. The scope of the audit is to:

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I am writing to you to invite comment from the Department of Planning and Environment – Water in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06 0311)), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

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Regards

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(02) 4979 9923

Elliot.holland@ghd.com

Mollend.



Your ref: 0001 Our ref: 12572751

23 March 2022

Department of Primary Industries - Fisheries Locked Bag 1 Nelson Bay, NSW, 2315

Chain Valley Colliery (SSD-5465) and Mannering Colliery (PA06_0311) Independent Environmental Audit

To whom it may concern

Great Southern Energy Pty Ltd (trading as 'Delta Coal') has engaged GHD to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery. These audits would be prepared in accordance with Schedule 6, Condition 9 of SSD-5465 (as modified) and Schedule 5, Condition 9 of PA06 0311 (as modified, respectively. The scope of the audit is to:

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- Review the adequacy of strategies, plans or programs required under the Development Consent
- Recommend measures or actions to improve the environmental performance of the project and/or any assessment, plan or program required under the approval.

I am writing to you to invite comment from DPI – Fisheries in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06_0311)), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

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Elliot.holland@ghd.com

Mollerd.



Your ref: 0001 Our ref: 12572751

23 March 2022

Environment Protection Authority Locked Bag 5022 Parramatta, NSW, 2124

Chain Valley Colliery (SSD-5465) and Mannering Colliery (PA06_0311) Independent Environmental Audit

To whom it may concern

Great Southern Energy Pty Ltd (trading as 'Delta Coal') has engaged GHD to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery. These audits would be prepared in accordance with Schedule 6, Condition 9 of SSD-5465 (as modified) and Schedule 5, Condition 9 of PA06 0311 (as modified, respectively. The scope of the audit is to:

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I am writing to you to invite comment from the EPA in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06 0311)), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

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Elliot Holland

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Elliot.holland@ghd.com

Mollerd.



Your ref: 0001 Our ref: 12572751

23 March 2022

General Manager Lake Macquarie City Council PO Box 1906 Hunter Regional Mail Centre, NSW, 2310

Chain Valley Colliery (SSD-5465) and Mannering Colliery (PA06_0311) Independent Environmental Audit

To whom it may concern

Great Southern Energy Pty Ltd (trading as 'Delta Coal') has engaged GHD to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery. These audits would be prepared in accordance with Schedule 6, Condition 9 of SSD-5465 (as modified) and Schedule 5, Condition 9 of PA06 0311 (as modified, respectively. The scope of the audit is to:

- Assess the environmental performance of the development and whether it is complying with the relevant requirements of the consent and any relevant EPLs or Mining Leases (including any assessment, plan or program required under these approvals)
- Review the adequacy of strategies, plans or programs required under the Development Consent
- Recommend measures or actions to improve the environmental performance of the project and/or any assessment, plan or program required under the approval.

I am writing to you to invite comment from Lake Macquarie City Council in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06 0311), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

It would be appreciated if you could provide your comments in regard to the performance of Delta Coal's in meeting these obligations under the following headings:

- Compliance with requirements
- Progress to meeting requirements
- Details of incidents of non-compliance
- Adequacy of actions taken
- Adequacy of the requirements of the licence.

I also invite you to comment on Delta Coal's performance with other requirements, as you may deem appropriate.

The site visit for the audit is currently scheduled to be conducted the week commencing Monday, 7 April 2022. We wish to invite you to provide comment on Delta Coal's compliance/performance so that we may adequately address any concerns during the audit.

Upon receipt of this letter, please advise GHD of the primary contact within your organisation that will be coordinating this request. It would be appreciated if you could submit your written comments by close of business Wednesday, 6 April 2022.

All correspondence in relation to this matter should be directed to Elliot Holland, GHD Lead Auditor on 02 4979 9923 or elliot.holland@ghd.com.

Regards

Elliot Holland

Exemplar Global - Lead Auditor: EMS

(02) 4979 9923

Elliot.holland@ghd.com

Mollend.



Your ref: 0001 Our ref: 12572751

23 March 2022

NSW Resource Regulator 516 High St. Maitland, NSW, 2320

Chain Valley Colliery (SSD-5465) and Mannering Colliery (PA06_0311) Independent Environmental Audit

To whom it may concern

Great Southern Energy Pty Ltd (trading as 'Delta Coal') has engaged GHD to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery. These audits would be prepared in accordance with Schedule 6, Condition 9 of SSD-5465 (as modified) and Schedule 5, Condition 9 of PA06 0311 (as modified, respectively. The scope of the audit is to:

- Assess the environmental performance of the development and whether it is complying with the relevant requirements of the consent and any relevant EPLs or Mining Leases (including any assessment, plan or program required under these approvals)
- Review the adequacy of strategies, plans or programs required under the Development Consent
- Recommend measures or actions to improve the environmental performance of the project and/or any assessment, plan or program required under the approval.

I am writing to you to invite comment from the NSW Resources Regulator in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06_0311)), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

It would be appreciated if you could provide your comments in regard to the performance of Delta Coal's in meeting these obligations under the following headings:

- Compliance with requirements
- Progress to meeting requirements
- Details of incidents of non-compliance
- Adequacy of actions taken
- Adequacy of the requirements of the licence.

I also invite you to comment on Delta Coal's performance with other requirements, as you may deem appropriate.

The site visit for the audit is currently scheduled to be conducted the week commencing Monday, 7 April 2022. We wish to invite you to provide comment on Delta Coal's compliance/performance so that we may adequately address any concerns during the audit.

Upon receipt of this letter, please advise GHD of the primary contact within your organisation that will be coordinating this request. It would be appreciated if you could submit your written comments by close of business Wednesday, 6 April 2022.

All correspondence in relation to this matter should be directed to Elliot Holland, GHD Lead Auditor on 02 4979 9923 or elliot.holland@ghd.com.

Regards

Elliot Holland

Exemplar Global – Lead Auditor: EMS

(02) 4979 9923

Elliot.holland@ghd.com

Mollerd.

Jane Mackintosh

From: Heidi Watters < Heidi.Watters@Planning.nsw.gov.au > on behalf of DPE PSVC

Compliance Mailbox < compliance@planning.nsw.gov.au>

Sent: Friday, 25 March 2022 9:27 AM

To: Elliot Holland

Subject: RE: 12572751 - Chain Valley Colliery (CVC) and Mannering Colliery Independent

Environmental Audits

Dear Elliot

Thank you for the invitation to comment on the upcoming IEA for CVC and Mannering Colliery.

In addition to the requirements of the IEA conditions for both sites, the department would like the audit team to pay particular attention to the following:

- Implementation of approved management plans
- Noise management and monitoring in particular, is the current monitoring regime adequate for the surrounding receivers and are the monitoring locations most representative of the nearest residential receivers?
- Surface water management and discharge events
- Complaints management and responses

Regards

Heidi Watters Team Leader Compliance

Planning & Assessment | Department of Planning and Environment T 02 6575 3401 | M 0472 820 374 | E heidi.watters@planning.nsw.gov.au Suite 14, Level 1, 1 Civic Avenue, Singleton NSW 2333 www.dpie.nsw.gov.au



The Department of Planning and Environment acknowledges that it stands on Aboriginal land.

We acknowledge the traditional custodians of the land and we show our respect for elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

From: Elliot Holland < Elliot Holland@ghd.com Sent: Wednesday, 23 March 2022 11:55 AM

To: DPE PSVC Compliance Mailbox <compliance@planning.nsw.gov.au>

Subject: 12572751 - Chain Valley Colliery (CVC) and Mannering Colliery Independent Environmental Audits

Hi,

As per the attached, GHD has been engaged by Great Southern Energy Pty Ltd (trading as 'Delta Coal') to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery, in accordance with relevant requirements of their consents.

I am writing to the Compliance team at Department of Planning and Environment (DPE) to invite comment in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06_0311)), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

A copy of consolidated consent conditions for each site have been attached for your reference.

Regards
Elliot Holland
B Env. Sc. & Mgt.
Exemplar Global – Lead Auditor: EMS
Senior Environmental Scientist

GHD

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24 Honeysuckle Drive Newcastle NSW 2300 Australia **D** +612 4979 9923 **E** elliot.holland@ghd.com

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Jane Mackintosh

From: Steven James <Steven.James@epa.nsw.gov.au>

Sent: Friday, 25 March 2022 1:23 PM

To: Elliot Holland

Subject: RE: 12572751 - Chain Valley Colliery (CVC) and Mannering Colliery Independent

Environmental Audits

You don't often get email from steven.james@epa.nsw.gov.au. Learn why this is important

Hi Elliot,

Thanks for your email. The EPA does not have any comments at this time.

Regards,

Steve.

Steven James

Unit Head Regulatory Operations – Metro North NSW Environment Protection Authority +61 2 4908 6823 +61 413 450 328

www.epa.nsw.gov.au 🔰 @NSW_EPA DEPA YouTube

Report pollution and environmental incidents 131 555 (NSW only) or +61 2 9995 5555

From: Elliot Holland < Elliot. Holland@ghd.com > Sent: Wednesday, 23 March 2022 10:26 AM

To: EPA RSD Hunter Region Mailbox <hunter.region@epa.nsw.gov.au>

Subject: 12572751 - Chain Valley Colliery (CVC) and Mannering Colliery Independent Environmental Audits

Hi,

As per the attached, GHD has been engaged by Great Southern Energy Pty Ltd (trading as 'Delta Coal') to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery, in accordance with relevant requirements of their consents.

I am writing to you to invite comment in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06_0311)), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

A copy of consolidated consent conditions for each site have been attached for your reference.

Regards

Elliot Holland B Env. Sc. & Mgt. Exemplar Global – Lead Auditor: EMS Senior Environmental Scientist

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PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL

Jane Mackintosh

From: mmacdonald-hill@bigpond.com
Sent: Friday, 1 April 2022 1:58 PM

To: Elliot Holland

Subject: RE: 12572751 - Chain Valley Colliery (CVC) and Mannering Colliery Independent

Environmental Audits

Hi Elliot,

I have forwarded the information and scope of the IEA to the CCC members and as expected, no one has raised any matters of concern they wish you to investigate. The general consensus received is that the mine's operations and performance are in accordance with the relevant approvals.

All minutes and presentations of the Committee are available on the Delta Coal website.

Thank you for the opportunity to comment.

Margaret MacDonald-Hill 0448 414 888

From: Elliot Holland <Elliot.Holland@ghd.com>
Sent: Thursday, 24 March 2022 5:49 AM
To: mmacdonald-hill@bigpond.com

Subject: RE: 12572751 - Chain Valley Colliery (CVC) and Mannering Colliery Independent Environmental Audits

Hi Margaret,

Correct, audit period considered will be from 10 April 2019 to the site inspection date (7/8 April 2022)

Elliot Holland B Env. Sc. & Mgt.

Exemplar Global – Lead Auditor: EMS Senior Environmental Scientist

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24 Honeysuckle Drive Newcastle NSW 2300 Australia **D** +612 4979 9923 **E** elliot.holland@ghd.com

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Please consider the environment before printing this email.

From: mmacdonald-hill@bigpond.com <mmacdonald-hill@bigpond.com>

Sent: Wednesday, 23 March 2022 5:09 PM **To:** Elliot Holland < Elliot. Holland@ghd.com >

Subject: RE: 12572751 - Chain Valley Colliery (CVC) and Mannering Colliery Independent Environmental Audits

Hi Elliot,

Thanks for your email. Before I pass this on to the CCC members, I take it the audit period is from April 2019 to April 2022?

Margaret MacDonald-Hill 0448 414 888

From: Elliot Holland < Elliot Holland@ghd.com Sent: Wednesday, 23 March 2022 11:04 AM

To: mmacdonald-hill@bigpond.com

Subject: 12572751 - Chain Valley Colliery (CVC) and Mannering Colliery Independent Environmental Audits

Hi Margaret

As per the attached, GHD has been engaged by Great Southern Energy Pty Ltd (trading as 'Delta Coal') to undertake independent environmental audits of their underground operations Chain Valley Colliery (CVC) and Mannering Colliery, in accordance with relevant requirements of their consents.

I am writing to you to invite you, and by extension CCC members, to comment in regard to CVC operations (as they relate to SSD-5465 (as modified)) and Mannering Colliery operations (as they relate to PA06_0311)), as well as Delta Coal's performance with other requirements for each site, as you may deem appropriate.

A copy of consolidated consent conditions for each site have been attached for your reference.

Regards,

Elliot Holland B Env. Sc. & Mgt. Exemplar Global – Lead Auditor: EMS Senior Environmental Scientist

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AREQ0026557

Mr Elliot Holland GHD Pty Ltd GHD Tower Level 3, 24 Honeysuckle Drive Newcastle NSW 2300

By email: elliot.holland@ghd.com

Dear Mr Holland

Subject: Chain Valley Colliery and Mannering Colliery – Independent Environmental Audit

Thank you for your email dated 23 March 2022 requesting consultation on the independent audits to be undertaken of the Chain Valley Colliery and Mannering Colliery which are covered by the following mining leases:

Chain Valley Colliery

 CCL706 (1973)
----------------------------------	---

• CCL707 (1973)

• ML1051 (1906)

• ML1052 (1906)

• ML1308 (1906)

• ML1785 (1992)

MPL1349 (1906)

MPL1389 (1906)

MPL1400 (1906)

MPL337 (1973)

Mannering Colliery

• CCL719 (1973)

• CCL 721 (1973)

The Resources Regulator requires that the following issues be addressed in independent environmental audits undertaken in accordance with a planning consent condition.

- Review relevant mining leases and exploration licences as agreed with Resources Regulator
- Undertake an assessment of compliance against the conditions of title related to environmental management

- Verify that there is a current Mining Operations Plan (MOP) in place and it has been approved by the Regulator – review compliance against any conditions of approval of the MOP
- Undertake a critical review of the MOP, including an assessment of its compatibility with the description of operations contained in the planning approval. In particular:
 - Review the rehabilitation strategy as outlined in the MOP to determine if it is consistent with the Project Approval in terms of progressive rehabilitation schedule; and proposed final land use(s)
 - Review the rehabilitation objectives and completion criteria as outlined in the MOP to determine if they have been developed in accordance with the proposed final land use(s) as outlined in the Project Approval
- Review the development and implementation of any rehabilitation monitoring programs to assess performance against the nominated objectives and completion criteria – verified by reviewing monitoring reports and rehabilitation inspection records
- Determine if a rehabilitation care and maintenance program has been developed and implemented based on the outcomes of monitoring program – verified by reviewing Annual Rehabilitation Programs or similar documentation
- Confirm that mining operations are being conducted in accordance with the approved MOP (production, mining sequence etc.), including within the designated MOP approval boundary – to be verified by site plans and site inspection
- Confirm that rehabilitation progress is consistent with the approved MOP as verified by site plans and a site inspection. This should include an evaluation against rehabilitation targets and whether the final landform is being developed in accordance with conceptual final landform in the Project Approval
- Based on a visual inspection, determine if there are any rehabilitation areas that appear to have failed or that have incurred an issue that may result in a delay in achieving the successful rehabilitation outcomes.

In addition to the above, the audit should note observations where rehabilitation procedures, practices and outcomes represent best industry practice.

It would be appreciated if a copy of the final audit report could be sent to the Regulator at nswresourcesregulator@service-now.com upon completion of the audit.

Yours sincerely

Jenny EhmsenPrincipal Compliance Auditor

23 March 2022

Appendix C Compliance tables



1. Chain Valley

1.1 EPL 1770

Condition	Details			Compliance status	Relevant evidence	Commentary
1	1 Administrative Condi	tions				
A1	A1 What the licence au	uthorises and regulates				
A1.1	the premises specified activity classification, for Unless otherwise further	scheduled activities listed below at according to their scheduled an and the scale of the operation. this licence, the scale at which the scale specified in this condition.	Compliant	Site interviews conducted 12/13 April 2022 Site inspection conducted 12	The development is being conducted in generally in accordance with this licence.	
	Scheduled Activity	Fee Based Activity	Scale		April 2022 Annual Returns	
	Coal works	Coal works	> 2000000 - 5000000 T annual handing capacity		for 2019, 2020	
	Mining for coal	Mining for coal	> 2000000 - 3500000 T annual production capacity		and 2021	
A1.2			es more than 2.1 million tonnes of	Compliant	Annual Reviews	Delta Coal produced coal within the limits of this condition.
	ROM coal from the pre SSD5465 MOD 4.	M coal from the premises in any calendar year in line with Development Consent			for 2019, 2020 and 2021	- 2019: 0.79 million tonnes
	33D3403 MOD 4.				and 2021	- 2020: 1.38 million tonnes
						- 2021: 1.25 million tonnes
						Compliance for 2022 was not assessed as the reporting period did not encompass the entire calendar year.

Condition	Details	Compliance status	Relevant evidence	Commentary	
A2	A2 Premises or plant to which this licence applies				
A2.1	A2.1 The licence applies to the following premises:	Note	SIX Maps/SEED Portal	Noted	
	Premises Details CHAIN VALLEY COLLIERY CONSTRUCTION ROAD CHAIN VALLEY BAY NSW 2259 THE LICENSED PREMISES IS AS DEFINED IN THE FOLLOWING PLANS, "DELTA COAL CHAIN VALLEY COLLIERY, SURFACE EPA PREMISES PLAN,				
	DRG NO:C1SO165_2, 10 AUGUST 2021" AND "DELTA COAL CHAIN VALLEY COLLIERY, FIGURE 1 PROJECT OVERVIEW, DRG NO:C1S0165_1, 10 AUGUST 2021", WHICH SHOWS THE UNDERGROUND COAL WORKINGS PREMISES BOUNDARIES VIA A LIME GREEN LINE ALONG WITH THE EASTINGS AND NORTHINGS AT "TURNAROUND" LOCATIONS. THESE PLANS ARE SAVED AS EPA DOCUMENT NO. DOC21/691135.				
A3	A3 Other activities				
A3.1	A3.1 This licence applies to all other activities carried on at the premises, including:	Compliant	Site interviews conducted 12/13 April 2022	There is a sewage treatment system being operated on site, which was viewed in the site inspection.	
	Ancillary Activity Sewage Treatment Systems		Annual Reviews for 2019, 2020 and 2021		
A4	A4 Information supplied to the EPA				
A4.1	A4.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence. In this condition the reference to "the licence application" includes a reference to: a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.	Compliant	Site interviews conducted 12/13 April 2022 Site inspection conducted 12 April 2022	Review of relevant documentation verifies compliance with the requirements of this condition	

Condition	Details				Compliance status	Relevant evidence	Commentary
2	2 Discharg	es to Air and Water a	nd Applications to Lan	nd			
P1	P1 Locatio	n of monitoring/discha	arge points and areas				
P1.1	the purpos the air fron	es of monitoring and/on the point.	or the setting of limits	v are identified in this licence for for the emission of pollutants to	Compliant	Air Quality and Greenhouse Gas Management	Delta Coal operate a meteorological station that collects data continually. Whilst not a non-compliance, the AQGGMP does not show the location of the meteorological station.
	EPA identification no.	PA identi- Type of Monitoring Type of Discharge Point TEOM Monitor located on the site of the Mannering Park Sewage Treatment Plant, Thermo Fisher Scientific TEOM 1405 TEOM 1405 Coal - Chain Valley Colliery - Figure 1 Project Overview*, which as been filed as EPA document DOC21/691135	Plan (V2 – dated 21 January 2022), including DPE approval 21/03/2022 Noise Management Plan (Rev 2– Dated 12 March 2014)	Recommendation 1: As part of updates required to the AQMP, update figure 3 to show the location of the meteorological station.			
P1.2	licence for		nonitoring and/or the s	able below are identified in this etting of limits for any	Note		Noted
P1.3		of the monitoring and/o	or the setting of limits	lentified in this licence for the for discharges of pollutants to	Compliant	Water Management Plan (Rev 5–	Discharge data is presented in annual reviews and the monthly website reports. Discharge locations were viewed in the site audit.
	EPA Identi- fication no.	Type of Monitoring Point	Water and land Type of Discharge Point	Location Description		Dated 24 August 2021) Monthly website	
	1	Discharge to waters Discharge to waters Discharge to waters and monitoring Discharge quality and Discharge to waters and monitoring from final settlement pond, gravity Annual Rev	Annual Reviews for 2019, 2020				
	Discharge quality and Discharge quality	Discharge to waters Discharge quality and volume monitoring	Discharge to waters via dam spillway from final settlement pond adjacent to EPA Point 1 as identified in plan titled "Delta Coal Chain Valley Colliery, Surface EPA Premises Plan, DRG No: C150165_2" 10 August 2021 and saved as EPA Document DOC21/691135.				

Condition	Details			Compliance status	Relevant evidence	Commentary
P1.4	the purpose	es of weather and/or noise om the premises. No Type of monitoring point Noise monitoring Noise monitoring Noise monitoring Noise monitoring Noise monitoring Noise monitoring Moise monitoring Moise monitoring Moise monitoring	in the table below are identified in this licence for a monitoring and/or setting limits for the emission below the emission and/or setting limits for the emission and setting limits for the emission and/or setting limits for the emission and setting limi	Non-compliance (administrativ e)	Noise Management Plan (Rev 2- Dated 12 March 2014) Annual noise compliance assessment reports for 2019, 2020 and 2021 Quarterly noise monitoring reports Annual Reviews for 2019, 2020 and 2021	Monitoring locations are shown in Figure 2 of the Noise Management Plan and are described in Section 5.2. These locations are generally consistent with the requirements of this condition, however point 13 (R12) and point 14 (R13) are not shown, thus forming an administrative non-compliance. The auditor notes that a new noise management plan is being prepared for the site, which adequately describes the monitoring locations. Therefore, no corrective action is required.
L1	L1 Pollution					
L1.1		ust comply with section 12	vided in any other condition of this licence, the 0 of the Protection of the Environment	Non-compliant (low-risk)	Annual Reviews for 2019, 2020 and 2021	Several incidents related to water pollution occurred over the reporting period. These are described below in L2.4. L3.1 and L3.2

Condition	Details							Compliance status	Relevant evidence	Commentary
L2	L2 Con	centratio	n limits							
L2.1	L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.							Non-compliant (low risk)t	Annual Reviews for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022	2019 Audit recommendation: The Annual Reviews need to provide a clear statement regarding whether discharge criteria have been met. Several non-compliances have occurred within the reporting period. Refer to condition L2.4, L3.1 and L3.2 In regard to recommendation from the previous audit, the Annual Review includes a statement whether the discharge criteria have been met,. If any exceedances occurred in a reporting year, they are detailed in section 6.1.2. This recommendation has been closed out.
L2.2			H quality limit in the sp			the specified	d percentage of	Compliant	Annual Reviews for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022	Whilst several non-compliances occurred over the reporting period, no exceedances of pH quality has occurred.
L2.3			ny doubt, this oner than those			orise the poll	ution of waters by	Note		Note
L2.4	POINT 1,		Units of Measure colony forming units per 100 millilitres pH milligrams per litre	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit 200 6.5-8.5	Non-compliant (low-risk)	Annual Reviews for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022	Several non-compliances were recorded against this condition over the reporting period: Exceedance of faecal coliform limit at LDP01 on 31 August 2019 Exceedance of faecal coliform limit at LDP01 on 18 September 2019 Exceedance of faecal coliform limit at LDP01 on 17 December 2019 Exceedance of faecal coliform and TSS limit at LDP27 on 7 February 2020 Exceedance of faecal coliform and TSS limit at LDP27 on 26 July 2020 Exceedance of faecal coliform and TSS limit at LDP27 on 9 September 2020
										 Exceedance of faecal coliform and TSS limit at LDP27 on 18 March 2021 Exceedance of faecal coliform and TSS limit at LDP27 on 21 March 2021 Exceedance of faecal coliform limit at LDP01 on 18 January 2022 Exceedance of faecal coliform limit at LDP27 on 31 March 2022.

Condition	Details	Compliance status	Relevant evidence	Commentary
				These exceedances therefore form a non-compliance against this condition.
				Corrective action 1: Keep DPE up-to-date on the progress of works under DA 845-2020 to address exceedances associated with licensed discharges.
				Recommendation 2: There is an inconsistent naming convention for the discharge locations between sites. It is recommended that they are consistently referenced across management plans and annual reviews.
L3	L3 Volume and mass limits			
L3.1	L3.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of: a) liquids discharged to water; or; b) solids or liquids applied to the area; must not exceed the volume/mass limit specified for that discharge point or area.	Non-compliant (low risk)	Annual Reviews for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022	Several non-compliances were recorded against this condition over the reporting period: - Exceedance of daily volume limit at LDP01 on 30 August 2019 This exceedance therefore forms a non-compliance against this condition.
	Point Unit of Measure Volume/Mass Limit 1 kilolitres per day 12161 27 kilolitres per day 12161			
L3.2	L3.2 The volumetric daily discharge limit for the premises is the combined discharge measured at EPA discharge points 1 and 27 and must not exceed 12161 kilolitres per day.	Non-compliant (low risk)	Annual Reviews for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022	Several non-compliances were recorded against this condition over the reporting period: Exceedance of combined daily volume limit at LDP1 and LDP27 on 9 February 2020 Exceedance of combined daily volume limit at LDP1 and LDP27 on 26 July 2020 – there was also an exceedance of faecal coliforms and TSS at LDP27 on this day. This forms a medium risk non-compliance. Exceedance of combined daily volume limit at LDP1 and LDP27 on 18 March 2021 – there was also an exceedance of faecal coliforms and TSS at LDP27 on this day. This forms a medium risk non-compliance. Exceedance of combined daily volume limit at LDP1 and LDP27 on 21 March 2021- there was also an exceedance of faecal coliforms and TSS at LDP27 on this day. This forms a medium risk non-compliance. In addition, volumetric monitoring ceased between 26 December 2021 and 10 January 2022 due to vandalism and damage sustained to the discharge flow monitor. This has since been fixed and monitoring has recommenced. Corrective action 1: Refer to L2.4

ndition	Details				Compliance status	Relevant evidence	Commentary
	L4 Waste						
1	L4.1 The licensee must not cause, permit or allow any waste to be received at the premises, except the wastes expressly referred to in the column titled "Waste" and meeting the definition, if any, in the column titled "Description" in the table below. Any waste received at the premises must only be used for the activities referred to in relation to that waste in the column titled "Activity" in the table below. Any waste received at the premises is subject to those limits or conditions, if any, referred to in relation to that waste contained in the column titled "Other Limits" in the table below. This condition does not limit any other conditions in this licence.					Annual Reviews for 2019, 2020 and 2021 Waste tracking register Site interviews conducted 12/13 April 2022 Site inspection conducted 12	No waste has been received at the premises over the reporting period.
	NA (General or Specific Was exempted waste con exe 92 c the	te that meets all the litions of a resource photion under Clause of the Protection of Environment rations (Waste)	source		April 2022	
	L5 Noise li	mits					
.1	established of the table	d under this licence muse below for that point du	at not exceed the noise le ring the corresponding tin	ach noise monitoring point vels specified in Column 4 ne periods specified in ement parameters listed in	compliance (administrativ e) Pla	Noise Management Plan (Rev 2– Dated 12 March 2014) Annual noise	A review of the data presented in the quarterly noise monitoring reports and the annual compliance assessments found that Chain Valley Colliery is operating within the noise limits define by this condition, with the exception of Point 23 (ATN007). There was noted that there appears to be a typographical error in the limits for Point 23 (ATN007) and that the noise limits of
	Time p	period Measurement parameter	Measurement frequency	Noise level dB(A)		compliance assessment	EPL were not consistent with the noise limits in SSD-5465.
	Day Evening Night Night	Day-LAeq (15 minute) g Evening-LAeq (15 minute) Night-LAeq (15 minute) Night-LA1 (1 minute)	- te) - -	49 49 49 54		reports for 2019, 2020 and 2021 Quarterly noise monitoring reports Annual Reviews	The EPL was modified on 30 September 2021 so that the noise limits for Point 23 (ATN007) were consistent with those presented in SSD-5465. Even so, noise monitoring results did not compare findings against previous EPL criteria, thus constituting an administrative non-compliance. As this issue with the EPL has been resolved, no corrective actions are required.
	POINT 13					for 2019, 2020 and 2021	actions are required.
	Time p	period Measurement parameter	Measurement frequency	Noise level dB(A)		anu 2021	
	Day	Day-LAeq (15 minute)	-	49			
	Evening	g Evening-LAeq (15 minu	te) -	49			
	Night	Night-LAeq (15 minute	-	49			
	Night	Night-LA1 (1 minute)		53			
		,,					

Detai	ils			
POINT	14			
	Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
	Day	Day-LAeq (15 minute)		43
	Evening	Evening-LAeq (15 minute)	-	43
	Night	Night-LAeq (15 minute)		43
	Night	Night-LA1 (1 minute)	-	49
POINT	16			
I OIII	Time period	Measurement	Measurement frequency	Noise level dB(A)
1	Day	parameter Day-LAeq (15 minute)		36
	Evening	Evening-LAeq (15 minute)		36
	Night	Night-LAeq (15 minute)		36
	Night	Night-LA1 (1 minute)		45
POINT	20			
	Time period	Measurement	Measurement frequency	Noise level dB(A)
		parameter		
	Day	Day-LAeq (15 minute)		37
	Evening	Evening-LAeq (15 minute)	•	37
	Night	Night-LAeq (15 minute)	•	37
	Night	Night-LA1 (1 minute)	-	45
POIN	T 23			
	Time period	Measurement parameter	Measurement frequency	Noise level dB(A)
1	Day	Day-LAeq (15 minute)		46
	Evening	Evening-LAeq (15 minute)		46
	Night	Night-LAeq (15 minute)		46
	Night	Night-LA1 (1 minute)	-	46
POIN	то			
FOIN	Time period	Measurement	Measurement frequency	Noise level dB(A)
	Time period	measurement parameter	measurement frequency	NOISE IEVEL OD(A)
	Day	Day-LAeq (15 minute)	-	38
	Evening	Evening-LAeq (15 minute)		38
	Night	Night-LAeq (15 minute)		38

Condition	Details	Compliance status	Relevant evidence	Commentary
L5.2	L5.2 The licensee must ensure that noise generated on the premises does not exceed: a) 35 LAeq(15min) during the day, evening or night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1; and b) 45 LA1(1min) during the night at any privately owned land nearest to the residence apart from those receivers identified in Condition 5.1. Note: The licensee may provide to the EPA written evidence of any agreement with a landholder which is subject to the above noise limits. The written evidence may be submitted with a licence variation to remove the landholder from the above tables.	Compliant	Annual Reviews for 2019, 2020 and 2021 Annual noise compliance assessment reports for 2019, 2020 and 2021 Quarterly noise monitoring reports for 2019, 2020 and 2021	Monitoring results over the reporting period were in compliance with condition L5.1, therefore no further monitoring at residences were required.
L5.3	L5.3 For the purpose of condition L5.1 and condition L5.2: (a) Day is defined as the period from 7am to 6pm Monday to Saturday and 8am to 6pm Sunday and public holidays; (b) Evening is defined as the period 6pm to 10pm, and (c) Night is defined as the period from 10pm to 7am Monday to Saturday and 10pm to 8am Sunday and public holidays.	Note		Noted
	L5.4 The noise limits set out in condition L5.1 and condition L5.2 apply under all meterorological conditions except for any one of the following: (a) Wind speeds greater than 3 metres/second at 10 metres above ground level; or (b) Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or (c) Stability category G temperature inversion conditions. (d) Or as defined under the NSW EPA Noise Policy for Industry 2017.	Note		Noted
L5.5	L5.5 For the purpose of condition L5.4: (a) the meteorological data to be used for determining meteorological conditions is the data recorded at the meteorological station identified in this licence as EPA Identification Point 26. (b) Stability category temperature inversion conditions are to be determined in accordance with the NSW EPA Noise Policy for Industry 2017. Note: The weather station must be designed, commissioned and operated in a manner to obtain the necessary parameters required under the above condition.	Complaint	Annual Reviews for 2019, 2020 and 2021 Noise Management Plan (Rev 2– Dated 12 March 2014) Quarterly noise monitoring reports for 2019, 2020 and 2021	The onsite meteorological station is used to determine weather parameters for the site during monitoring events in compliance with the requirements of this condition.
L5.6	L5.6 For the purpose of determining the noise generated at the premises the licensee must use a Class 1 or Class 2 noise monitoring device as defined by AS IEC61672.1 and AS IEC61672.2-2004, or other noise monitoring equipment accepted by the EPA in writing.	Compliant	Quarterly noise monitoring reports for 2019, 2020 and 2021	Quarterly noise monitoring reports indicate that measurements are being taken using calibrated machinery compliant with the requirements of this condition.

Condition	Details	Compliance status	Relevant evidence	Commentary
L5.7	L5.7 To determine compliance: 1. With the LAeq(15 min) noise limits in condition L5.1 and condition L5.2, the licensee must locate noise monitoring equipment;	Administrative non-compliance	Noise Management Plan (Rev 2–	Monitoring for LA1(1minute) noise levels is not completed at 1m from a façade; however, such noise monitoring is generally not practical due to disturbance to residents during the sensitive
	(a) within 30 metres of a dwelling facade (but not closer than 3 metres) where any dwelling on the property is situated more then 30 metres from the property boundary that is closest to the premises;		Dated 12 March 2014) Quarterly noise monitoring	night-time period. Furthermore, operation of Schedule 6, Condition 12 of SSD-5465 allows monitoring from representative locations.
	(b) approximately on the boundary where any dwelling is situated 30 metres or less from the property boundary that is closest to the premises, or, where applicable,		reports for 2019, 2020 and 2021	
	(c) within approximately 50 metres if the boundary of a national park or nature reserve.			
	2. With the LA1(1 minute) noise limits in condition L5.1 and L5.2, the noise monitoring equipment must be located within 1 metre of a dwelling facade.			
	3. With the noise limits in condition L5.1 and condition L5.2, the noise monitoring equipment must be located;			
	(a) at the most affected point at a location where there is no dwelling at the location, or			
	(b) at the most affected point within an area at a location prescribed by conditions L5.7 1(a) or L5.7 1(b).			
L5.8	L5.8 A non-compliance of condition L5.1 or condition L5.2 will still occur where noise generated from the premises in excess of the appropriate limit is measured;	Note		Noted
	a) at a location other than an area prescribed by conditions L5.7 1(a) and L5.7 1(b), and /or			
	b) at a point other than the most affected point at a location.			
L5.9	L5.9 For the purposes of determining the noise generated at the premises all applicable modification factors as described in the NSW EPA Noise Policy for Industry 2017 must be applied, as appropriate, to the noise levels measured by the noise monitoring equipment.	Compliant	Quarterly noise monitoring reports for 2019, 2020 and 2021	The NSW EPA Noise Policy for Industry is referenced in the noise management reports, as well as a discussion on its applicability with the data from the monitoring period.
4	4 Operating Conditions			
01	O1 Activities must be carried out in a competent manner	Compliant	Site interviews conducted 12/13 April 2022	During the conduct of the audit, documentation reviewed, and the site inspection indicates general compliance with the requirements of this condition.
			Site inspection conducted 12 April 2022	
			Induction	
			Servicing record samples on Pulse	

Condition	Details	Compliance status	Relevant evidence	Commentary
01.1	O1.1 Licensed activities must be carried out in a competent manner. This includes: a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.	Non- compliance (low risk)	Site interviews conducted 12/13 April 2022 Site inspection conducted 12 April 2022 Waste tracking sheet	Recommendation from 2019 IEA: Ensure the minor waste management issues identified during the audit are rectified: — Improve bin labelling; — Ensure all hydrocarbon containers (empty or full) are stored within bunds 2022 IEA findings: Waste tracking sheets were viewed during the site audit and were found to be adequate and in compliance with this condition. During the site inspection, the auditor noted that waste was not always appropriately sorted on site — for example rubbish in the oily rags bin. In regard to the previous audit, it was noted that all hydrocarbon waste containers were stored within a bund. Corrective Action 2: As bins are clearly labelled and adequate disposal facilities are available across the site, Delta should investigate means to address the workforce culture in relation to inadequate disposal of waste that has persisted across this, and the previous, audit.
02	O2 Maintenance of plant and equipment			
02.1	O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity: a) must be maintained in a proper and efficient condition; and b) must be operated in a proper and efficient manner.	Compliant	Site interviews conducted 12/13 April 2022 Site inspection conducted 12 April 2022 Servicing records	During the conduct of the audit, documentation reviewed, and the site inspection indicates general compliance with the requirements of this condition.

Condition	Details	Compliance status	Relevant evidence	Commentary
О3	O3 Dust			
03.1	O3.1 The premises must be maintained in a condition which minimises or prevents the emission of dust on or from the premises.	Compliant	Annual Review for 2019, 2020 and 2021 Site inspection conducted 12 April 2022 Monitoring data for 2019, 2020, 2021 and 2022	Recommendation from 2019 IEA: Ensure TEOM is setup with alarms/notifications for when results are approaching or have exceeded the short term criterion for particulate matter. This will ensure exceedances are immediately detected and reported as soon as possible to the EPA and DPE. Ensure exceedances and other incidents are reported as per this condition (Detailed Incident Report within 7 days). 2022 IEA findings: There were several non-compliances against depositional dust and 24 hour PM ₁₀ criteria as presented in SSD-5465. These exceedances were investigated and all but one exceedance was attributed to factors outside the site. This exceedance has not occurred again over the reporting period, showing that steps have been taken to manage dust at the premises. There were also exceedances of the PM2.5 daily limits as defined by SSD-5465 in 2022, however these were found to be attributed to other factors outside the site. Several incident reports were viewed during the audit. Appropriate action was taken by Delta Coal in responding to incidents. During the site inspection some dust being generated on site was observed. It was noted that on dry days a watercart would be employed to keep dust down, and that as rain was forecast on the day of the audit, it had not been used. The 2019 IEA recommended that the TEOM is set up with alarms and notifications when the short term criterion for particulate matter is approached or exceeded. Delta Coal provided evidence that this has occurred, and this
03.2	O3.2 Activities occurring in or on the premises must be carried out in a manner that will minimise the generation of wind-blown or traffic generated dust.	Compliant	Annual Review for 2019, 2020 and 2021 Site inspection conducted 12 April 2022	recommendation is considered closed out. Trafficable areas were generally sealed or gravel roads. During the site inspection some dust being generated on site was observed. It was noted that on dry days a watercart would be employed to keep dust down, and that as rain was forecast on the day of the audit, it had not been used. Given the circumstances, the auditor considers Delta Coal compliant with this condition.

Condition	Details	Compliance status	Relevant evidence	Commentary
O3.3	O3.3 All trafficable areas, coal stockpile(s) and storage areas, and vehicle manoeuvring areas in or on the premises must be maintained, at all times, in a condition that will minimise the generation of dust.	Compliant	Site inspection conducted 12 April 2022 Site interviews conducted 12/13 April 2022	Refer to condition O3.2
O3.4	O3.4 All vehicles transporting coal from the premises must be covered immediately after loading to prevent wind blown emissions and spillage Note: Vehicles transporting coal on the private haul road from Chain Valley Colliery to Vales Point Power station are exempt from covering their load if surface coal moisture is above 8%.	Compliant	Coal Haulage Reports for 2019, 2020, 2021 and 2022 Site inspection conducted 12 April 2022 Site interviews conducted 12/13 April 2022	Delta Coal have generally used conveyor systems to transport coal. There have been several limited occasions over the reporting period where coal has been transported via haul trucks. When haul trucks were used, no transport on public roads occurred.
O3.5	O3.5 Activities occurring in or on the premises must be carried out in a manner that will minimise the tracking of dust from the premises.	Compliant	Site inspection conducted 12 April 2022 Site interviews conducted 12/13 April 2022	Given that coal transport is predominantly done by conveyor and not haul truck, there is limited scope for dust to be tracked off the premises.
04	O4 Effluent application to land			
O4.1	O4.1 An area must be provided for the use of effluent from the office building sewage treatment system. The design of the effluent irrigation area must be in accordance with the EPA's Environmental Guideline: Use of Effluent by Irrigation.	Compliant	Water Management Plan (Rev 5– Dated 24 August 2021)	There are two separate wastewater systems on site, each with their own treatment systems. Following treatment of water, it is used for irrigating grassed areas.
04.2	O4.2 The quantity of wastewater applied to the utilisation area(s) must not exceed the capacity of the utilisation area(s) to effectively utilise the effluent. For the purpose of this condition. "effectively utilise" includes the ability of the soil to absorb the nutrient, salt and hydraulic loads and the applied organic material without causing harm to the environment.	Compliant	Site inspection conducted 12 April 2022 Site interviews conducted 12/13 April 2022 Monitoring data for 2019, 2020, 2021 and 2022 Annual Review for 2019, 2020 and 2021	As discussed above, the wastewater system comprises of two systems with independent treatment systems. The system is serviced regularly and operates below capacity.

Condition	Details	Compliance status	Relevant evidence	Commentary
O5	O5 Emergency response			
	Note: The licensee must maintain, and implement as necessary, a current Pollution Incident Response Management Plan (PIRMP) for the premises. The PIRMP must be developed in accordance with the requirements in Part 5.7A of the Protection of the Environment Operations (POEO) Act 1997 and POEO Regulations. The licensee must keep the incident response plan on the premises at all times. The incident response plan must document systems and procedures to deal with all types of incidents (e.g. spills, explosions or fire) that may occur at the premises or that may be associated with activities that occur at the premises and which are likely to cause harm to the environment. The PIRMP must be tested annually or following a pollution incident.	Compliant	Pollution Incident Response Plan (Rev 2.4 – Dated 15 December 2021) Site inspection conducted 12 April 2022	 2019 IEA Recommendation: Update PIRMP to include: Current site contacts; Email details for government contacts; and Figures that clearly show the location of hazardous substances and where pollution response equipment is stored. 2022 IEA findings: A review of the PIRMP found that the recommendations of the 2019 IEA have been incorporated and are closed out. The PIRMP was tested 3 times in the reporting period: 17 December 2019 23 December 2020 21 December 2021
О6	O6 Processes and management			
	Bunding			
O6.1	O6.1 All above ground tanks containing material that is likely to cause environmental harm must be bunded or have an alternative spill containment system in place.	Compliant	Site inspection conducted 12 April 2022	All above ground storage tanks observed during the audit were surrounded by bunds.
O6.2	O6.2 Bunds must: a) have walls and floors constructed of impervious materials; b) be of sufficient capacity to contain 110% of the volume of the tank (or 110% volume of the largest tank where a group of tanks are installed); c) have floors graded to a collection sump; and d) not have a drain valve incorporated in the bund structure, or be constructed and operated in a manner that achieves the same environmental outcome.	Compliant	Site inspection conducted 12 April 2022	Bunds were viewed in the site inspection and were compliant with the requirements of this condition.
07	O7 Waste management			
07.1	O7.1 The licensee must ensure that any liquid and/or non liquid waste generated and/or stored at the premises is assessed in accordance with the EPA Waste Classification Guidelines as in force from time to time.	Compliant	Site inspection conducted 12 April 2022 Site interviews conducted 12/13 April 2022	Wastewater and oil water separator systems viewed in site audit. Septic systems were adequate.

Condition	Details	Compliance status	Relevant evidence	Commentary
07.2	O7.2 The licensee must ensure that waste identified for recycling is stored separately from other waste.	Non- compliance (low risk)	Site inspection conducted 12 April 2022	 2019 Audit recommendation: Ensure the minor waste management issues identified during the audit are rectified. Including: Improve bin labelling; Ensure all hydrocarbon containers (empty or full) are stored within bunds. 2022 IEA Findings: The site audit identified that there were adequate vessels for recycling on site, however recycling was not adequately implemented by staff. There were several instances of incorrect waste being placed into a clearly labelled waste stream bin. Refer to Corrective Action 2 at Condition 01.1
08	O8 Other operating conditions			
	Sewage Treatment			
O8.1	O8.1 All sewage generated on the premises must be directed, collected and treated by the sewage treatment system(s).	Compliant	Annual Review for 2019, 2020 and 2021 Servicing records Waste tracking sheet	Servicing records were provided showing evidence of regular servicing. Disposal effluent is tracked in the waste tracking sheet.
O8.2	O8.2 The licensee is responsible for the correct operation of the sewage treatment system(s) on their premises.	Compliant	Water Management Plan (Rev 5– Dated 24 August 2021) Annual Review for 2019, 2020 and 2021 Servicing records	 2019 Audit recommendation: Include additional detail in the Water Management Plan regarding sewage management. Include an update of sewage system during the audit period in the Annual Review. Ensure servicing is completed and records kept onsite. 2022 IEA findings: Records of servicing were provided to the auditor during the audit. No incidents or emergencies have occurred with the sewage system during the reporting period. The sewage system is described in the WMP. The Annual Reviews include sufficient detail regarding the amendments to the sewage system on site.
O8.3	O8.3 Correct operation involves regular supervision and system maintenance. The licensee must be aware of the system requirements and must ensure that the necessary service contracts are in place.	Compliant	Servicing records	Servicing records were provided showing evidence of regular servicing.

Condition	Details	Compliance status	Relevant evidence	Commentary
O8.4	O8.4 The sewage treatment system(s) must be serviced by a suitably qualified and experienced waste water technician at least once each quarterly period and a minimum of four times per year.	Non- compliance (administrativ e)	Servicing records	Servicing records were provided showing evidence of regular servicing. It was noted by the auditors that the servicing for Q4 2020 was not completed on time, therefore constituting an administrative non-compliance. However, the servicing event occurred 7 days following the end of Q4 2020, and therefore no corrective action is proposed.
O8.5	O8.5 The licensee must record each inspection and any actions required or recommended by the technician; including all results from tests performed on the sewage treatment system(s) by the technician as defined in Condition O8.4.	Compliant	Servicing records	Sampling records have been provided to the auditor, which contained no actions or recommendations required.
O8.6	O8.6 All treated sewage that is discharged from the premises must be discharged through licensed discharge point "EPA Identification no. 1", as defined in condition P1.3.	Compliant	Water Management Plan (Rev 5– Dated 24 August 2021) Annual Review for 2019, 2020 and 2021 Site inspection conducted 12 April 2022	Conduct of the site inspection verified compliance with the requirements of this condition.
5	Monitoring and Recording Conditions			
M1	M1 Monitoring records			
M1.1	M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition	Compliant	Monitoring data for 2019, 2020, 2021 and 2022 Annual Return for 2019, 2020 and 2021	A review of the published data and the raw data provided found Delta Coal to be compliant with this condition.
M1.2	M1.2 All records required to be kept by this licence must be: a) in a legible form, or in a form that can readily be reduced to a legible form; b) kept for at least 4 years after the monitoring or event to which they relate took place; and c) produced in a legible form to any authorised officer of the EPA who asks to see them.	Compliant	Monitoring data for 2019, 2020, 2021 and 2022 Annual Return for 2019, 2020 and 2021	Evidence of data going back four years from the data of the audit have been sighted.

Condition	Details	Compliance status	Relevant evidence	Commentary
M1.3	M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence: a) the date(s) on which the sample was taken; b) the time(s) at which the sample was collected; c) the point at which the sample was taken; and d) the name of the person who collected the sample.	Non- compliance (administrativ e)	Depositional dust monitoring sheets Monitoring data for 2019, 2020, 2021 and 2022	Water sampling sheets were viewed during the site audit. They were found to be compliant with the requirements of this condition. Air quality sheets were found to be generally compliant, however they did not include a sample time, thus a non-compliance against clause (b) is recorded. Corrective action 3: Ensure contractors record sample time when recording air quality monitoring data in accordance with the requirements of Condition M1.3.
M2	M2 Requirement to monitor concentration of pollutants discharged			
M2.1	M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:	Compliant	Annual reviews for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022 Monthly website reports	Data capture is presented in the Annual Reviews and on the website in the monthly data reports. Review of relevant data indicates compliance.
M2.2	POINT 25 Pollutant Units of measure Frequency Sampling Method Particulate matter micrograms per cubic metre Continuous AM-22	Non-compliant (low risk)	Air Quality and Greenhouse Gas Management Plan (V2 – dated 21 January 2022 Monitoring data for 2019, 2020, 2021 and 2022 Annual reviews for 2019, 2020 and 2021	2019 IEA Recommendation: Update the Air Quality Management Plan following this audit. Improve data capture for PM10. Review possibilities of backup power supply. Ensure issues with data capture are reported in Section 1 and 7 of the Annual Review. Ensure TEOM is setup with alarms/notifications for when results are approaching or have exceeded the short term criterion for particulate matter. This will ensure exceedances are immediately detected and reported as soon as possible to the EPA and DPE. 2022 IEA findings: The AQGGMP has been updated in January 2022.A review of the monitoring data provided indicates that the development is monitoring in accordance with the requirements of this condition. The TEOM stopped recording data for a short period in December 2020 due to severe thunderstorms. The gap in monitoring is recorded as a non-compliance against this condition. Delta Coal have since rectified the system and no corrective action is required. The 2019 IEA recommended that the TEOM is set up with alarms and notifications when the short term criterion for particulate matter is approached or exceeded. Delta Coal provided evidence that this has occurred, and this recommendation is considered closed out. The 2019 IEA

Condition E	etails				Compliance status	Relevant evidence	Commentary
					status	evidence	recommendation to investigate back up power supply for the TEOM has not been carried out in the reporting period. Recommendation 3: Improve data capture for PM10. Review possibilities of backup power supply.
	12.3 Water and/ or L	_and Monitoring Req	uirements Frequency	Sampling Method	Compliant	Water Management Plan (Rev 5– Dated 24 August 2021)	A review of the data provided indicates that samples are being taken in compliance with this condition.
	Biochemical oxygen demand Enterococci	milligrams per litre	Once a month (min. of 4 weeks) Once a month (min. of 4	Grab sample Grab sample		Annual Review for 2019, 2020	
	Faecal Coliforms	100 millilitres colony forming units per 100 millilitres	weeks) Once a month (min. of 4 weeks)	Grab sample		and 2021 Monitoring data	
	pH Total suspended	pH milligrams per litre	Once a month (min. of 4 weeks) Once a month (min. of 4	Grab sample Grab sample		for 2019, 2020, 2021 and 2022	
	solids	grano por mio	weeks)	- La sample			
P	DINT 27						
	Pollutant	Units of measure	Frequency	Sampling Method			
	Enterococci	colony forming units per 100 millilitres	Daily during any discharge	Grab sample			
	Faecal Coliforms	colony forming units per 100 millilitres	Daily during any discharge	Grab sample			
	pH	pH	Daily during any discharge	Grab sample			
	Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample			

Condition	Details	Compliance status	Relevant evidence	Commentary
М3	M3 Testing methods - concentration limits			
M3.1	M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:	Compliant	Air Quality and Greenhouse	Monitoring methodology is being undertaken in compliance with the requirements of this EPL, SSD – 5465 and the POEO Act.
	 a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or 		Gas Management Plan DRAFT	
	b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or		(V2 – dated 21 January 2022	
	 c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place. 		Monitoring data for 2019, 2020, 2021 and 2022	
	Note: The Protection of the Environment Operations (Clean Air) Regulation 2021 requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".		2021 and 2022	
M3.2	M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted	Compliant	Water Management Plan (Rev 5- Dated 24 August 2021) Annual Review for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022	A review of the data provided indicates that water monitoring is being undertaken as per the requirements of this condition.
M4	M4 Environmental monitoring			
	Requirement to monitor noise			
M4.1	M4.1 To determine compliance with condition L5.1, attended noise monitoring must be undertaken in accordance with conditions L5.7 and L5.8, and (a) at each one of the locations listed in condition L5.1; (b) occur quarterly within the reporting period of the Environment Protection Licence with at least 2 months between monitoring periods; (c) occur during each day, evening and night period as defined in the NSW Industrial Noise Policy (EPA 2000) for a minimum of 15 minutes for three of the quarters; (d) the night time 15 minute attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am; (e) the night time LA1 (1 min) attended monitoring in accordance with c) must be undertaken between the hours of 1am and 4am;	Compliant	Noise Management Plan (Rev 2– Dated 12 March 2014) Quarterly Noise Monitoring Reports for 2019, 2020, 2021 and 2022	2019 Audit Recommendation: Update Noise Management Plan. Ensure monitoring is completed in accordance with Noise Management Plan. 2022 IEA Findings: A review of the quarterly noise monitoring reports found that noise monitoring was being undertaken consistent with the requirements of this condition.

Condition	Detail	s					Compliance status	Relevant evidence	Commentary
	(f) one quarterly monitoring must occur during each day, evening and night period as defined in the NSW EPA Noise Policy for Industry 2017 for a minimum of 1.5 hours during the day; 30 minutes during the evening; and 1 hours during the night, and				of 1.5 hours				
	(g) each quarterly monitoring must be undertaken on a different day(s) of the week not including Saturdays, Sundays and public holidays; and) of the week not			
	(h) the	se monitori	ng conditions take	effect in the 2015	Reporting perio	d.			
	(h) these monitoring conditions take effect in the 2015 Reporting period. Note: The intention of this condition is that quarterly monitoring be undertaken at each sensitive receiver. That at each sensitive receiver monitoring is undertaken over a range of different days excluding weekends and public holidays during the reporting period so as to be representative of operating hours. That night time 15 minute attended monitoring and the LA1 (1min) monitoring for three of the quarters be undertaken at worst case being the most stable atmospheric conditions and when noise would be most intrusive to sleep. All of the sensitive receivers do not have to be monitored on the same day, evening and night for sub condition f.								
M4.2	monito (usual noise i	oring require ly quarterly	ed by the current D monitoring for noi requirements in the	od ending March 2 Department of Plar se as dB(A) Leq15 is licence, as a sin	nning and Environ Sminutes) for con	nment consent npliance with	Compliant	Annual noise compliance assessment reports for 2019, 2020 and 2021	2019 IEA Recommendation: For future Annual Returns a single noise monitoring report should be prepared and attached to the Annual Return. 2022 IEA Findings: Consolidated noise reports were completed for 2019, 2020 and 2021 over the reporting period.
M5	M5 We	eather moni	toring						
M5.1	obtain using t	ing results the correspo	oy analysis) the particular of	t, the licensee must arameters specified nethod, units of me site in the Column	d in Column 1 of easure, averagin	the table below, g period and	Compliant	Air Quality and Greenhouse Gas Management Plan (V2 –	Weather data is presented in the Annual Review documents with relevant data recorded in accordance with this condition.
	POINT	26						dated 21 January 2022),	
		Parameter	Sampling method	Units of measure	Averaging period	Frequency		including DPE	
		Rainfall	AM-4	millimetres	24 hours	Continuous		approval	
		Wind Direction at 10 metres	AM-2 & AM-4	Degrees	1 hour	Continuous		21/03/2022	
		Wind Speed	AM-2 & AM-4	metres per second	1 hour	Continuous		Noise	
		Temperature at 10 metres	AM-4	degrees Celsius	1 hour	Continuous		Management Plan (Rev 2–	
		Sigma Theta	AM-2 & AM-4	Degrees	15 minutes	Continuous		Dated 12 March	
		Relative	AM-4	percent	1 hour	Continuous		2014)	
	humidity				Annual Review for 2019, 2020 and 2021				
								Raw data export from meteorological station	

Condition	Details	Compliance status	Relevant evidence	Commentary
M5.2	M5.2 The licensee may use the Vales Point Power Station Meteorological Station to determine compliance with condition M5.1, provided the licensee has authority from Sunset Power International Pty Ltd to access meteorological data at all times.	Not triggered		The Delta Coal weather station at Mannering Colliery is used to collect weather data. This condition remains not triggered.
M6	M6 Recording of pollution complaints			
M6.1	M6.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.	Compliant	Complaint and incident register (https://www.del tacoal.com.au/c ommunity/compl aint-and-incident-register)	The complaints register is kept on the project website.
M6.2	M6.2 The record must include details of the following: a) the date and time of the complaint; b) the method by which the complaint was made; c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect; d) the nature of the complaint; e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and f) if no action was taken by the licensee, the reasons why no action was taken.	Compliant	Complaint and incident register (https://www.del tacoal.com.au/c ommunity/compl aint-and-incident-register)	2019 IEA Recommendation: Ensure all complaints are recorded in the internal database on site and the relevant details required under this condition are outlined in the Annual Review. 2022 IEA Findings: The auditor viewed the complaints and incidents register on the website and the internal complaints database and was found to be compliant with the requirements of this condition.
M6.3	M6.3 The record of a complaint must be kept for at least 4 years after the complaint was made.	Compliant	Complaint and incident register (https://www.del tacoal.com.au/c ommunity/compl aint-and-incident-register)	Complaint records back to April 2018 are available to view on the website.
M6.4	M6.4 The record must be produced to any authorised officer of the EPA who asks to see them.	Not triggered	Site interviews dated 12/13 April 2022	No request of this nature has been made over the reporting period. This condition remains not triggered.
M7	M7 Telephone complaints line			
M7.1	M7.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.	Compliant	Community information line web page https://www.delt acoal.com.au/m edia/community-information-line	The community information line functions as the complaints line. The number is 1800 115 277.

Condition	Details			Compliance status	Relevant evidence	Commentary
M7.2			the complaints line telephone number and e impacted community knows how to make	Compliant	July 2019 Community Newsletter Community information line web page https://www.delt acoal.com.au/m edia/community- information-line	2019 IEA Recommendation: With the new ownership an advertisement should be placed in the paper/newsletter providing a link to the Delta Coal website and outlining the complaint management details. 2022 IEA findings: The community information line is advertised on the website in an easy to find location. The Community Newsletter from July 2019 fulfilled the 2019 IEA recommendation.
M7.3	M7.3 The preceding two issue of this licence.	o conditions do not a	pply until 3 months after: the date of the	Note		Noted
M7.4	timely response to eme (a) the nominated conta (b) contact details must	rgencies or any othe act must be available include a telephone	contact details of personnel capable of a r exigent circumstances. at all times. number and must be current. days of receiving this licence.	Compliant	Pollution Incident Response Plan (Rev 2.4 – Dated 15 December 2021)	2019 IEA Recommendation Update the details of designated representatives of the company in the PIRMP. 2022 IEA Findings: The PIRMP has been updated within the reporting period. Designated representatives are nominated in Table 3.
M8	M8 Requirement to mo	nitor volume or mass				
M8.1	M8 Requirement to monitor volume or mass M8.1 For each discharge point or utilisation area specified below, the licensee must monitor: a) the volume of liquids discharged to water or applied to the area; b) the mass of solids applied to the area; c) the mass of pollutants emitted to the air; at the frequency and using the method and units of measure, specified below.			Non- compliance (administrativ e)	Annual Review for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022	that monitoring of discharge points was generally adequate over the reporting period. The exception being volumetric monitoring also ceased between 26 December 2021 and 10 January 2022 due to the vandalism
	Frequency Continuous during discharge	Unit of Measure kilolitres per day	Sampling Method In line instrumentation			action is recommended.
	POINT 27	Kiloliuos per day	III iii o ii sa aine naasii			
	Frequency	Unit of Measure	Sampling Method			
	Continuous during discharge	kilolitres per day	In line instrumentation			

Condition	Details	Compliance status	Relevant evidence	Commentary	
6	6 Reporting Conditions				
R1	R1 Annual return documents				
R1.1	R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:	Compliant	Annual Return for 2019, 2020	Review of relevant data indicates compliance with the requirements of this condition.	
	1. a Statement of Compliance,		and 2021		
	2. a Monitoring and Complaints Summary,				
	3. a Statement of Compliance - Licence Conditions,				
	4. a Statement of Compliance - Load based Fee,				
	5. a Statement of Compliance - Requirement to Prepare Pollution Incident Response Management Plan,				
	6. a Statement of Compliance - Requirement to Publish Pollution Monitoring Data; and				
	7. a Statement of Compliance - Environmental Management Systems and Practices.				
	At the end of each reporting period, the EPA will provide to the licensee notification that the Annual Return is due.				
R1.2	R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided below.	Compliant	Annual Return for 2019, 2020 and 2021	Review of relevant data indicates compliance with the requirements of this condition.	
	Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.				
R1.3	R1.3 Where this licence is transferred from the licensee to a new licensee:	Not triggered	Annual Return for 2019, 2020 and 2021	2019 IEA Recommendation: LakeCoal and Delta Coal to	
	a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and			prepare Annual Returns based on the period of the Annual Return and dates of the sale of Chain Valley. 2022 IEA Findings: The licence was transferred from LakeCoal to Delta Coal on 1 April 2019, which is outside the reporting period.	
	b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.				
	Note: An application to transfer a licence must be made in the approved form for this purpose.				
R1.4	R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:	Not triggered	Annual Return for 2019, 2020 and 2021	Delta Coal have not surrendered the licence within the reporting period, and therefore this condition remains not triggered.	
	a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or				
	b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.				
R1.5	R1.5 The Annual Return for the reporting period must be supplied to the EPA via eConnect EPA or by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').	Compliant	Annual Return for 2019, 2020 and 2021	2019 IEA Recommendation: Ensure Annual Returns are completed as per the EPA requirements and submitted within the due date. Review of relevant data indicates compliance with the requirements of this condition.	

Condition	Details	Compliance status	Relevant evidence	Commentary
R1.6	R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.	Compliant	Annual Return for 2019, 2020 and 2021	Review of relevant data indicates compliance with the requirements of this condition.
R1.7	R1.7 Within the Annual Return, the Statements of Compliance must be certified and the Monitoring and Complaints Summary must be signed by: a) the licence holder; or b) by a person approved in writing by the EPA to sign on behalf of the licence holder.	Compliant	Annual Return for 2019, 2020 and 2021	Review of relevant data indicates compliance with the requirements of this condition.
R2	R2 Notification of environmental harm			
	Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.	Note		Noted
R2.1	R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.	Compliant	Incident reports Annual Reviews for 2019, 2020 and 2021.	Notifications were made to the environment line as required, whilst there were environmental incidents occurring the audit period, none of these incidents required the PIRMP to be enacted.
R2.2	R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which they became aware of the incident.	Compliant	Incident reports Annual Reviews for 2019, 2020 and 2021.	Notifications were made to the environment line as required, whilst there were environmental incidents occurring the audit period, none of these incidents required the PIRMP to be enacted.
R3	R3 Written report			
R3.1	R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that: a) where this licence applies to premises, an event has occurred at the premises; or b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence, and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.	Not triggered		No requests of this nature have been made over the reporting period. This condition remains not triggered.
R3.2	R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.	Not triggered		As above
R3.3	R3.3 The request may require a report which includes any or all of the following information: a) the cause, time and duration of the event; b) the type, volume and concentration of every pollutant discharged as a result of the event; c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;	Not triggered		As above

Condition	Details	Compliance status	Relevant evidence	Commentary
	 d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort; 			
	e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;			
	f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and			
	g) any other relevant matters.			
R3.4	R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.	Not triggered		As above
R4	R4 Other reporting conditions			
	Noise Monitoring Report			
R4.1	R4.1 The licensee must submit to the EPA a noise compliance assessment report at the end of each reporting period. The report must be submitted with the Environment Protection Licence Annual Return. The report must be prepared by a suitably qualified and experienced acoustical consultant which:	Compliant	Annual noise compliance assessment reports for 2019,	2019 IEA Recommendation: Send a combined noise report for the Annual Return period to the EPA. 2022 IEA Findings: Consolidated noise reports were completed for 2019, 2020 and 2021 over the reporting period via the EPA eConnect portal.
	(a) details the noise monitoring undertaken in accordance with condition M4;		2020 and 2021	
	(b) assesses compliance with noise limits presented in condition L5.1 and condition 5.2; and			
	(c) outlines any management actions taken within the monitoring period to address any exceedences of limits contained in condition L5.1 and condition L5.2.			
	Note: The licensee must provide the EPA with one report, but this report may be a combination of the monitoring undertaken by the licensee as part of their quarterly monitoring program as required by the Project Approval SSD-5456 and must include LA1(1min).			
7	General Conditions			
G1	G1 Copy of licence kept at the premises or plant	Compliant	Site inspection conducted 12 April 2022	Conduct of the site inspection verified compliance with the requirements of this condition.
G1.1	G1.1 A copy of this licence must be kept at the premises to which the licence applies	Compliant	Site inspection conducted 12 April 2022	Conduct of the site inspection verified compliance with the requirements of this condition.
G1.2	G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.	Not triggered		An EPA officer has not asked to see the licence over the reporting period. This condition remains not triggered.
G1.3	G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.	Compliant	Site inspection conducted 12 April 2022	Conduct of the site inspection verified compliance with the requirements of this condition.

Condition	Details			Compliance status	Relevant evidence	Commentary
G2	G2 Contact number for incidents and responsible employees					
G2.1	G2.1 The licensee must operate 24-hour telephone contact lines for the purpose of enabling the EPA to directly contact one or more representatives of the licensee who can: a) respond at all times to incidents relating to the premises; and b) contact the licensee's senior employees or agents authorised at all times to:			Compliant		Changes of personnel at Chain Velley Colliery have been updated via the EPA eConnect portal.
	i) speak on behalf ofii) provide any information	ation or document required under this	licence.			
G2.2	G2.2 The licensee is subsequent contact p	to inform the EPA in writing of the app persons, or changes to the person's co y event within fourteen days of the app	ointment of any ntact details as soon as	Compliant		Changes of personnel at Chain Velley Colliery have been updated via the EPA eConnect portal.
G3	G3 Other general cor	nditions				
G3.1	G3.1 Completed Prog	grams		Not triggered		The projects listed in the table were completed prior to the scope of the audit, and therefore this condition is not triggered.
	Program	Description	Completed Date			
	Coal Mine Particulate Matter Control Best Practice Assessment of Potential Impacts of Metals in wastewater	Requires licensee to conduct a site specific Best Management Practice (BMP) determination to identify ways to reduce particle emissions. The licensee must conduct an assessment of metals detected in wastewater discharges from the mine in accordance with the ANZECC water quality guidelines. To obtain a greater understanding of the type and concentration of metals discharged in mine water and entering the receiving waters. To limit the concentration of metals discharged in mine water within ANZECC guidelines.	28-September-2012 23-October-2013			
	Air Quality Monitoring	The licensee must evaluate best locations and install monitoring devices as defined in Project Approval MP10_0161 under the Environent Planning & Assessment Act 1979.	31-December-2013			
	PRP4 - Upgrade to Clean and Dirty Water Management System	The licensee must review and upgrade separation of the Clean and Dirty Water Management System and review and upgrade bunding.	14-August-2015			
	PRP5 - Remediation of Dam Wall and Spillway formalisation	The licensee must design and remediate the dam wall on the final control pond and formalise a spillway to prevent dam seepage and to ensure that volumetric discharge can be monitored	27-February-2015			
	PRP 6 Upgrade to Sewage Treatment Systems	Assessment of options for improved disinfection of effluent from STP on licenced premises.				
	PRP7 Sewage Treatment System Concept Design	Provide the EPA with a Concept Design and Timetable for Implementation of Upgrade to the Sewage Treatment System	nentation of Upgrade to the			

Condition	Details	Compliance status	Relevant evidence	Commentary
8	8 Pollution Studies and Reduction Programs			
U1	U1 PRP 8 – Connection of Bathouse Wastewater to Sewer			
U1.1	U1.1 Background The licensee has historically treated and disposed of effluent and grey water generated by activities at the premises through the surface water management system. The licensee has committed to undertaking scoping works and planning pathways to enable the connection of the bathhouse wastewater at the premises to the Central Coast Council sewer. The EPA understands that in 2021 the licensee was granted approval by Central Coast Council to undertake the necessary works to discharge effluent and grey water generated at the bathhouse to sewer. Deliverables The licensee must undertake all works proposed and specified under the planning approval by Central Coast Council to enable all bathhouse effluent and greywater to be disposed to the Central Coast Council sewerage network by no later than Friday 26 August 2022. Upon completion of the sewerage connection the licensee must provide the EPA with a letter report identifying all works completed under this PRP.	Compliant	Site interviews conducted 12/13 April 2022	IEA Recommendation: Liaise with the EPA regarding the current status of the Sewage System Project. Implement any agreed actions in terms of timing 2022 IEA Findings: This upgrade is in the process of being completed and is on track to be completed by 26 August 2022 as per the requirements of this condition.
U2	U2 PRP 9 - Office Area Wastewater System Upgrades to Best Practice			
U2.1	U2.1 Background Wastewater from the premises office is currently managed by a sewage treatment system that employs surface irrigation of effluent via an above ground sprinkler system. The EPA understand that the sewage treatment system services around four office staff. The EPA understand that the effluent currently irrigated is not disinfected. The EPA considers that the current effluent irrigation system is in need of upgrades to reduce any potential impact to public health and the environment. Deliverables The licensee must gain any necessary approvals and upgrade the current sewage management system servicing the office building to a current best practice sewage management system. This may include upgrades to the effluent irrigation system to sub-surface irrigation or other best practice methods. The licensee must upgrade the current wastewater management system servicing the office building to best practice by no later than Friday 26 August 2022. Upon completion of all works required by this PRP the licensee must supply the EPA with a letter report identifying all works and actions taken to upgrade the office building sewage management system.	Compliant	Site interviews conducted 12/13 April 2022	This upgrade is in the process of being completed and is on track to be completed by 26 August 2022 as per the requirements of this condition.

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Condition	Details	Compliance status	Relevant evidence	Commentary
	Schedule 2 – Administrative conditions			
	OBLIGATION TO MINIMISE HARM TO THE ENVIRONMENT			
1	1. In addition to meeting the specific performance measures and criteria established under this consent, the Applicant must implement all reasonable and feasible measures to prevent, and if prevention is not reasonable and feasible, minimise, any material harm to the environment that may result from the construction and operation of the development, and any rehabilitation required under this consent.	Compliant	Site inspection conducted 12 April 2022 Site interview conducted 12/13 April 2022	Conduct of the audit verifies compliance with the requirements of this condition.
	TERMS OF APPROVAL			
2	2. The development may only be carried out: (a) in compliance with the conditions of this consent; (b) in accordance with the statement of commitments in Appendix 9; (c) in accordance with the Subsidence Zones in Appendix 3; (d) in accordance with all written directions of the Planning Secretary; and (e) generally in accordance with the EIS, SEE (Mod 1), SEE (Mod 2), SEE (Mod 3) and SEE (Mod 4).	Non-compliance (low risk)	Site inspection conducted 12 April 2022 Site interview conducted 12/13 April 2022	The following conditions of this licence were identified as being non-compliant over the reporting period: Schedule 2, Condition 2 Schedule 3, Condition 5 Schedule 3, Condition 9 Schedule 3, Condition 17 Schedule 3, Condition 18 Schedule 3, Condition 23 Schedule 6, Condition 3 Schedule 6, Condition 4 Schedule 6, Condition 12 Schedule 6, Condition 13 As these conditions of the licence have not been complied with, this condition is also non-compliant. Refer to corrective actions and recommendations on each condition.

Condition	Details	Compliance status	Relevant evidence	Commentary
3	3. Consistent with the requirements in this consent, the Planning Secretary may make written directions to the Applicant in relation to: (a) the content of any strategy, study, system, plan, program, review, audit, notification, report or correspondence submitted under or otherwise made in relation to this consent, including those that are required to be, and have been, approved by the Planning Secretary; and (b) the implementation of any actions or measures contained in any such document referred to in condition 3(a).	Not triggered	Annual Review for 2019, 2020 and 2021	No directions have been given to Delta Coal over the reporting period.
4	4. The conditions of this consent and directions of the Planning Secretary prevail to the extent of any inconsistency, ambiguity or conflict between them and a document/s listed in condition 2(e). In the event of an inconsistency, ambiguity or conflict between any of the document/s listed in condition 2(e), the most recent document prevails to the extent of the inconsistency, ambiguity or conflict.	Note		Noted
	LIMITS ON CONSENT			
	Mining Operations			
5	5. The Applicant may carry out mining operations on the site until 31 December 2027. Note: Under this consent, the Applicant is required to rehabilitate the site and perform additional undertakings to the satisfaction of either the Planning Secretary or the RR. Consequently, this consent will continue to apply in all other respects other than the right to conduct mining operations until the rehabilitation of the site and these additional undertakings have been carried out satisfactorily.	Compliant		Mining operations were undertaken within the audit period.
	Coal Extraction			
6	6. The Applicant must not extract more than 2.1 million tonnes of ROM coal from the site in any calendar year.	Compliant	Annual Review for 2019, 2020 and 2021	Delta Coal produced coal within the limits of this condition. - 2019: 0.79 million tonnes - 2020: 1.38 million tonnes - 2021: 1.25 million tonnes Compliance for 2022 was not assessed as the reporting period did not encompass the entire calendar year.
	Coal Transport – Public Roads			
7	7. The Applicant must ensure that no laden coal trucks are dispatched from the site to public roads outside of the hours of 5:30 am to 5:30 pm, Monday to Friday, and not at all on Saturdays, Sundays or public holidays.	Compliant	Site interview conducted 12/13 April 2022	2019 IEA Recommendation: Ensure detailed records of coal transportation are recorded and able to be provided to auditors upon request. The spreadsheets should cover the requirements of the key conditions of the Development Consent. 2022 IEA Findings: Coal was generally transferred to Vales Point Power Station via conveyor. Some haulage trucks were used over the reporting period to supplement the conveyor transport.

Condition	Details	Compliance status	Relevant evidence	Commentary
8	 8. The Applicant must not dispatch from the site more than: (a) 660,000 tonnes of product coal in any calendar year to the Port of Newcastle for export; (b) 180,000 tonnes of product coal in any calendar year to domestic customers other than Vales Point Power Station; (c) a total of 270 laden coal trucks per day by public roads; (d) a total of 32 laden coal trucks per hour; and (e) an average of 16 laden coal trucks per hour by public roads during peak hour periods, calculated monthly, until the intersection of M1 Motorway and Sparks Road Interchange (East Side - unsignalised with stop sign) is upgraded to a signalised intersection. 	Compliant	Site interview conducted 12/13 April 2022	2019 IEA Recommendation: Ensure detailed records of coal transportation are recorded and able to be provided to auditors upon request. The spreadsheets should cover the requirements of the key conditions of the Development Consent. 2022 IEA Findings: No export to Port of Newcastle and generally no laden trucks by public roads. Small exceptions were during 2020 and 2021 where stockpiled coal was transported off site for treatment due to contamination. Volumes were within limits of this condition.
	Coal Transport – Vales Point Power Station			
9	9. The Applicant must ensure that only private roads are used for the transport of coal by truck to Vales Point Power Station, except in an emergency. In an emergency, product coal may be transported by public roads, with the prior written approval of the Planning Secretary, and subject to any restrictions that the Planning Secretary may impose.	Compliant	Site interview conducted 12/13 April 2022 Annual Review for 2019, 2020 and 2021 Coal haulage register for 2019, 2020, 2021 and 2022	2019 IEA Recommendation: Ensure detailed records of coal transportation are recorded and able to be provided to auditors upon request. The spreadsheets should cover the requirements of the key conditions of the Development Consent. 2022 IEA Findings: Small exceptions were during 2020 and 2021 where stockpiled coal was transported off site for treatment due to contamination. Volumes were within limits of this condition.
10	The Applicant must restrict the transport of coal by truck to the Vales Point Power Station between 10 pm and 5:30 am to: (a) 16 laden trucks per hour for the Spring and Autumn months; and (b) zero during Winter months	Compliant	Site interview conducted 12/13 April 2022 Road Transport Protocol (Rev 3 – Dated 1 December 2019).	2019 IEA Recommendation: Ensure detailed records of coal transportation are recorded and able to be provided to auditors upon request. The spreadsheets should cover the requirements of the key conditions of the Development Consent. 2022 IEA Findings: Coal is not transported to Vales Point Power Station between these hours. This is outlined in Section 2 of the Road Transport Protocol Driver Code of Conduct.

Condition	Details	Compliance status	Relevant evidence	Commentary
	PLANNING AGREEMENT			
11	11. Within 12 months of the date of this consent, unless otherwise agreed by the Planning Secretary, the Applicant must enter into a planning agreement with the CC Council in accordance with Division 6 of Part 4 of the EP&A Act that provides for payment to the CC Council for community enhancement purposes. The agreement must include provision for those matters set out in condition 12 below. If there is any dispute between the Applicant and CC Council relating to the preparation or implementation of the planning agreement, then either party may refer the matter to the Planning Secretary for resolution.	Not triggered		Not triggered as this was executed in 2016, which is outside reporting period.
	COMMUNITY ENHANCEMENT			
12	12. The Applicant must pay CC Council \$0.035 for each tonne of product coal produced by the development for the purposes of improving public infrastructure and providing community projects for the communities of Summerland Point, Gwandalan, Chain Valley Bay and Mannering Park. Payments from the approval date of project approval 10_0161 must be: (a) made by the end of March, for coal produced in the previous calendar year; (b) made for each year that coal is produced by the colliery; and (c) subject to indexation in accordance with the Australian Bureau of Statistics Consumer Price Index.	Compliant	Annual Review for 2019, 2020 and 2021 VPA Tracking spreadsheet Payment receipts	Table 1 in the Annual Review details the money accrued for the Voluntary Planning Agreement with Council. 2019 \$29,982.33 2020 \$48,205.00 2021 \$52, 360.00 A comparison of production statistics and required contributions found that Delta Coal were operating in compliance with the requirements of this condition. Evidence of payment was provided during the audit. Compliance for 2022 was not assessed as the reporting period did not encompass the entire calendar year.
13	Deleted			
14	Deleted			
	STRUCTURAL ADEQUACY			
15	 15. The Applicant must ensure that all new buildings and structures, and any alterations or additions to existing buildings and structure, that are part of the development are constructed in accordance with: (a) the relevant requirements of the BCA; and (b) any additional requirements of the SA NSW where the building or structure is located on land within declared Mine Subsidence Districts. Notes: Under Part 8 of the EP&A Act, the Applicant is required to obtain construction and occupation certificates for the proposed building works; Part 8 of the EP&A Regulation sets out the requirements for the certification of the development; and Under section 21 of the Coal Mine Subsidence Compensation Act 2017, the Applicant is required to obtain the SA NSW's approval before constructing any improvements in a Mine Subsidence District. 	Not triggered		No new buildings have been constructed over the audit period. This condition is not triggered.

Condition	Details	Compliance status	Relevant evidence	Commentary
	DEMOLITION			
16	16. The Applicant must ensure that all demolition work is carried out in accordance with Australian Standard AS 2601-2001: The Demolition of Structures, or its latest version.	Compliant	Demolition documentatio n	Demolition of some old mine cottages and ROM coal bin occurred over the reporting period. Demolition was undertaken by Novocastrian Demolition. Demolition documentation was viewed in the audit and was found to be compliant with this condition.
	OPERATION OF PLANT AND EQUIPMENT			
17	17. All plant and equipment used on site, or to monitor the performance of the development must be:	Compliant	Calibration certificates	Calibration certificates for noise loggers and the TEOM were provided.
	(a) maintained in a proper and efficient condition; and(b) operated in a proper and efficient manner.		Pulse tracking system	While the Pulse tracking system was also reviewed while completing the site inspection.
18	Deleted			
	ROAD MAINTENANCE CONTRIBUTION			
19	19. The Applicant must pay Road Maintenance Fees to CC Council in accordance with its Road Maintenance Agreement with CC Council.	Compliant	Corresponden ce with Lake Macquarie Council	Correspondence with council regarding the payment of Road Maintenance Fees was provided.
	COMMUNITY CONSULTATIVE COMMITTEE			
20	20. A Community Consultative Committee (CCC) must continue to operate for the development in accordance with the Department's Community Consultative Committee Guidelines: State Significant Projects (2019). The CCC must continue to operate during the life of the development, or other timeframe agreed by the Planning Secretary. Notes:	Compliant	Community Consultative Committee (CCC) Meeting Minutes	The Community Consultative Committee (CCC) were held quarterly over the reporting period and in compliance with the requirements of this condition.
	The CCC is an advisory committee only.		CCC Annual reports for	
	 In accordance with the Guidelines, the Committee should comprise an independent chair and appropriate representation from the Applicant, Affected Councils and the local community. 		2019, 2020 and 2021	
21	21. With the approval of the Planning Secretary, the Applicant may combine the CCC required by this consent with any similar CCC required by a consent or approval for any adjoining mine subject to common, shared or related ownership or management.	Compliant	Community Consultative Committee (CCC) Meeting Minutes CCC Annual reports for 2019, 2020 and 2021	The CCC for the Chain Valley Colliery is combined with Mannering Colliery

Condition	Details	Compliance status	Relevant evidence	Commentary
	EVIDENCE OF CONSULTATION			
22	EVIDENCE OF CONSULTATION 22. Where conditions of this consent require consultation with an identified party, the Applicant must: (a) consult with the relevant party prior to submitting the subject document; (b) provide details of the consultation undertaken including: i. the outcome of that consultation, matters resolved and unresolved; and ii. details of any disagreement remaining between the party consulted and the Applicant and how the Applicant has addressed the matters not resolved.	Compliant	Coal Haulage Traffic Management System Plan (Rev 3) — Dated 25 September 2020 Independent Traffic Audits Air Quality and Greenhouse Gas Management Plan DRAFT (V2 — dated 21 January 2022 Benthic Communities Management Plan (Rev 5 — 6 April 2021) Biodiversity Management Plan (Rev 5 — Dated 1 December 2019) Built Features Management Plan (Rev 0 — Dated 6 April 2021) Heritage Management Plan (Rev 4 — Dated 6 November 2020)	Consultation requirements were generally in compliance with the requirements of this condition. The BMP was sent to the parties outlined in Schedule 3 Condition 20. No comments were received. Recommendation 4: The outcome of consultation is not included in the BMP, it is recommended that a statement saying that no comments were received is included in the plan.
			Noise Management Plan (Rev 2–	

Condition	Details	Compliance status	Relevant evidence	Commentary
		Status	Dated 12 March 2014) Miniwall S5 and Northern Pillar Area Extraction Plan (Rev 1.2 – Dated10 March 2020) Public Safety Management Plan (Dated 19 March 2021) Rehabilitation Management Plan (Rev 5 – Dated 10 March 2020) Seagrass Management Plan (Rev 8 – Dated 6 April 2021) Subsidence Monitoring Program (Dated 20 November 2020) Water Management Plan (Rev 5 – Dated 24 August 2021)	
	STAGING, COMBINING AND UPDATING STRATEGIES, PLANS OR PROGRAMS			
23	23. With the approval of the Planning Secretary, the Applicant may: (a) prepare and submit any strategy, plan or program required by this consent on a staged basis (if a clear description is provided as to the specific stage and scope of the development to which the strategy, plan or program applies, the relationship of the stage to any future stages and the trigger for updating the strategy, plan or program);	Non-compliance (administrative)	Air Quality and Greenhouse Gas Management Plan (V2 – dated 21 January 2022)	2019 IEA Recommendation: All management plans require updating due to the length of time since the previous reviews. All should in a Delta Coal template. Ensure there is a cross referencing table covering this condition in management plans.

Condition	Details	Compliance status	Relevant evidence	Commentary
	(b) combine any strategy, plan or program required by this consent (if a clear relationship is demonstrated between the strategies, plans or programs that are proposed to be combined); (c) update any strategy, plan or program required by this consent (to ensure the strategies, plans and programs required under this consent are updated on a regular basis and incorporate additional measures or amendments to improve the environmental performance of the development); and (d) combine any strategy, plan or program required by this consent with any similar strategy, plan or program required by an adjoining mining consent or approval, in common ownership or management.		Biodiversity Management Plan (Rev 5 - Dated 1 December 2019) Environmental Management Strategy (Rev 1 - Dated 24 March 2021) Heritage Management Plan (Rev 3 - Dated 27 April 2020) Noise Management Plan (Rev 2- Dated 12 March 2014)) Seagrass Management Plan (Rev 8 - Dated 10 July 2020) Water Management Plan (Rev 5 - Dated 24 August 2021) Benthic Communities Management Plan (Dated 6 April 2021)	Additional detail including Trigger, Action, Response Tables (contingency plan) should be developed in the next round of management plan updates. 2022 IEA Findings: The following management plans were completed for Chain Valley Colliery: Environmental Management Strategy (EMS): The EMS was published in March 2021. Attachment 1 contains a table of compliance with the conditions of approval. AQGGMP: This plan was most recently updated January 2022 to be combined with Mannering Colliery and cover both sites. The recommendation of the previous audit to incorporate Trigger Action Response Tables has not been incorporated into the plan. BMP: This plan was updated recently and is not due for review until December 2022. Appendix 2 contains a table outlining how the relevant conditions of approval are satisfied in the document. Table 9 contains the Trigger Action Response Tables recommended by the previous audit. HMP: This plan was updated recently and is not due for review until December 2022. Appendix 2 contains a table outlining how the relevant conditions of approval are satisfied in the document. There is no inclusion of the Trigger Action Response Tables recommended by the previous audit. NMP: The NMP for the site has not been updated within the reporting period and is therefore non-compliant with Clause (c). The NMP does not include Trigger Action Response Plans or a compliance table. The auditor notes that a new NMP is being prepared that satisfies the 2019 IEA Recommendations and the requirements of this condition. Therefore, no corrective actions are required. Seagrass Management Plan: This plan was most recently updated in July 2020 and was due for review in July 2021. Appendix 2 contains a table outlining how the relevant conditions of approval are addressed in the plan. There is no inclusion of the Trigger Action Response Tables recommended by the previous audit. Benthic Communities Management Plan: This plan was most recently updated in 6 April 2021. Appendix 2 contains a table outlining how the re

Condition	Details	Compliance status	Relevant evidence	Commentary
				in the document. There is no inclusion of the Trigger Action Response Tables recommended by the previous audit.
				As the recommendation of the previous audit to ensure that Trigger Action Response Plans are added into the management plans has not been followed though in the audit, a non-compliance with clause (c) of this condition is recorded.
				Corrective action 4: Ensure that TARPs are included in the AQMP, HMP, Seagrass Management Plan, Benthic Communities Management Plan and WMP in the next update. This includes developing a TARP to further detail the management procedures for the newly established PM2.5 alarms within the AQMP.
				Correspondence was received from DPIE on 9 October 2020 to provide approval for the AQGGMP, HMP, Land Management Plan (LMP) and NMP to be combined for Chain Valley Colliery and Mannering Colliery in the next update. As above, the AQGGMP has been updated, however the other three plans have not at the time of audit.
24	24. If the Planning Secretary agrees, a strategy, plan or program may be staged or updated without consultation being undertaken with all parties required to be consulted in the relevant condition in this consent.	Not triggered		Delta Coal have not received directions such as this over the reporting period. This condition remains not triggered.
25	25. If the Planning Secretary agrees, a strategy, plan or program may be staged without addressing particular requirements of the relevant condition of this consent if those requirements are not applicable to the particular stage.	Not triggered		Delta Coal have not received directions such as this over the reporting period. This condition remains not triggered.
	APPLICATION OF EXISTING STRATEGIES, PLANS OR PROGRAMS			
26	26. The Applicant must continue to apply existing management strategies, plans or monitoring programs approved prior to the approval of Modification 3, until the approval of a similar plan, strategy or program following the approval of Modification 3.	Compliant	Biodiversity Management Plan (Rev 5 - Dated 1 December 2019) Heritage Management Plan (Rev 3 - Dated 1 December 2019) Noise Management	Modification 3 (MOD3) was issued in June 2020. The current consent is MOD4 issued July 2021.
			Plan (Rev 2– Dated 12 March 2014))	

Condition	Details	Compliance status	Relevant evidence	Commentary
	PROTECTION OF PUBLIC INFRASTRUCTURE			
27	27. Unless the Applicant and the applicable authority agree otherwise, the Applicant must: (a) repair, or pay the full costs associated with repairing, any public infrastructure a that is damaged by carrying out the development; and (b) relocate, or pay the full costs associated with relocating, any public infrastructure a that needs to be relocated as a result of the development. a This condition does not apply to any damage to roads caused as a result of general road usage or to damage that has been compensated under the Mining Act 1992.	Not triggered.		No public infrastructure has been damaged over the reporting period. This condition remains not triggered.
	COMPLIANCE			
28	28. The Applicant must ensure that all of its employees, contractors (and their sub-contractors) are made aware of, and are instructed to comply with, the conditions of this consent relevant to activities they carry out in respect of the development.	Compliant	Site interview conducted 12/13 April 2022	Conduct of the site inspection and review of relevant documentation verifies compliance with the requirements of this condition.
	APPLICABILITY OF GUIDELINES			
29	29. References in the conditions of this consent to any guideline, protocol, Australian Standard or policy are to such guidelines, protocols, Standards or policies in the form they are in as at the date of inclusion (or later update) in the condition.	Note		
30	30. However, consistent with the conditions of this consent and without altering any limits or criteria in this consent, the Planning Secretary may, in respect of ongoing monitoring and management obligations, agree to or require compliance with an updated or revised version of such a guideline, protocol, Standard or policy, or a replacement of them.	Not triggered		No directions of this manner have been received during the audit period. This condition remains not triggered.
	SCHEDULE 3			
	ENVIRONMENTAL CONDITIONS – GENERAL			
	TRANSPORT			
	Monitoring of Coal Transport		F	2010/54 5
	The Applicant must: (a) keep accurate records of the amount of coal transported from the site (on a weekly basis); and (b) make these records publicly available on its website at the end of each calendar quarter.	Compliant	Environmental Reporting webpage (https://www.d eltacoal.com.a u/environment /chain-valley- colliery/chain- valley-colliery- environmental -reporting)	2019 IEA Recommendation: See recommendation regarding detailed transport records. Ensure transport records from this Audit period (January 2016) onwards are recorded on the website. This could be appended to the Annual Review summarising the weekly transport. 2022 IEA findings: Weekly Coal Haulage has been reported on the website adequately over the reporting period.

Condition	Details	Compliance status	Relevant evidence	Commentary
	Road Works			
2	2. The Applicant must upgrade the Ruttleys Road and Construction Road intersection within 6 months of the date of this consent, unless the Planning Secretary directs otherwise, by: (a) installing additional signage on and adjacent to Construction Road prior to the intersection; (b) repairing the surface of Construction Road as required and ensuring the edge seal of the left turn lane is of sufficient width to accommodate coal trucks; (c) installing or replacing "Stop" signs in accordance with Austroads guidelines; (d) repainting road line markings and raised pavements associated with this intersection; and (e) installing barriers to prevent trucks parking on the gravel area adjacent to the intersection and the electricity substation located in the vicinity of this intersection. The design and construction of these works must be undertaken in consultation with, and to the relevant satisfaction of, CC Council, TfNSW and Delta Electricity and to the satisfaction of the Planning Secretary.	Not triggered		Not triggered as this was executed outside the reporting period
	Road Transport Protocol			
3	3. The Applicant must prepare a Road Transport Protocol to the satisfaction of the Planning Secretary. This protocol must: (a) be prepared in consultation with TfNSW, NCC, CC Council and CCC and submitted to the Planning Secretary for approval within 6 months of the date of this consent; (b) describe the designated haulage routes to be used (as shown in Appendix 5); the maximum number of road movements proposed and the haulage hours permitted under this consent; (c) include a Traffic Management Plan, which includes: • procedures to ensure that drivers adhere to the designated haulage routes; • measures to maximise the use of a low frequency (regular) trucking schedule rather than an intermittently-high frequency (campaign) trucking schedule, especially during the morning peak hour; • contingency plans to apply when (for example) the designated haulage route is disrupted, including procedures for notifying relevant agencies and affected communities of the need to implement such contingency plans; • procedures to ensure that all haulage vehicles associated with the development are clearly distinguishable as Chain Valley Colliery coal haulage trucks; • details of procedures for receiving and addressing complaints from the community concerning traffic issues associated with truck movements to and from the site; • measures to ensure that the provisions of the Traffic Management Plan are implemented, eg driver training in the heavy vehicle driver's Code of Conduct and contractual agreements with heavy vehicle operators; and	Compliant	Coal Haulage Traffic Management System Plan (Rev 3) – Dated 25 September 2020	2019 IEA Recommendations: Ensure Coal Haulage Traffic Management Plan is reviewed as per the requirements of the consent and commitments in the management plan. Attach Driver Code of Conduct to the management plan. 2022 IEA Findings: The Coal Haulage Management System Plan. Evidence of consultation is provided in Appendix A . Designated haul routes are described in the Driver Code of Conduct, which is appended to the plan in Appendix 2. The Traffic Management Plan is detailed in Section 3, 4, 5 and 6 and is compliant with the requirements of this condition. The recommendations of the previous audit have been incorporated into the plan.

Condition	Details	Compliance status	Relevant evidence	Commentary
	 procedures for ensuring compliance with and enforcement of the heavy vehicle driver's Code of Conduct; (d) include a Code of Conduct for heavy vehicle drivers that addresses: travelling speeds; instructions to avoid grouping or convoying of trucks; instructions to drivers not to overtake each other on the haulage route, as far as practicable, and to maintain appropriate distances between vehicles; instruction to drivers to adhere to the designated haulage routes; instruction to drivers to be properly safety conscious and to strictly obey all traffic regulations; and appropriate penalties for infringements of the Code. The Applicant must implement the approved Road Transport Protocol as approved from time to time by the Planning Secretary. 			
4	 4. Prior to 31 March 2014, and every 12 months thereafter for each calendar year in which coal haulage from the site is undertaken utilising public roads, unless the Planning Secretary directs otherwise, the Applicant must commission a suitably qualified person, whose appointment has been approved by the Planning Secretary at least one month prior to undertaking the audit, to conduct an Independent Traffic Audit of the development. This audit must: (a) be undertaken without prior notice to the Applicant, and in consultation with TfNSW, NCC, CC Council and the CCC; (b) assess the impact of the development on the performance and safety of the road network, including a review of: haulage records; accident records on the haulage route, infringements relating to the code of conduct and any incidents involving haulage vehicles; community complaints register; and (c) assess the effectiveness of the Road Transport Protocol; and, if necessary, recommend measures to reduce or mitigate any adverse (or potentially adverse) impacts. 	Compliant	Chain Valley Traffic Audit – Eight Independent Traffic Audit – Dated December 2019 Chain Valley Traffic Audit – Ninth Independent Traffic Audit - 2020 – Dated February 2021 Chain Valley Traffic Audit – Tenth Independent Traffic Audit – Tenth Independent Traffic Audit – Dated 11 February 2022	2019 IEA Recommendation: Ensure Traffic Audits are completed annually in accordance with this condition. 2022 IEA Findings: The independent traffic audits were undertaken on annual basis over the reporting period and were in compliance with the requirements of this condition.
5	5. Within 1 month of receiving the audit report, or as otherwise agreed by the Planning Secretary, the Applicant must submit a copy of the report to the Planning Secretary, with a detailed response to any of the recommendations contained in the audit report, including a timetable for the implementation of any measures proposed to address the recommendations in the audit report. A summary of the audit report must be included in the Annual Review.	Non-compliance (administrative)	Annual Review for 2019, 2020 and 2021	2019 IEA Recommendation: Ensure the report is submitted to the DPE. A summary of the Independent Traffic Audit findings are not included in the annual review documentation. This constitutes and administrative non-compliance. Corrective action 5: Ensure a summary of the results of Independent Traffic Audits are included in Annual Reviews.

Condition	Details	Compliance status	Relevant evidence	Commentary
	Alternative Coal Transport Options			
6	6. Prior to 31 December 2014, and every three years thereafter, the Applicant must prepare and submit to the Planning Secretary for approval, a study of the reasonable and feasible options to reduce or eliminate the use of public roads to transport coal from the development, unless otherwise agreed by the Planning Secretary. The assessment must include: (a) an analysis of the capital, construction and operating costs of the alternative transport options; and (b) quantified social and environmental impacts associated with road and rail transport. 	Compliant	Corresponden ce from DPIE received 15 December 2020.	2019 IEA Recommendation: Ensure the Alternative Transport Options Report is completed as per the frequency in this condition. 2022 IEA findings: Delta Coal received correspondence from DPE on 15 December 2020 granting an exception from conducting the Alternative Coal Transport Options Assessment. The exception applies until such time coal haulage via public roads is proposed.
	NOISE			
	Noise Impact Assessment Criteria			
7	7. The Applicant must ensure that the noise generated by the development at any residence on privately-owned land does not exceed the criteria for the location in Table 1 nearest to that residence. Table 1: Noise Criteria dB(A)	Compliant	Noise Management Plan (Rev 2– Dated 12 March 2014) Annual reviews for 2019, 2020 and 2021 Quarterly Noise Monitoring Reports for 2019, 2020, 2021 and 2022	2019 IEA Recommendation: Continue investigations of any noise issues and, where practicable, implement reasonable and feasible mitigation measures. Ensure accurate/consistent monitoring results are presented in Annual Reviews. 2022 IEA findings: Noise monitoring results over the reporting period indicate that the premises is operating within the limits of this condition. The noise management plans noted that a technical non-compliance for ATN007 for every monitoring event due to access issues. Noise monitoring for ATN007 was conducted at intermediate locations. Total noise levels shown were measured at the alternative locations and site contributions were calculated back to ATN007. Operation of Schedule 6, Condition 12 of SSD-5465 allows monitoring from representative locations.

Condition	Details	Compliance status	Relevant evidence	Commentary
	Operating Conditions			
8	8. The Applicant must: (a) implement best management practice, including all reasonable and feasible noise mitigation measures, to minimise the construction, operational and transport noise generated by the development; (b) regularly assess the noise monitoring and meteorological data and relocate, modify, and/or stop operations on site to ensure compliance with the relevant conditions of this consent; (c) minimise the noise impacts of the development during meteorological conditions under which the noise limits in this consent do not apply (see Appendix 8); (d) use its best endeavours to achieve the long-term noise goals in Table 2, where reasonable and feasible, and report on progress towards achieving these goals in each Annual Review; (e) carry out a comprehensive noise audit of the development in conjunction with each independent environmental audit; and (f) prepare an action plan to implement any additional reasonable and feasible onsite noise mitigation measures identified by each audit; to the satisfaction of the Planning Secretary.	Compliant	Noise Management Plan (Rev 2— Dated 12 March 2014) Site interviews conducted 12/13 April 2022 Annual reviews for 2019, 2020 and 2021 Complaints and Incident Register Quarterly Noise Monitoring Reports for	2019 IEA Recommendation: The real - time noise monitor should be re-established for the site. Liaise with the DPE regarding the best location as the majority of noise complaints have resulted from Mannering Colliery operations, not CVC. Mannering Colliery is also owned by Delta Coal. Update the Noise Management Plan. 2022 IEA Findings: Operations were generally compliant over the reporting period. Exceedances of the long-term noise goals were recorded at R22 during: - 2021 Q3 -3 dB exceedance during the evening and night period - 2021 Q4 - 2 dB exceedance during the day and 4 dB exceedance during evening and night period. A review of the complaints register found that one noise complaints was received over the reporting period. This complaint occurred in October 2020 and did not occur again over the reporting period. This indicates that adaptive noise management is being undertaken by Delta Coal. As 8(d) does not require absolute compliance, instead being based on complying where reasonable and feasible, a non-compliance with this condition has not been identified.
	Table 2: Long-term Noise Goals dB(A) Location Day Evening Night LAeq(15 min) R11 - R13 41 41 41 41 R22 40 Notes: • To interpret the locations referred to in Table 2, see Appendix 6 and the EIS; and • Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy. Appendix 8 sets out the meteorological conditions under which these criteria apply, and the requirements for evaluating compliance with these criteria.		2019, 2020, 2021	The real – time noise monitor was re-established on site in October 2019. Photographic evidence was provided for its installation. Data was also provided to show its implementation, therefore, the recommendation of the previous audit is considered closed. Real time monitoring was reported upon in the relevant Annual Reviews for the audit period.
	Noise Management Plan			
9	9. The Applicant must prepare a Noise Management Plan for the development to the satisfaction of the Planning Secretary. This plan must: (a) be prepared in consultation with the EPA and submitted to the Planning Secretary for approval within 4 months of the date of this consent, unless otherwise agreed by the Planning Secretary; (b) describe the measures that would be implemented to ensure compliance with the noise criteria and operating conditions in this consent;	Non-compliance (administrative)	Noise Management Plan (Rev 2– Dated 12 March 2014) Quarterly Noise Monitoring Reports for	A review of the approved management plan for the site found it generally compliant with the requirements of this condition. The plan however has not been updated since 2014, and therefore does not accurately reflect the activities and conditions occurring on site, therefore a non-compliance against condition (c). The auditor notes that this plan is in the process of being updated, and that no corrective action is necessary. Recommendation 9:The outcomes of the noise mitigation study currently being completed should be captured in a

Condition	Details				Compliance status	Relevant evidence	Commentary
	(c) describe the proposed noise management system in detail including the mitigation measures that would be implemented to minimise noise during construction and operations, including on and off site road noise generated by vehicles associated with the development; and			2019, 2020, 2021	revised noise management plan and reflect any changes to monitoring, as relevant.		
	(d) include a monitoring program that	at:					
	 uses attended monitoring to evaluate the noise criteria in this consent; 	ate the compliance	e of the develop	pment against			
	evaluates and reports on:						
	- the effectiveness of the on-site noi	se management s	system; and				
	- compliance against the noise oper	•					
	 defines what constitutes a noise in and notifying the Department and re 	levant stakeholde	rs of any noise	incidents.			
	The Applicant must implement the N Planning Secretary.	loise Managemen	it Plan as appro	oved by the			
	AIR QUALITY						
	Odour						
10	10. The Applicant must ensure that no offensive odours are emitted from the site, as defined under the POEO Act.		Compliant	Complaints and Incidents Register	No complaints regarding odours have been received over the reporting period.		
	Air Quality Criteria						
11	11. The Applicant must ensure that mitigation measures are employed s by the development do not cause exany residence on privately-owned la	so that particulate sceedances of the	matter emissio	ns generated	Compliant	and Greenhouse Gas Management Plan (V2 –	2019 IEA Recommendation: Update the Air Quality Management Plan following this audit. Improve data capture for PM10. Review possibilities of backup power supply. Ensure issues with data capture are reported in Section 1 and 7 of the Annual Review.
	Table 3: Air quality criteria Pollutant	Averaging period	Criter	ion			
						dated 21 January 2022	Ensure TEOM is setup with alarms/notifications for when results
	Particulate matter < 2.5 µm (PM _{2.5})	Annual	^{а, с} 8 µ <u>ç</u>	g/m³		Annual	are approaching or have exceeded the short term criterion for
		24 hour	^ь 25 µg	J/m ³		reviews for	particulate matter. This will ensure exceedances are immediately detected and reported as soon as possible to the EPA and DPE.
	D (14 4 4 4 6 4 6 4 1)	Annual	a. ° 25 μ	g/m³		2019, 2020 and 2021	detected and reported at coord at pecchanic to the El Walla Br E.
	Particulate matter < 10 μm (PM ₁₀)	24 hour	ь 50 µg	ı/m³		Monitoring	2022 IEA findings:
	Total suspended particulate (TSP) matter	Annual	а. c 90 µ	g/m³		data for 2019, 2020, 2021 and 2022	Several exceedances of criteria were recorded for 24 hour PM ¹⁰ over the reporting period:
	d Deposited dust Annual b 2 g/m²/month a 4 g/m²/month Notes:			anu zuzz	 19 exceedances during 2019, between 26 October and 31 December. Exceedances were reported to DPIE who considered them representative of regional bushfires and dust storms and not non-compliances attributed to the site. 		

Condition	Details	Compliance status	Relevant evidence	Commentary
	b Incremental impact (i.e. incremental increase in concentrations due to the development on its own). c Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary. d Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.	status	evidence	 Four exceedances during 2020, between 4 January and 24 January. As per the 2019 exceedances, these were reported to DPIE who considered them representative of regional bushfires and dust storms and not non-compliances attributed to the site. Seven exceedances of PM^{2.5} criteria occurred during January 2022. Investigation of these exceedances found that they were attributed to factors off site and not activities occurring at Chain Valley Colliery. Several exceedances of depositional dust occurred over the reporting period, including exceedances of monthly criteria during 2020 at DDG005 in February, April, June, July, September, November and December. Exceedances at this location also occurred in February, April, August, September and December of 2021. The annual average depositional dust for this location was exceeded as well. These exceedances were attributed to contamination. DDG005 is proposed to be moved in the latest revision of the AQGGMP yet to be approved by DPE. These exceedances are not considered non-compliances. The 2019 IEA recommended that the TEOM is set up with alarms and notifications when the short term criterion for particulate matter is approached or exceeded. Delta Coal provided evidence that this has occurred, and this recommendation is considered
				closed out. Therefore, in accordance with note c of this condition. These exceedances are not considered non-compliances with this condition.
11A	11A. The air quality criteria in Table 3 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or land to exceed the air quality criteria, and the Applicant has advised the Department in writing of the terms of this agreement.	Note		Noted
	Operating Conditions			
12	 12. The Applicant must: (a) implement best practice air quality management at the site, including all reasonable and feasible measures to minimise the off-site odour, fume and dust emissions generated by the development; (b) implement best practice management to minimise the risk of spontaneous combustion and related emissions; (c) implement all reasonable and feasible measures to minimise the release of greenhouse gas emissions from the site; (d) operate an air quality management system on site to ensure compliance with the relevant conditions of this consent; 	Compliant	Air Quality and Greenhouse Gas Management Plan (V2 – dated 21 January 2022 Site inspection 12 April 2022	2019 IEA Recommendation: Update the Air Quality Management Plan following this audit. Improve data capture for PM10. Review possibilities of backup power supply. Ensure issues with data capture are reported in Section 1 and 7 of the Annual Review. Ensure TEOM is setup with alarms/notifications for when results are approaching or have exceeded the short term criterion for particulate matter. This will ensure exceedances are immediately detected and reported as soon as possible to the EPA and DPE.

Condition	Details	Compliance status	Relevant evidence	Commentary
	(e) minimise the air quality impacts of the development during adverse meteorological conditions and extraordinary events (see note c to Table 3 above); (f) regularly assess the air quality monitoring data, and modify operations on site to ensure compliance with the relevant conditions of this consent, to the satisfaction of the Planning Secretary.		Annual reviews for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022	2022 IEA findings: As discussed in Schedule 3 Condition 11, there have been numerous exceedances of air quality criteria. The majority of these exceedances have been attributed to contamination or regional events. A single exceedance at DG001 was reported in December 2020, which has not occurred since demonstrating that adaptive management has been undertaken. A review of the controls and monitoring program in the AQGGMP found them satisfactory with the requirements of this condition. The site inspection identified that the site produces limited dust, and that measures such as water carts are used on days where rain is not forecast. In regard to spontaneous combustion (clause (b)), there have been no incidents occurring over the reporting period. Controls such as sealing of extracted panels and monitoring of mine gasses occur to mitigate the risk of spontaneous combustion on site.
	Air Quality Management Plan			
13	 13. The Applicant must prepare an Air Quality Management Plan for the development to the satisfaction of the Planning Secretary. This plan must: (a) be prepared in consultation with the EPA, and submitted to the Planning Secretary for approval within 6 months of the date of this consent; (b) describe the measures that would be implemented to ensure compliance with the relevant air quality criteria and operating conditions of this consent; (c) describe the measures that would be implemented to minimise the release of greenhouse gas emissions from the site; (d) describe the proposed on-site air quality management system; and (e) include an air quality monitoring program that: is capable of evaluating the operating conditions of this consent; evaluates and reports on: the effectiveness of the air quality management system; and compliance against the air quality operating conditions; defines what constitutes an air quality incident and includes a protocol for identifying and notifying the Department and relevant stakeholders of any air quality incidents. The Applicant must implement the Air Quality Management Plan as approved by the Planning Secretary. 	Compliant	Air Quality and Greenhouse Gas Management Plan DRAFT (V2 – dated 21 January 2022 Site inspection 12 April 2022 Annual reviews for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022	2019 IEA Recommendation: Update the Air Quality Management Plan following this audit. Improve data capture for PM10. Review possibilities of backup power supply. Ensure issues with data capture are reported in Section 1 and 7 of the Annual Review. Ensure TEOM is setup with alarms/notifications for when results are approaching or have exceeded the short term criterion for particulate matter. This will ensure exceedances are immediately detected and reported as soon as possible to the EPA and DPE 2022 IEA Findings: The AQGGMP has been updated in January 2022. The plan adequately describes measures to be implemented on the site to minimise the impact of dust generation and air quality modifiers. These measures are adequately described in Section 3. Greenhouse gas management is adequately described in Section 5. The monitoring program presented in Section 4 reflects the removal of DG005 as requested by Delta Coal due to ongoing contamination issues. The monitoring program also adequately described

Condition	Details	Compliance status	Relevant evidence	Commentary
	METEOROLOGICAL MONITORING			
14	14. During the life of the development, the Applicant must ensure that there is a suitable meteorological station operating in the vicinity of the site that: (a) complies with the requirements in the Approved Methods for Sampling of Air Pollutants in New South Wales guideline; and (b) is capable of continuous real-time measurement of temperature lapse rate in accordance with the NSW Industrial Noise Policy, unless a suitable alternative is approved by the Planning Secretary following consultation with the EPA.		Air Quality and Greenhouse Gas Management Plan DRAFT (V2 – dated 21 January 2022 Noise Management Plan (Rev 2– Dated 12 March 2014)	Delta Coal operate a meteorological station that collects data continually. Whilst not a non-compliance, the AQGGMP does not show the location of the meteorological station.
	SOIL & WATER			
	Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain the necessary water licences for the development.	Compliant	Annual reviews for 2019, 2020 and 2021	Annual reviews indicate Water Access Licence 41508/Work Approval 20MW065025 have been obtained for the project
	Water Supply			
15	15. The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of mining operations to match its available water supply, to the satisfaction of the Planning Secretary.	Compliant	Annual reviews for 2019, 2020 and 2021	Annual reviews indicate Water Access Licence 41508/Work Approval 20MW065025 have been obtained for the project
	Water Pollution			
16	16. Unless an EPL authorises otherwise, the Applicant must comply with Section 120 of the POEO Act.	Compliant		There were no pollution events over the reporting period, and therefore Delta Coal complied with Section 120 of the POEO Act.
	Sewage Management			
17	17. The Applicant must manage sewage generated by the development in accordance with the requirements of an EPL.	Non-compliant (Administrative)	Water Management Plan (Rev 5– Dated 24 August 2021) Annual Review for 2019, 2020 and 2021	2019 IEA Recommendation: Include additional detail in the Water Management Plan regarding sewage management. Include an update of sewage system during the audit period in the Annual Review. Ensure servicing is completed and records kept onsite. 2022 IEA Findings: The wastewater system was viewed during the site audit. The sewage system installation is proposed to be completed by 26 August 2022 as per condition U1.1 and U1.2 of EPL 1770. An update on the progress of this project is included in

Condition	Details	Compliance status	Relevant evidence Monitoring data for 2019, 2020, 2021 and 2022 Site inspection on 12 April 2022 Servicing records	Section 12.2 of the Annual Review, In regard to the recommendation from the 2019 IEA, additional details have been included in the WMP regarding the wastewater system. The proposed upgrades are not discussed as at the time of audit they have not been constructed. Recommendation 5: Ensure the WMP is updated to reflect the changes to on-site sewage management, which are scheduled to be completed by 26 August 2022. The wastewater system was generally being operated in accordance with this condition and of the conditions of the EPL. However, quarterly servicing regimes were not followed at times during the reporting period, constituting a non-compliance against the condition of the EPL (refer to condition 08.4). Quarterly servicing was missed due to scheduling and contractor delay.
	Water Management Plan			
18	18. The Applicant must prepare a Water Management Plan for the surface facilities sites to the satisfaction of the Planning Secretary. This plan must be prepared in consultation with DPIE Water and EPA, by suitably qualified and experienced persons whose appointment has been endorsed by the Planning Secretary and submitted to the Planning Secretary for approval within 6 months of the date of this consent. This plan must include: (a) a comprehensive water balance for the development that includes details of: • sources and security of water supply; • water make in the underground workings; • water transfers from the underground operations to the surface; • water use; and • any water discharges; (b) management plans for the surface facilities sites, that include: • a detailed description of water management systems for each site, including: - clean water diversion systems; - erosion and sediment controls; and - any water storages; • measures to minimise potable water use and to reuse and recycle water;	Non-compliant (Administrative)	Water Management Plan (Rev 5– Dated 24 August 2021) Site inspection on 12 April 2022	2019 IEA Recommendations: Update the water balance or justify why the current water balance is still applicable to the current operations. Ensure dams and drainage lines are free on silt. Establish a maintenance schedule. 2022 IEA findings: The WMP includes a Water Balance that adequately fulfils the requirements of clause (a). The Water Balance has been updated since the previous IEA fulfilling the recommendation. Surface water management is described in Section 4 and satisfies the requirements of (b). Inspection and maintenance are described in Section 5.8. The implementation of the plan on site was generally adequate. It is noted that maintenance schedules are currently not established for desilting dams on site. Therefore the recommendation of the previous IEA is still applicable. Recommendation 6: Ensure a maintenance schedule is established to ensure dams and drainage lines are free of silt
	 measures to manage acid sulphate soils, if encountered; activities that would involve ground disturbance at the site; and monitoring and reporting procedures. (c) a Surface Water Management Plan which: includes baseline data on surface water flows and quality of Swindles Creek; 			and water storage is maximised. In addition, per commentary on Condition 17 Schedule 3 above, the WMP is considered to not be implemented as approved in relation to onsite sewage management and therefore the WMP should be updated to reflect the current practices onsite. This is in line with Recommendation 5 above.

Condition	Details	Compliance status	Relevant evidence	Commentary
	 details surface water impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on surface water resources or surface water quality; 			
	provides a program to monitor:			
	- surface water discharges;			
	- surface water flows and quality; and			
	- channel stability;			
	(d) a Ground Water Monitoring Program which includes a program to:			
	monitor and report groundwater inflows to underground workings;			
	 predict, manage and monitor impacts to nearby groundwater bores on privately- owned land that may be impacted by the development; and 			
	(e) a detailed review of surface water management at the site, with particular reference to the water storages within the dirty water management system, to:			
	 determine whether the capacity, integrity, retention time and management of the dirty water storages (particularly the final Pollution Control Dam) are sufficient to ensure that water discharged from the site meets the EPL limits and surface water impact assessment criteria within the Surface Water Management Plan; and 			
	propose any appropriate changes to the surface water management system.			
	The Applicant must implement the Water Management Plan as approved by the Planning Secretary.			
	Note: The Planning Secretary may require the Applicant to implement upgrades and other changes identified under paragraph (e), in accordance with condition 3 of Schedule 2.			
	BIODIVERSITY			
	Biodiversity Enhancement Strategy			
19	19. The Applicant must implement a Biodiversity Enhancement Strategy as described in the EIS and summarised in Table 4, in consultation with BCD, and to the satisfaction of the Planning Secretary.	Compliant	Biodiversity Management Plan (Rev 5 –	2019 IEA Recommendations: Include the biodiversity monitoring reports as appendices to the Annual Review. The current monitoring is provided in a spreadsheet with an email
	Table 4: Summary of the Biodiversity Enhancement Strategy		Dated 1	summary. Prepare a small Biodiversity Monitoring Report outlining
	Area Offset Type Minimum Size/Amount		December 2019)	results, a comparison against trigger levels and potential reasons
	Biodiversity Enhancement Area Enhancement and restoration measures, including weed and rubbish removal, return of Enhancement Area Enhancement Area Enhancement and restoration measures, including weed and rubbish removal, return of Endangered and Floodplain Forest and Swamp Oak Floodplain Forest endangered ecological communities within the surface facilities sites Note: To identify the Biodiversity Enhancement Area referred to in Table 4 see the applicable figures in Appendix 7. The Applicant must implement its preferred option of the three options set out in new dot point 1 of the Terrestrial Ecology section of its Statement of Commitments		Annual Review for 2019, 2020 and 2021	for changes 2022 IEA Findings: The Biodiversity Enhancement Strategy is described in section 6 of the Biodiversity Management Plan. The recommendations of the 2019 IEA have been closed out, whereby a standalone annual Biodiversity Report is appended to the Annual Review.
	by 1 December 2016, following consultation with BCD and to the satisfaction of the Planning Secretary.			

Condition	Details	Compliance status	Relevant evidence	Commentary
	Biodiversity Management Plan			
20	20. The Applicant must prepare a Biodiversity Management Plan for the surface facilities sites, for all areas that are not, or will not, be subject to condition 7 of schedule 4, to the satisfaction of the Planning Secretary. This plan must: (a) be prepared by a suitably qualified person approved by the Planning Secretary; in consultation with BCD, and submitted to the Planning Secretary within 6 months of the date of this consent; (b) establish baseline data for the existing habitat in the Biodiversity Enhancement Area and elsewhere on the site; (c) describe the short, medium, and long term measures that would be implemented to: • manage the impacts of clearing vegetation; • manage the remnant vegetation and habitat in the Biodiversity Enhancement Area and elsewhere on the site; and • implement the Biodiversity Enhancement Strategy, including detailed performance and completion criteria; (d) include a program to monitor and report on the effectiveness of these measures, and progress against the detailed performance and completion criteria; (e) identify the potential risks to the successful implementation of the Biodiversity Enhancement Strategy, and the contingency measures that would be implemented to mitigate these risks; and (f) include details of who would be responsible for monitoring, reviewing, and implementing the plan. The Applicant must implement the Biodiversity Management Plan as approved by the Planning Secretary.	Compliant	Biodiversity Management Plan (Rev 5 – Dated 1 December 2019) Annual Review for 2019, 2020 and 2021	2019 IEA Recommendations: Include the biodiversity monitoring reports as appendices to the Annual Review. The current monitoring is provided in a spreadsheet with an email summary. Prepare a small report outlining results, a comparison against trigger levels and potential reasons for changes. Prepare a separate section with short, medium and long-term measures in the Biodiversity Management Plan. 2022 IEA Findings: As discussed in Schedule 3 Condition 19, the recommendations of the 2019 IEA to include a Biodiversity Monitoring Report in the Annual Reviews have been closed out. The BMP was prepared by a suitably qualified person. The BMP was submitted to the EPA, BCD and DPIE on 1 December for review and comment. There is no record of response from agencies to the BMP. Baseline data is adequately described in section 3.2, satisfying the requirements of clause (b) Short-, medium- and long-term measures are described adequate within the report. The biodiversity monitoring program is described in Section 11 and is consistent with clause (d). The main risks to implementation are described in Table 3, with appropriate corrective actions provided that fulfil the requirements of (e). Roles and responsibilities for implementation are described in Section 17 consistent with clause (f).
20A	20A. Within 3 months of the approval of MOD 2, the Applicant must revise the Biodiversity Management Plan to incorporate the measures required to implement its commitments described in new dot point 2 of the Terrestrial Ecology section of its Statement of Commitments, and submit it to the Planning Secretary for approval.	Not triggered		Conduct of the audit indicates this condition has not been triggered.

Condition	Details	Compliance status	Relevant evidence	Commentary
	HERITAGE			
	Protection of Aboriginal Heritage			
21	21. The Applicant must ensure that the development does not cause any direct or indirect impact on any identified heritage item located outside the approved disturbance area, beyond those predicted in the documents listed in condition 2(e) of Schedule 2.	Compliant	Heritage Management Plan (Rev 4 – Dated 6 November 2020) Annual Review for 2019, 2020 and 2021	During the 2020 reporting period 2 previously unidentified Aboriginal Heritage Sites were disturbed during the demolition of former mine cottages. Incident report was submitted to DPIE-compliance, BCD, the EPA and to Registered Aboriginal Parties (RAPs) on 22 October 2020. An independent heritage consultant inspected the site to provide further management recommendations. The sites were added to the AHIMS register as CV002 (AHIMS Site ID 45-7-0412) and CV003 (45-7-0413). Access to sites CV002 and CV003 is prevented by locked gates, and the sites were fenced off to prevent any further accidental damage.
	Heritage Management Plan			
21A	21A. The Applicant must prepare a Heritage Management Plan for the development to the satisfaction of the Planning Secretary. This Plan must: (a) be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Planning Secretary; (b) be prepared in consultation with BCD and Registered Aboriginal Parties; (c) include consideration of the Aboriginal and non-Aboriginal cultural context and significance of the site; (d) describe the procedures and management measures to be implemented on the site or within any offset area to: i. ensure all workers receive suitable Aboriginal cultural heritage inductions prior to carrying out any activities which may cause impacts to Aboriginal objects or Aboriginal places, and that suitable records are kept of these inductions; ii. protect, monitor and manage identified non-Aboriginal heritage, Aboriginal objects and Aboriginal places (including any proposed archaeological investigations of potential subsurface objects and salvage of objects within the approved disturbance area) in accordance with the commitments made in the document/s listed in condition 2(e) of Schedule 2 and including the ongoing monitoring of site 45-7-0189 at Summerland Point; iii. protect non-Aboriginal heritage, Aboriginal objects and Aboriginal places located outside the approved disturbance area from impacts of the development; iv. manage the discovery of suspected human remains and any new Aboriginal objects or Aboriginal places, including provisions for burials, over the life of the development; v. maintain and manage reasonable access for relevant Aboriginal stakeholders to Aboriginal objects and Aboriginal places (outside of the approved disturbance area); and	Compliant	Heritage Management Plan (Rev 4 – Dated 6 November 2020)	2019 IEA Recommendations: Update the Heritage Management Plan, including the removal of Site #45-7-0154. 2022 IEA Findings: Section 1.5 outlines the consultation completed in the preparation of the plan, which is satisfactory of clause (b). The Aboriginal cultural context is adequately described in Section 3. Section 8.1 of the HMP details that the plan should be reviewed, and if necessary, updated if an incident report has been submitted. As discussed in Schedule 3 Condition 21, an incident report was submitted to DPIE during 2020 as an unexpected find occurred. In addition, the HMP was revised to cover these additional sites and was approved as part of the Extraction Plan for Miniwall S5 and NPA Extraction Plan on 6 April 2021. Non-Aboriginal cultural context is described in Section 4 satisfying the requirements of clause c. Management measures for Aboriginal Heritage are described in Section 5.1. non-Aboriginal heritage is described in Section 5.2. Both sections are compliant with clause (d). Management of Aboriginal item salvage is described in Section 5.1.3 and is compliant with the requirements of this condition.

Condition	Details	Compliance status	Relevant evidence	Commentary
	vi. facilitate ongoing consultation and involvement of Registered Aboriginal Parties in the conservation and management of Aboriginal cultural heritage on the site; and			
	(e) include a strategy for the care, control and storage of Aboriginal objects salvaged on site, both during the life of the development and in the long term.			
	The Applicant must implement the Heritage Management Plan approved by the Planning Secretary.			
	VISUAL			
	Visual Amenity and Lighting			
22	22. The Applicant must: (a) minimise visual impacts, and particularly the off-site lighting impacts, of the Surface facilities sites; (b) take all reasonable and feasible measures to further mitigate off-site lighting impacts from the development; and. (c) ensure that all external lighting associated on site complies with Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting, to the satisfaction of the Planning Secretary.	Compliant	Chain Valley and Mannering Lighting Survey (July 2019)	2019 IEA Recommendations: Complete a visual and lighting assessment against the Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting. 2022 IEA findings: Delta Coal undertook a lighting survey to assess the sites compliance with this condition and Australian Standards. The survey found that the development is being carried out in compliance with this condition. This survey closed out the recommendation from the previous IEA.
	WASTE			
23	23. The Applicant must: (a) minimise and monitor the waste generated by the development; (b) ensure that the waste generated by the development is appropriately stored, handled and disposed of and (c) report on waste management and minimisation in the Annual Review, to the satisfaction of the Planning Secretary.	Non-compliant (low)	Annual Review for 2019, 2020 and 2021 Waste tracking register Site inspection conducted 12 April 2022	A review of the Waste Tracking register found that waste was being adequately tracked as per clause (a). Waste management is reported in section 3.6 in the Annual Reviews as per clause (c) Waste systems were viewed on site during the site inspection. There were adequate, clearly marked receptacles placed around the site for waste, however it was noticed that staff were not segregating waste appropriately. This therefore constitutes a noncompliance with clause (b).

Condition	Details	Compliance status	Relevant evidence	Commentary
	BUSHFIRE MANAGEMENT			
24	24. The Applicant must: (a) ensure that the development is suitably equipped to respond to any fires on site; and (b) assist the Rural Fire Service and emergency services as much as possible if there is a fire in the vicinity of the Surface facilities sites.	Compliant	Site interviews conducted 12 April 2022 Site inspection conducted 12 April 2022 STD 00110 – Standards Template – Fire Water Reticulation and Bushfire Fighting (Rev 1) – Dated 23 April 2018	STD 00110 – Standards Template – Fire Water Reticulation and Bushfire Fighting (Rev 1) outlines the procedure for bushfire fighting and water reticulation for the site. It was noted during audit interviews the Land Management Plan (combined with Mannering) has been revised and will be submitted to RFS soon for comment/information.
	REHABILITATION			
	Rehabilitation Objectives			
25	25. The Applicant must rehabilitate the site in accordance with the conditions imposed on the mining lease(s) associated with the development under the Mining Act 1992. This rehabilitation must be generally consistent with the proposed rehabilitation strategy described in the EIS, and comply with the objectives in Table 5.	Compliant	Mining Operations Plan Amendment 1 Rehabilitation Management Plan 2021- 2023 (Dated 23 February 2021) Mining Operations Plan Rehabilitation Management Plan 2020- 2023 (Dated 10 June 2020) Mining Operations Plan Amendment 1	Minor rehabilitation works have been undertaken though the demolition of former mine cottages in Mining Domain 1A has occurred over the reporting period. Land is being returned to open grasslands. Rehabilitation has been undertaken in compliance with the approved MOP.

Condition	Details		Compliance status	Relevant evidence	Commentary
	underground mining taking place a infrastructure that is part of the devi • Rehabilitation of subsidence impact	self-sustaining ecosystems comprised of: local native plant species (unless the RR agrees otherwise); and a landform consistent with the surrounding environment. Repair to pre-mining condition or equivalent unless: the owner agrees otherwise; or the damage is fully restored, repaired or compensated under the Coal Mine Subsidence Compensation Act 2017. Ensure public safety. Minimise the adverse socio-economic effects associated with mine closure. Poply to all subsidence impacts and environmental consequences caused by the first the granting of project approval MP 10_0161, and to all development surface elopment, whether constructed prior to or following the date of this consent. Its and environmental consequences caused by mining which took place prior to _0161 mining which took place p		Rehabilitation Management Plan 2018 - 2020 (23 December 2019) Annual Review for 2019, 2020 and 2021	
	Progressive Rehabilitatio	n			
26		ry out the rehabilitation of the site progressively, that is, ticable following disturbance.	Compliant	Mining Operations Plan Amendment 1 Rehabilitation Management Plan 2021- 2023 (Dated 23 February 2021) Mining Operations Plan Rehabilitation Management Plan 2020- 2023 (Dated 10 June 2020) Mining Operations Plan Amendment 1	The former mine cottages in Mining Domain 1A are being progressively rehabilitation in accordance with the approved MOP. This area is currently being rehabilitated to open grassland.

Condition	Details	Compliance status	Relevant evidence	Commentary
			- Rehabilitation Management Plan 2018 - 2020 (23 December 2019)	
	Rehabilitation Management Plan			
27	27. The Applicant must prepare a Rehabilitation Management Plan for the development, in accordance with the conditions imposed on the mining lease(s) associated with the development under the Mining Act 1992. This plan must: (a) be prepared in consultation with BCD, DPIE Water, CC Council, LMCC and the CCC; (b) be submitted to the RR within 12 months of the date of approval of this development consent; (c) be prepared in accordance with any relevant RR guideline and be consistent with the rehabilitation objectives in the EIS and in Table 5; (d) describe how the performance of the rehabilitation would be monitored and assessed against the objectives in Table 5; (e) describe the process whereby additional measures would be identified and implemented to ensure the rehabilitation objectives are achieved; (f) provide for detailed mine closure planning, including measures to minimise socio-economic effects due to mine closure, to be conducted prior to the site being placed on care and maintenance; and (g) be integrated with the other management plans required under this consent. Note: The Rehabilitation Management Plan should address all land impacted by the development whether prior to, or following, the date of this consent.	Compliant	Rehabilitation Management Plan (Rev 5 – Dated 10 March 2020)	2019 IEA Recommendations: Ensure a copy of the approved Rehabilitation Management Plan is put on the website 2022 IEA Findings: The RMP was updated in 2020 following the 2019 IEA. The RMP is available on the project website, therefore closing out the 2019 IEA Recommendation. Consultation with relevant parties is detailed in Section 1.4 and included in Appendix 1. This is compliant with clause (a) Clause (b) is not applicable as the scope of the audit. In regard to clause (d), (e) and (f), the RMP does not contain extensive details about closure, rehabilitation monitoring and adaptive measures due to the site still being operational over the course of the reporting period, and being an underground mine there is no rehabilitation that can be completed except that required due to subsidence. Integration with other management plans is discussed in Section 4.5. Recommendation 8: Ensure the RMP required by SSD-5465 is updated to consider the requirements of the RMP and Annual Rehabilitation Report and Forward Program currently being prepared (as now required by the NSW Resources Regulator instead of a MOP) and documents where topsoil will be stored and the estimated volumes required for rehabilitation.
	EXPLORATION ACTIVITIES AND SURFACE INFRASTRUCTURE			
	Exploration Activities and Minor Surface Infrastructure Management Plan			
28	28. Prior to carrying out exploration activities on the site under this consent that would cause temporary surface disturbance, or exploration activities within the waters or lake bed of Lake Macquarie, or the construction and/or upgrade of minor surface infrastructure on the site, the Applicant must prepare an Exploration Activities and Minor Surface Infrastructure Management Plan for the development to the satisfaction of the Planning Secretary. This Plan must: (a) be prepared by a suitably qualified and experienced person/s whose appointment has been endorsed by the Planning Secretary; (b) be prepared in consultation with MEG, NSW Maritime Division of TfNSW, NSW Fisheries and BCD;	Not triggered		No physical exploration has occurred over the reporting period. This condition is not triggered.

Condition	Details	Compliance status	Relevant evidence	Commentary
	(c) include a description of the measures to be implemented for:			
	i. managing exploration activities;			
	ii. managing construction and operation of minor surface infrastructure and associated access tracks;			
	iii. consulting with and if necessary compensating affected landowners;			
	iv. assessing noise, air quality, traffic, biodiversity, heritage, public safety and other impacts;			
	v. beneficial re-use or flaring of drained hydrocarbon gases, wherever practicable;			
	vi. avoiding significant impacts and minimisation of impacts generally;			
	vii. avoiding or minimising impacts on threatened species, populations or their habitats and EECs;			
	viii. minimising clearance and disturbance of native vegetation (including seagrasses);			
	ix. minimising and managing erosion and sedimentation; and			
	x. rehabilitating disturbed areas.			
	The Applicant must implement the Exploration Activities and Minor Surface Infrastructure Management Plan as approved by the Planning Secretary.			
	SCHEDULE 4			
	ENVIRONMENTAL CONDITIONS – UNDERGROUND MINING			
	SUBSIDENCE			
1	1. The Applicant must ensure that vertical subsidence within the High Water Mark Subsidence Barrier and within seagrass beds is limited to a maximum of 20 millimetres (mm). If at any stage predicted subsidence levels are exceeded within these areas, an ecological monitoring program shall be initiated to assess the impacts to ecological communities and threatened species and if appropriate, offsets are to be provided for any impacts detected.	Compliant	Annual Review for 2019, 2020 and 2021 Subsidence Monitoring Program (Dated 20 November 2020)	2019 Audit Recommendations: See Section 5.2 of the 2019 IEA Report for Subsidence Recommendations. Subsidence reporting is presented in section 6.13 of the Annual Review and in Appendix 8. A review of the data presented found that subsidence impacts remained in compliance with the requirements of this condition.

Condition	Details		Compliance status	Relevant evidence	Commentary	
	Performance Measures - Natura	al Environment				
2	The Applicant must ensure that the development does not cause any exceedance of the performance measures in Table 6 to the satisfaction of the Planning Secretary. Table 6: Subsidence Impact Performance Measures – Natural and Heritage Features Biodiversity		Compliant	Annual Review for 2019, 2020 and 2021 Benthic	2019 Audit Recommendations: See Section 5.2 of the 2019 IEA Report for Subsidence Recommendations. A review of Annual Reviews and Seagrass, Benthic and the Annual Subsidence Reports are that the criteria in Table 6 has not been exceeded in the reporting period.	
	Threatened species or endangered populations Seagrass beds	Negligible environmental consequences Negligible environmental consequences including: • negligible change in the size and distribution of seagrass beds; • negligible change in the functioning of seagrass beds; and • negligible change to the composition or distribution of seagrass species within seagrass beds.		Communities monitoring report 2021 Seagrass monitoring reports for	Communities monitoring report 2021 Seagrass monitoring	
	Benthic communities	Minor environmental consequences, including minor changes to species composition and/or distribution.		and 2021		
	Mine workings First workings under an approved Extraction Plan beneath any feature where performance measures in this table require negligible environmental consequences	To remain long-term stable and non-subsiding.		Subsidence Monitoring Program (Dated 20 November 2020)		
	for each of these performance measures in the Condition T below). Measurement and/or monitoring of complianc undertaken using generally accepted methods the feature or characteristic is located. These the event of a dispute over the appropriateness	To be carried out only in accordance with an approved Extraction Plan. letailed performance indicators (including impact assessment criteria) various management plans that are required under this consent (see e with performance measures and performance indicators is to be that are appropriate to the environment and circumstances in which ethods are to be fully described in the relevant management plans. In of proposed methods, the Planning Secretary will be the final arbiter. the impacts and consequences of mining operations, construction or roval of this consent.				
	Offsets					
3	Secretary determines that:	formance measures in Table 6 and the Planning to remediate the impact or environmental	2019, 20	Annual Review for 2019, 2020 and 2021	2019 Audit Recommendations: See Section 5.2 of the 2019 IEA Report for Subsidence Recommendations.	
	(b) the remediation measures imp satisfactorily remediate the impac then the Applicant must provide a environmental consequence to the	suitable offset to compensate for the impact or e satisfaction of the Planning Secretary. is condition must be proportionate with the			2022 IEA Findings: As subsidence monitoring did not exceed criteria presented in Table 6, this condition is not triggered.	

Condition	Details		Compliance status	Relevant evidence	Commentary
	Performance Measures – Built Features	•			
4	The Applicant must ensure that the develoced exceedances of the performance measure Planning Secretary.		Compliant	Annual Review for 2019, 2020 and 2021	2019 Audit Recommendations: See Section 5.2 of the 2019 IEA Report for Subsidence Recommendations. Review of relevant documentation indicates compliance with the requirements of this condition.
	Table 7: Subsidence Impact Performance Measures – Built F Built Features	eatures Performance Measure			
	Trinity Point Marina Development Other built features	Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repaired, replaced or fully compensated.			
	Public Safety	replaced or fully compensated.			
	Public Safety.	Negligible additional risk.			
	Notes:				
	The Applicant will be required to define n each of these performance measures in B Public Safety Management Plan (see Con	uilt Features Management Plans or a			
	 Measurement and/or monitoring of comp performance indicators is to be undertakental are appropriate to the environment and circharacteristic is located. These methods a management plans. In the event of a dispurproposed methods, the Planning Secretary 	n using generally accepted methods that cumstances in which the feature or re to be fully described in the relevant ute over the appropriateness of			
	The requirements of this condition only a of mining operations undertaken following	pply to the impacts and consequences			
	 Requirements regarding safety or service actions or mitigation being taken prior to o maintain these outcomes. 				
	Requirements under this condition may be accordance with the Coal Mine Subsidence.				
5	5. Any dispute between the Applicant and interpretation, application or implementation measures in Table 7 is to be settled by the consultation with the SA NSW and MEG. A shall be final and not subject to further dis	on of the subsidence performance Planning Secretary, following Any decision by the Planning Secretary	Not triggered		No disputes of this nature have occurred over the reporting period and therefore this condition remains not triggered.

Condition	Details	Compliance status	Relevant evidence	Commentary
	Multi-Seam Mining Feasibility Investigation			
6	6. Prior to the submission of an Extraction Plan related to the Chain Valley Bay mining area as shown in Appendix 3, the Applicant must prepare a detailed Multi-Seam Mining Feasibility Investigation to the satisfaction of the Planning Secretary. This plan must: (a) be prepared in consultation with MEG by suitably qualified and experienced persons whose appointment has been endorsed by the Planning Secretary; (b) assess the extent of the soft claystone floor/roof conditions within former workings in the Great Northern and Wallarah Seams; (c) assess the stability of remnant coal pillars within former workings in the Great Northern and Wallarah Seams; (d) give particular consideration to the risks of irregular subsidence, pillar run and long-term subsidence leading to subsidence outside of the predicted angle of draw; (e) include revised multi-seam subsidence predictions for the proposed second workings; and (f) recommend final design of the second workings and any necessary adaptive management measures.	Not triggered	Annual Review for 2019, 2020 and 2021	Mining in the Chain Valley Bay area has not recommenced, and therefore the requirement to undertake the Multi-Seam Mining Feasibility Investigation has not been triggered.
	Extraction Plan			
7	 7. The Applicant must prepare an Extraction Plan for all second workings on site, to the satisfaction of the Planning Secretary. Each Extraction Plan must: (a) be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Planning Secretary; (b) be approved by the Planning Secretary before the Applicant carries out any second workings covered by the plan; (c) include detailed plans of existing and proposed first and second workings and any associated surface development, including any applicable adaptive management measures; (d) include detailed performance indicators for each of the performance measures in Tables 6 and 7; (e) provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, incorporating any relevant information obtained since this consent; (f) describe the measures that would be implemented to ensure compliance with the performance measures in Tables 6 and 7, and manage or remediate any impacts and/or environmental consequences; (g) include a Built Features Management Plan, which has been prepared in consultation with RR and the owners of affected public infrastructure, to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which 	Compliant	Miniwall S5 and Northern Pillar Area Extraction Plan (Rev 1.2 – Dated10 March 2020) Benthic Communities Management Plan (Rev 5 – 6 April 2021) Seagrass Management Plan (Rev 8 – Dated 6 April 2021) Subsidence Monitoring Program (Dated 20 November 2020)	 The Miniwall S5 and Northern Pillar Area Extraction Plan (Extraction Plan) was prepared in 2020. Compliance against the requirements of this condition are detailed below: a) A letter of approval of plan authors was received from DPIE on 22 October 2020. This is included in Appendix 16 b) Approval of the plan was granted on 6 April 2021. This approval letter is included in Appendix 16 c) Existing and proposed first and second workings are shown on the plans in Appendix 14 d) Performance measures and requirements of this consent are outlined in Section 3.3 e) Subsidence predictions are described in Section 3.2 f) Section 3.4 outlines general measures that Delta Coal will take to manage environmental impact. Section 4 lists related plans that would also form part of the management framework. There is no discussion on how these will be implemented to directly relate to Tables 6 and 7 in this consent. g) A review of the Built Features Management plan found it to be generally compliant with the requirements of this condition.

Condition	Details	Compliance status	Relevant evidence	Commentary																							
	 addresses in appropriate detail all items of public infrastructure and all classes of other built features; 		Built Features Management	h) A review of the Benthic Communities Management Plan against the requirements of the requirements of this																							
	 has been prepared following appropriate consultation with the owner/s of potentially affected feature/s; 		Plan (Rev 0 – Dated 6 April	condition found that its satisfactory. i) A review of the Seagrass Management Plan against the																							
	 recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate all predicted impacts on potentially affected built features in a timely manner; and; 		2021) Public Safety Management	requirements of the requirements of this condition found that its satisfactory.																							
	(h) include a Benthic Communities Management Plan, which has been prepared in consultation with BCD, LMCC, and DPI Fisheries, which provides for the management of the potential impacts and/or environmental consequences of the		Plan (Dated 19 March 2021)	 j) The Public Management Plan was prepared with RR (as well as other parties) to ensure public safety. Evidence of consultation is provided in the plan. 																							
	proposed second workings on benthic communities, and which includes: • surveys of the lake bed to enable contours to be produced and changes in depth			 The subsidence monitoring program is compliant with the requirement of this condition. 																							
	following subsidence to be accurately measured; • benthic species surveys within the area subject to second workings, as well as control sites outside the area subject to second workings (at similar depths) to																									1)	The contingency plan is located in the form of Trigger Action Response Plans in Appendix 4 of the Extraction Plan.
	establish baseline data on species number and composition within the communities:			m) Rehabilitation Management Plan is included in Appendix																							
	a program of ongoing seasonal monitoring of benthic species in both control and impact sites;			Subsidence monitoring is discussed in Section 5.2 and Appendix 13 of the Extraction Plan. Plans appended contain monitoring criteria for assessment that would feed																							
	 development of a model to predict likely impact of increased depth and associated subsidence impacts and effects, including but not limited to light reduction and sediment disturbance, on benthic species number and benthic communities composition, incorporating the monitoring and survey data collected; and 			into future extraction plans.																							
	 updating the model every 2 years using the most recent monitoring and survey data; 																										
	(i) include a Seagrass Management Plan, which has been prepared in consultation with BCD, LMCC, and DPI Fisheries, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on seagrass beds, and which includes:																										
	 a program of ongoing monitoring of seagrasses in both control and impact sites; and 																										
	 a program to predict and manage subsidence impacts and environmental consequences to seagrass beds to ensure the performance measures in Table 6 are met; 																										
	(j) include a Public Safety Management Plan, which has been prepared in consultation with RR, to ensure public safety;																										
	(k) include a Subsidence Monitoring Program which has been prepared in consultation with RR, to:																										
	 provide data to assist with the management of the risks associated with subsidence; 																										
	validates the subsidence predictions;																										

Condition	Details	Compliance status	Relevant evidence	Commentary
	analyses the relationship between the predicted and resulting subsidence effects and predicted and resulting impacts under the plan and any ensuing environmental consequences; and			
	informs the contingency plan and adaptive management process;			
	(I) include a contingency plan that expressly provides for adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Tables 6 and 7, or where any such exceedance appears likely;			
	(m) include appropriate revisions to the Rehabilitation Management Plan required under Condition 27 of Schedule 3; and			
	(n) include a program to collect sufficient baseline data for future Extraction Plans.			
	The Applicant must implement the Extraction Plan as approved by the Planning Secretary.			
8	8. The Applicant must ensure that the management plans required under conditions 7(g)-(j) above include: (a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this	Compliant	Benthic Communities Management Plan (Rev 5 – 6 April 2021)	A review of the plans required under condition 7(g)-(j) found that they were revised to include the potential environmental consequences of the action plan. Measures for the relevant environmental factors are adequately
	consent; and (b) a detailed description of the measures that would be implemented to remediate predicted impacts.		Seagrass Management Plan (Rev 8 – Dated 6 April 2021)	proposed.
			Subsidence Monitoring Program (Dated 20 November 2020)	
			Built Features Management Plan (Rev 0 – Dated 6 April 2021)	
			Public Safety Management Plan (Dated 19 March 2021	

Condition	Details	Compliance status	Relevant evidence	Commentary
	First Workings			
9	9. The Applicant may carry out first workings within Subsidence Zones A and B as shown in Appendix 3, other than in accordance with an approved Extraction Plan, provided that the first workings are designed to remain stable and non-subsiding in the long-term and do not generate more than 20 mm of vertical subsidence at the surface, except insofar as they may be impacted by approved second workings. Note: The intent of this condition is to ensure that first workings are built to geotechnical and engineering standards sufficient to ensure long-term stability, with negligible direct subsidence impacts.	Compliant	2021 Annual Subsidence Review	First have been undertaken in Zone B over the reporting period. The workings were made in compliance with the requirements of this condition.
9A	9A. Within 3 months of the approval of MOD 1, the Applicant must produce and subsequently implement a Built Features Management Plan that considers surface infrastructure potentially affected by the first workings of the Underground Linkage between Chain Valley Colliery and Mannering Colliery, including WCS's MP01 sewer rising main, TransGrid's electricity transmission assets and infrastructure associated with the Vales Point Power Station, to the satisfaction of the Planning Secretary.	Not triggered		Not triggered – outside of audit period
	Payment of Reasonable Costs			
10	10. The Applicant must pay all reasonable costs incurred by the Department to engage suitably qualified, experienced and independent experts to review the adequacy of any aspect of an Extraction Plan.	Not triggered		DPE have not required Delta Coal to engage an independent expert to review the adequacy of the Extraction Plan. This condition is not triggered.
	SCHEDULE 5 ADDITIONAL PROCEDURES			
	NOTIFICATION OF LANDOWNERS			
1	As soon as practicable after obtaining monitoring results showing: (a) an exceedance of any relevant criteria in Schedule 3, the Applicant must notify affected landowners in writing of the exceedance, and provide regular monitoring results to each affected landowner until the development is again complying with the relevant criteria; and (b) an exceedance of any relevant air quality criteria in Schedule 3, the Applicant must send a copy of the NSW Health fact sheet entitled "Mine Dust and You" (NSW Health, 2017) (as may be updated from time to time) to the affected landowners and/or existing tenants of the land (including the tenants of any mineowned land).	Compliant	Air Quality and Greenhouse Gas Management Plan (V2 – dated 21 January 2022	2019 IEA Recommendations: Define who are potentially 'affected landowners' in the Air Quality Management Plan? Affected landowners should be contacted when there is a non-compliance relating to dust or noise. This should be completed even if it is a regional dust event as Delta Coal—are still recording it as a non-compliance in the Annual Review. 2022 IEA findings: In response to the recommendations of the previous IEA, the updated AQMP adequately defines 'potentially affected landowners' in Section 6.3 The auditor disagrees with the 2019 recommendation to contact landowners affected by regional dust events. Regardless of how it is reported in Annual Reviews, Schedule 3, Condition 11 of SSD-5465 specifically notes that exceedances at any residence on privately-owned land do not apply in relation to extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary of DPE.

Condition	Details	Compliance status	Relevant evidence	Commentary
	INDEPENDENT REVIEW			
2	2. If an owner of privately-owned land considers the development to be exceeding the relevant criteria in Schedule 3, then he/she may ask the Planning Secretary in writing for an independent review of the impacts of the development on his/her land.	Not triggered		A request of this nature has not been received over the reporting period. This condition remains not triggered
	If the Planning Secretary is satisfied that an independent review is warranted, then within 2 months of the Planning Secretary's decision the Applicant must:			
	(a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Planning Secretary, to:			
	consult with the landowner to determine his/her concerns;			
	 conduct monitoring to determine whether the development is complying with the relevant criteria in Schedule 3; and 			
	 if the development is not complying with these criteria then identify the measures that could be implemented to ensure compliance with the relevant criteria; and 			
	(b) give the Planning Secretary and landowner a copy of the independent review.			
	SCHEDULE 6			
	ENVIRONMENTAL MANAGEMENT, REPORTING AND AUDITING			
	ENVIRONMENTAL MANAGEMENT			
	Environmental Management Strategy			
1	The Applicant must prepare an Environmental Management Strategy for the development to the satisfaction of the Planning Secretary. This strategy must:	Compliant	Environmental Management	2019 IEA Recommendations: Prepare a cross referencing table outlining where sub conditions have been covered.
	(a) provide the strategic framework for environmental management of the development;		Chain Valley Colliery and Mannering Include Schedule 5 Condition 2 requirement in landowner's of exceedances 'as soon as practical'	Ensure plans are reviewed as per Schedule 6 Condition 5. Include Schedule 5 Condition 2 requirement in the EMS to notify
	(b) identify the statutory approvals that apply to the development; (c) set out the role, responsibility, authority and accountability of all key personnel			landowner's of exceedances 'as soon as practical'. Define a time period for as soon as practical.
	involved in the environmental management of the development;		Colliery (Rev 1 – Dated 16	2022 Findings: The EMS document provides an overview of the
	(d) set out the procedures to be implemented to:		March 2021)	strategic framework and statutory approvals for the development in Appendix 3 and 4. The Environmental policy is provided in
	 keep the local community and relevant agencies informed about the operation and environmental performance of the development; 			Appendix 1. The roles and responsibilities for implementation are outlined in Section 3.10.
	receive record, handle and respond to complaints;			Community communication is adequately discussed in Section 4.
	resolve any disputes that may arise during the course of the development;			Emergency response is described in Section 5.2 and 5.3. Non-
	respond to any non-compliance and any incident;			compliance and incident response is adequately described in Section 5.4.
	respond to emergencies; and			The EMS adequately outlines the Environmental Management
	(e) include:			Plans required under this consent in Section 3.1. Monitoring
	 references to any strategies, plans and programs approved under the conditions of this consent; and 			requirements briefly covered in Appendix 7. In regard to the recommendations of the previous audit, cross
	 a clear plan depicting all the monitoring to be carried out under the conditions of this consent. 			referencing tables are provided in Appendix 3 and Appendix 4.

Condition	Details	Compliance status	Relevant evidence	Commentary
	The Applicant must implement the Environmental Management Strategy as approved by the Planning Secretary.			The EMS has been reviewed within the reporting period and is compliant with the required revision timeframe.
				The recommendation from the previous audit to notify land owners has not been incorporated into the EMS. This therefore remains outstanding.
				Recommendation 7: Include a requirement in the EMS to notify landowner's of exceedances 'as soon as practical'. Define a time period for as 'soon as practical'.
	Adaptive Management			
2	2. The Applicant must assess and manage development-related risks to ensure that there are no exceedances of the criteria and performance measures in this consent. Any exceedance of these criteria or performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation. Where any exceedance of these criteria or performance measures has occurred, the Applicant must, at the earliest opportunity: (a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur; (b) consider all reasonable and feasible options for remediation (where relevant) and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and (c) implement reasonable remediation measures as directed by the Planning Secretary.	Compliant	Annual Review for 2019, 2020 and 2021 Quarterly Noise Monitoring Reports for 2019, 2020, 2021 Monitoring data for 2019, 2020, 2021 and 2022 Incident reports	A review of the monitoring data and the Annual Review found that exceedances occurring over the reporting period were formally investigated. The majority of exceedances were air quality related, however most of these were not attributed to the site as discussed in Schedule 3 Condition 11. The exceedance of air quality criteria attributed to the site was adequately addressed, and has not occurred again over the reporting period.
	Management Plan Requirements			
3	Management plans required under this consent must be prepared in	Non-compliant	Coal Haulage	2019 IEA Recommendations: All management plans require
	accordance with relevant guidelines, and include: (a) a summary of relevant background or baseline data;	(Administrative)	Traffic Management	updating due to the length of time since the previous reviews. Include in a Delta Coal template.
	(b) details of:		System Plan (Rev 3) –	Ensure there is a cross referencing table covering this condition in
	the relevant statutory requirements (including any relevant approval, licence or lease conditions);		Dated 25 September	management plans. Additional detail including Trigger, Action, Response Tables
	any relevant limits or performance measures and criteria; and		2020	(contingency plan) should be developed in the next round of management plan updates.
	 the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures; 		Independent Traffic Audits Air Quality	2022 IEA findings: Below is a summary of Management Plans prepared under this consent and their compliance against the requirements of this condition.
	(c) any relevant commitments or recommendations identified in the document/s listed in condition 2(e) of Schedule 2;		and Greenhouse Gas	AQGGMP: This plan was found to be generally compliant with the requirements of this condition. The recommendation of the
	(d) a description of the measures to be implemented to comply with the relevant statutory requirements limits, or performance measures and criteria;		Management Plan DRAFT (V2 – dated	previous audit to incorporate Trigger Action Response Tables has not been incorporated into the plan.

- (e) a program to monitor and report on the:
- impacts and environmental performance of the development; and
- effectiveness of the management measures set out pursuant to condition 2(e) of Schedule 2;
- (f) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;
- (g) a program to investigate and implement ways to improve the environmental performance of the development over time;
- (h) a protocol for managing and reporting any:
- incident, non-compliance or exceedance of any impact assessment criterion or performance criterion;
- · complaint; or
- · failure to comply with other statutory requirements;
- (i) public sources of information and data to assist stakeholders in understanding environmental impacts of the development; and
- (j) a protocol for periodic review of the plan.

Note: The Planning Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.

21 January 2022 Benthic Communities Management Plan (Rev 5 – 6 April 2021) Biodiversity

6 April 2021)
Biodiversity
Management
Plan (Rev 5 –
Dated 1
December
2019)

Built Features Management Plan (Rev 0 – Dated 6 April 2021)

Heritage Management Plan (Rev 4 – Dated 6 November 2020)

Noise Management Plan (Rev 2– Dated 12 March 2014) Public Safety

Public Safety Management Plan (Dated 19 March 2021)

Rehabilitation Management Plan (Rev 5 – Dated 10 March 2020)

Seagrass Management Plan (Rev 8 – Dated 6 April 2021)

Water Management Plan (Rev 5–

- Benthic Communities Management Plan: This plan was found to be compliant with the requirements of this condition. The recommendation of the previous audit to incorporate Trigger Action Response Tables has not been incorporated into the plan.
- BMP: This plan was found to be compliant with the requirements of this condition.
- Built Features Management Plan: This plan was found to be compliant with the requirements of this condition.
- HMP: This plan was found to be compliant with the requirements of this condition.
- NMP: The plan being implemented on site is date 12 March 2014 and has not been reviewed or updated over the audit period. This forms a non-compliance against clause (f) as the plan has not been periodically reviewed. The auditor notes that this plan is in the process of being updated and that no corrective action is required to be undertaken.
- Public Safety Management Plan: This plan was found to be compliant with the requirements of this condition.
- Rehabilitation Management Plan: This plan was found to be compliant with the requirements of this condition.
- Seagrass Management Plan: This plan was found to be generally compliant with the requirements of this condition.
 The recommendation of the previous audit to incorporate
 Trigger Action Response Tables has not been incorporated into the plan, however the Trigger Action Response Tables in the overarching Extraction Plan cover requirements of this plan.
- WMP: This plan was found to be generally compliant with the requirements of this condition. The WMP however does not adequately describe the baseline conditions for flows in Swindles Creek. Refer to Schedule 3 Condition 18 for corrective action. The recommendation of the previous audit to incorporate Trigger Action Response Tables has not been incorporated into the plan, however the Trigger Action Response Tables in the overarching Extraction Plan cover requirements of this plan.

The recommendations of the previous IEA were generally carried forward in the revised management plan, with the exceptions listed above.

Condition	Details	Compliance status	Relevant evidence	Commentary
			Dated 24 August 2021)	
4	4. The Applicant must ensure that management plans prepared for the development are consistent with the conditions of this consent and any EPL issued for the site.	Non-compliant (Administrative)		Refer to discussion for Schedule 2, Condition 23 and Schedule 3, Condition 9.
	REVISION OF STRATEGIES, PLANS AND PROGRAMS			
5	5. Within three months of: (a) the submission of an incident report under condition 6; (b) the submission of an Annual Review under condition 8; (c) the submission of an Independent Environmental Audit under condition 9; or (d) the approval of any modification of the conditions of this consent (unless the conditions require otherwise), the suitability of existing strategies, plans and programs required under this consent must be reviewed by the Applicant. If necessary, to either improve the environmental performance of the development, cater for a modification or comply with a direction, the strategies, plans and programs required under this consent must be revised, to the satisfaction of the Planning Secretary. Where revisions are required, the revised document must be submitted to the Planning Secretary for approval within six weeks of the review. Note: This is to ensure strategies, plans and programs are updated on a regular basis and to incorporate any recommended measures to improve the environmental performance of the development.:	Non-compliant (Administrative)	Site interviews conducted 12 April 2022	Refer to discussion for Schedule 2, Condition 23 and Schedule 3, Condition 9. Failure to complete a review and (as necessary) a revision of the relevant plans has resulted in an administrative non-compliance with clauses (c) and (d). Corrective action 6: Ensure plans are updated within three months of submission of this IEA and otherwise in accordance with the requirements of Schedule 6, Condition 5.
	REPORTING AND AUDITING Incident Notification			
6	6. The Applicant must immediately notify the Department and any other relevant agencies immediately after it becomes aware of an incident. The notification must be in writing via the Department's Major Projects website and identify the development (including the development application number and name) and set out the location and nature of the incident.	Compliant	Complaints and incidents register Incident reports	2019 IEA Recommendation: Ensure TEOM is setup with alarms/notifications for when results are approaching or have exceeded the short term criterion for particulate matter. This will ensure exceedances are immediately detected and reported as soon as possible to the EPA and DPE. Ensure exceedances and other incidents are reported as per this condition (Detailed Incident Report within 7 days) 2022 IEA findings: Several exceedances occurred over the reporting period, which are detailed in conditions above. A review of several incident reports provided by Delta Coal have found that the reporting procedures are satisfactory with the requirements of this condition.

Condition	Details	Compliance status	Relevant evidence	Commentary
	Non-Compliance Notification			
7	7. Within seven days of becoming aware of a non-compliance, the Applicant must notify the Department of the non-compliance. The notification must be in writing via the Department's Major Projects website and identify the development (including the development application number and name), set out the condition of this consent that the development is non-compliant with, why it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance. Note: A non-compliance which has been notified as an incident does not need to also be notified as a non-compliance	Compliant	Complaints and incidents register Incident reports	Review of relevant data verifies compliance with the requirements of this condition.
	Annual Review			
8	8. By the end of March in each year after the commencement of the development, or other timeframe agreed by the Planning Secretary, a report must be submitted to the Department reviewing the environmental performance of the development, to the satisfaction of the Planning Secretary. This review must: (a) describe the development (including any rehabilitation) that was carried out in the previous calendar year, and the development that is proposed to be carried out over the current calendar year; (b) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, including a comparison of these results against the: • 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 document/s listed in condition 2(e) of Schedule 2; (c) identify any non-compliance or incident which occurred in the previous calendar year, and describe what actions were (or are being) taken to rectify the non-compliance and avoid reoccurrence; (d) evaluate and report on: • the effectiveness of the noise and air quality management systems; and • compliance with the performance measures, criteria and operating conditions of this consent; (e) identify any trends in the monitoring data over the life of the development; (f) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and (g) describe what measures will be implemented over the next calendar year to improve the environmental performance of the development. Copies of the Annual Review must be submitted to the Affected Councils and made available to the CCC and any interested person upon request.	Compliant	Annual Review for 2019, 2020 and 2021	2019 IEA Recommendations: The Annual Reviews are set out differently to the DPE Annual Review Guidelines (2015). Ensure table of contents matches the guidelines. Ensure transport records from this Audit period (January 2016) onwards are recorded on the website. This could be appended to the Annual Review summarising the weekly transport. Include the biodiversity monitoring reports as appendices to the Annual Review. See Section 5.2 of the Main Audit Report for Subsidence Recommendations. 2022 IEA findings: A review of the Annual Reports for 2019, 2020 and 2021 found that they were generally prepared in compliance with this condition. The form of the Annual Reports has been updated since the previous IEA and is consistent with DPE Annual Review Guidelines (2015). Activities undertaken during the reporting period are adequately described in Section 4 of the Annual Review. Monitoring results are included in Section 6 and 7. The monitoring results presented compare results against criteria and predictions and are satisfactory with clause (b), (d) and (f) of this condition. Complaints are included adequately in 9.1. Non-compliances are briefly outlined in the Statement of Compliance and are detailed adequately in Section 11. Activities proposed over the subsequent reporting are described adequately in Section 12.

Condition	Details	Compliance status	Relevant evidence	Commentary
	Independent Environmental Audit			
9	9. By the end of February 2022, and every three years after, unless the Planning Secretary directs otherwise, the Applicant must commission and pay the full cost of an Independent Environmental Audit of the development. The audit must: (a) led by a suitably qualified, experienced and independent auditor whose	Compliant		This audit. Delta Coal commissioned the auditors prior to February 2022.
	appointment has been endorsed by the Planning Secretary;			
	(b) be led and conducted by a suitably qualified, experienced and independent team of experts (including any be expert in field/s specified by the Planning Secretary) whose appointment has been endorsed by the Planning Secretary;			
	(c) be carried out in consultation with the relevant agencies and the CCC;			
	(d) assess the environmental performance of the development and whether it is complying with the relevant requirements in this consent, water licences and mining leases for the development (including any assessment, strategy, plan or program required under these approvals);			
	(e) review the adequacy of any approved strategy, plan or program required under the abovementioned approvals and this consent;			
	(f) recommend appropriate measures or actions to improve the environmental performance of the development and any assessment, strategy, plan or program required under the abovementioned approvals and this consent; and			
	(g) be conducted and reported to the satisfaction of the Planning Secretary.			
10	10. Within three months of commencing an Independent Environmental Audit, or other timeframe agreed by the Planning Secretary, the Applicant must submit a copy of the audit report to the Planning Secretary, and any other NSW agency that requests it, together with its response to any recommendations contained in the audit report, and a timetable for the implementation of the recommendations. The recommendations must be implemented to the satisfaction of the Planning Secretary.	Compliant	IEA submission email dated 25 June 2019	The previous IEA was submitted on 25 June 2019, within 3 months of it being conducted.
	Monitoring and Environmental Audits			
11	11. Any condition of this consent that requires the carrying out of monitoring or an environmental audit, whether directly or by way of a plan, strategy or program, is taken to be a condition requiring monitoring or an environmental audit under Division 9.4 of Part 9 of the EP&A Act. This includes conditions in respect of incident notification, reporting and response, non-compliance notification, compliance report and independent audit.	Note		
	For the purposes of the condition, as set out in the EP&A Act, "monitoring" is monitoring of the development to provide data on compliance with the consent or on the environmental impact of the development, and an "environmental audit" is a periodic or particular documented evaluation of the development to provide information on compliance with the consent or the environmental management or impact of the development.			

Condition	Details	Compliance status	Relevant evidence	Commentary
12	12. Noise and/or air quality monitoring under this consent may be undertaken at suitable representative monitoring locations instead of at privately-owned residences or other locations listed in Schedule 3, providing that these representative monitoring locations are set out in the respective management plan/s.	Non-compliance (administrative)		A review of the approved NMP for the site found it generally compliant with the requirements of this condition. The plan however has not been updated since 2014, and therefore does not accurately reflect the activities and conditions occurring on site (including relevant monitoring locations), therefore an administrative non-compliance has been identified. The current NMP does not currently identify the representative site being used for noise monitoring at site ATN007. Delta Coal advise that noise monitoring has been undertaken at this location since Q2 2019. The auditor notes a revised NMP was approved by DPE following conduct of the site inspection, addressing this non-compliance.
	ACCESS TO INFORMATION			
13	13. Until the completion of all rehabilitation required under this consent, the Applicant must: (a) make the following information and documents (as they are obtained, approved or as otherwise stipulated within the conditions of this consent) publicly available on its website: • the documents referred to in condition 2(e) of Schedule 2 of this consent; • all current statutory approvals for the development; • all approved strategies, plans and programs required under the conditions of this consent; • the proposed staging plans for the development if the construction, operation or decommissioning of the development is to be staged; • minutes of CCC meetings; • regular reporting on the environmental performance of the development in accordance with the reporting requirements in any plans or programs approved under the conditions of this consent; • a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this consent, or any approved plans and programs; • a summary of the current progress of the development; • contact details to enquire about the development or to make a complaint; • a complaints register, updated monthly; • the Annual Reviews of the development; • audit reports prepared as part of any Independent Environmental Audit of the development and the Applicant's response to the recommendations in any audit report; and • any other matter required by the Planning Secretary; and (b) keep such information up to date, to the satisfaction of the Planning Secretary.	Non-compliance (administrative)	Delta Coal Website (https://www.d eltacoal.com.a u/)	2019 IEA Recommendation: Ensure all relevant information is brought across to the Delta Coal website. A review of the documentation on the website found that it generally contained the information listed in this clause. The information was up to date, and generally easy to find. There were however some documents on the website that were not the most up to date versions available. These were: Benthic Communities Management Plan Seagrass Management Plan Built Features Management Plan Noise Management Plan This therefore constitutes a non-compliance against clause (b) of this condition. Corrective action 7: Ensure that the most up to date management plans are uploaded onto the website.

Appendix D

Independent audit submission form

Independent Audit Dec	aration Form							
Project name	Chain Valley Colliery Extension Project							
Consent Number	SSD-5465							
Description of project	Description of project Refer to Section 1.1							
Project address	Off Construction Road, Vales Point, NSW, 2259							
Proponent	Great Southern Energy Pty Ltd (trading as 'Delta Coal')							
Title of audit	Independent Environmental Audit for SSD-5465							
Date	20 June 2022							

I certify that I have undertaken the independent audit and prepared the contents of the attached independent audit report and to the best of my knowledge:

- The audit has been undertaken in accordance with relevant approval condition(s) and in accordance with the auditing standard AS/NZS ISO 19011:2014 and Post Approval Guidelines – Independent Audits.
- The findings of the audit are reported truthfully, accurately and completely.
- I have exercised due diligence and professional judgement in conducting the audit.
- I have acted professionally, in an unbiased manner and did not allow undue influence to limit or over-ride objectivity in conducting the audit.
- I am not related to any owner or operator of the development as an employer, business partner, employee, sharing a common employer, having a contractual arrangement outside the audit, spouse, partner, sibling, parent, or child.
- I do not have any pecuniary interest in the audited development, including where there is a reasonable likelihood or expectation of financial gain or loss to me or to a person to whom I am closely related (i.e. immediate family).
- Neither I nor my employer have provided consultancy services for the audited development that were subject to this audit
 except as otherwise declared to the lead regulator prior to the audit.
- I have not accepted, nor intend to accept any inducement, commission, gift or any other benefit (apart from fair payment) from any owner or operator of the development, their employees or any interested party. I have not knowingly allowed, nor intend to allow my colleagues to do so.

Notes:

- a. The Independent Audit is an 'environmental audit' for the purposes of section 122B(2) of the *Environmental Planning and Assessment Act 1979*. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.
- b. The *Crimes Act 1900* contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).

Name of Lead auditor	Elliot Holland
Signature	Ellollard.
Qualification	Lead Auditor – Environmental Management Systems
Email address	Elliot.holland@ghd.com
Company and address	GHD Pty Ltd (GHD) GHD Tower, Level 3, 24 Honeysuckle Drive Newcastle NSW 2300
Date	20 June 2022





Appendix 11: Independent Environmental Audit Action Plan

Review Date	Next Review Date	Revision No	Revision No Document Owner									
			Environmental Compliance Coordinator	Page 112 of 114								
	DOCUMENT UNCONTROLLED WHEN PRINTED											



Delta Coal – Chain Valley Colliery Independent Environmental Audit 2022 Action Plan

Corrective Actions and Recommendations prepared by GHD Group Pty Ltd

Comments and Commitments made by Delta Coal

Audit conducted on: 12th April 2022

Version Prepared: 11th July 2022

Updated: 27 March 2023

Prepared by: Lachlan McWha (Environmental Compliance Coordinator)

Approved by: Pieter Van Rooyen (Technical Services Coordinator)



	Table 1 – Corrective Actions												
Action Number	Condition	Details	Compliance status	Relevant evidence	Commentary	Delta Coal Initial Comments	Proposed Completion Date and Completion/Update Comment	Person Responsible	Percentage Complete				
Environm	nental Protection	on License 1770											
1	L2.4 and L3.2	Keep DPE up-to-date on the progress of works under DA 845-2020 to address exceedances associated with licensed discharges.	Non- compliant (low-risk)	Annual Reviews for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022	Several non-compliances were recorded against this condition over the reporting period: Exceedance of faecal coliform limit at LDP01 on 31 August 2019 Exceedance of faecal coliform limit at LDP01 on 18 September 2019 Exceedance of faecal coliform limit at LDP01 on 17 December 2019 Exceedance of faecal coliform and TSS limit at LDP27 on 7 February 2020 Exceedance of faecal coliform and TSS limit at LDP27 on 26 July 2020 Exceedance of faecal coliform and TSS limit at LDP27 on 9 September 2020 Exceedance of faecal coliform and TSS limit at LDP27 on 18 March 2021 Exceedance of faecal coliform and TSS limit at LDP27 on 21 March 2021 Exceedance of faecal coliform limit at LDP01 on 18 January 2022 Exceedance of faecal coliform limit at LDP27 on 31 March 2022. These exceedances therefore form a non-compliance against this condition.	Agree Delta Coal to provide DPE and EPA a quarterly progress report on works under DA 845-2020 – Chain Valley Colliery sewage connection.	Status as of 31/03/2023: Quarterly thereafter: Report submitted October 2022 Report submitted February 2023 A completion report will be issued	Environmental Compliance Coordinator	Update provided to DPE on 04/08/2022 and will be provided quarterly thereafter.				
2	O1.1 and O7.2	As bins are clearly labelled and adequate disposal facilities are available across the site, Delta should investigate means to address the workforce culture in relation to inadequate disposal of waste that has persisted across this, and the previous, audit.	Non- compliant (low-risk)	Site inspection conducted 12 April 2022	2019 Audit recommendation: Ensure the minor waste management issues identified during the audit are rectified. Including: Improve bin labelling; Ensure all hydrocarbon containers (empty or full) are stored within bunds. 2022 IEA Findings: The site audit identified that there were adequate vessels for recycling on site, however recycling was not adequately implemented by staff. There were several instances of incorrect waste being placed into a clearly labelled waste stream bin.	Agree Delta Coal will implement a waste management system to address this non-compliance.	30 June 2023	Environmental Compliance Coordinator	10%				
3	M1.3	Ensure contractors record sample time when recording air quality monitoring data in accordance with the requirements of Condition M1.3.	Non- compliant (admin)	Depositional dust monitoring sheets Monitoring data for 2019, 2020, 2021 and 2022	Water sampling sheets were viewed during the site audit. They were found to be compliant with the requirements of this condition. Air quality sheets were found to be generally compliant, however they did not include a sample time, thus a non-compliance against clause (b) is recorded.	Agree Delta Coal have instructed third party contractor to include sampling times on depositional dust sampling field sheets.	Completed	Environmental Compliance Coordinator	100%				



	Table 1 – Corrective Actions												
Action Number	Conditio n	Details	Compliance status	Relevant evidence	Commentary	Delta Coal Initial Comments	Proposed Completion Date and Completion/Update Comment	Person Responsible	Percentage Complete				
Developme	nt Consent S	SD-5465											
	schedul e 2, Conditi on 23	Ensure that TARPs are included in the AQGHGMP, HMP, Seagrass Management Plan, Benthic Communities Management Plan and WMP in the next update. This includes developing a TARP to further detail the management procedures for the newly established PM2.5 alarms within the AQMP. Correspondence was received from DPIE on 9 October 2020 to provide approval for the AQGGMP, HMP, Land Management Plan (LMP) and NMP to be combined for Chain Valley Colliery and Mannering Colliery in the next update. As above, the AQGGMP has been updated, however the other three plans have not at the time of audit.	Non- compliant (admin)	Air Quality and Greenhouse Gas Management Plan (V2 – dated 21 January 2022) Biodiversity Management Plan (Rev 5 - Dated 1 December 2019) Environmental Management Strategy (Rev 1 – Dated 24 March 2021) Heritage Management Plan (Rev 3 – Dated 27 April 2020) Noise Management Plan (Rev 2– Dated 12 March 2014)) Seagrass Management Plan (Rev 8 – Dated 10 July 2020) Water Management Plan (Rev 5 – Dated 24 August 2021)	require updating due to the length of time since the previous reviews. All should in a Delta Coal template. Ensure there is a cross referencing table covering this condition in management plans. Additional detail including Trigger, Action, Response Tables (contingency plan) should be developed in the next round of management plan updates.' 2022 IEA Findings: The following management plans were completed for Chain Valley Colliery: Environmental Management Strategy (EMS): The EMS was published in March 2021. Attachment 1 contains a table of compliance with the conditions of approval. AQGGMP: This plan was most recently updated January 2022 to be combined with Mannering Colliery and cover both sites. The recommendation of the previous audit to incorporate Trigger Action Response Tables has not been incorporated into the plan. BMP: This plan was updated recently and is not due for review until December 2022. Appendix 2 contains a table outlining how the relevant conditions of approval are satisfied in the document. Table 9 contains the Trigger Action Response Tables recommended by the previous audit. HMP: This plan was updated recently and is not due for review until December 2022. Appendix 2 contains a table outlining how the relevant conditions of approval are satisfied in the document. Table 9 contains the Trigger Action Response Tables recommended by the previous audit. HMP: This plan was updated recently and is not due for review until December 2022. Appendix 2 contains a table outlining how the relevant conditions of approval are satisfied in the document. There is no inclusion of the Trigger Action Response Tables recommended by the previous audit. NMP: The NMP for the site has not been updated within the reporting period and is therefore noncompliant with Clause (c). The NMP does not include Trigger Action Response Plans or a compliance table. The auditor notes that a new NMP is being prepared that satisfies the 2019 IEA Recommendations and the requirements of this condition. Therefore, no corrective act	Agree: TARPs to be included in: Delta Coal Air Quality and Greenhouse Gas Management Plan Chain Valley Colliery Seagrass Management Plan Chain Valley Colliery Benthic Communities Management Plan Delta Coal Heritage Management Plan Delta Coal Land Management Plan Chain Valley Colliery Water Management Plan.	Status at 31/03/2023: All management plans were revised following the IEA and have been submitted for consultation and/or approval with TARPS included. Water Management Plan with TARP Approved. The following revised MP's are pending consultation or approval: Delta Coal Air Quality and Greenhouse Gas Management Plan Chain Valley Colliery Seagrass Management Plan Chain Valley Colliery Benthic Communities Management Plan Delta Coal Heritage Management Plan Delta Coal Land Management Plan	Environmental Compliance Coordinator	100%				



					Table 1 - Corrective Actions				
Action Number	Conditio n	Details	Compliance status	Relevant evidence	Commentary	Delta Coal Initial Comments	Proposed Completion Date and Completion/Update Comment	Person Responsible	Percentage Complete
5	Schedul e 3, Conditi on 5	Ensure a summary of the results of Independent Traffic Audits are included in Annual Reviews.	Non- compliant (admin)	Annual Review for 2019, 2020 and 2021	2019 IEA Recommendation: Ensure the report is submitted to the DPE. A summary of the Independent Traffic Audit findings are not included in the annual review documentation. This constitutes and administrative non-compliance	Agree Summary of traffic audit to be included in 2022 Annual Review.	31 March 2023 Summary provided in 2022 annual review, no coal haulage undertaken as such no independent traffic audit was required. Ongoing for subsequent years (2023 and 2024).	Environmental Compliance Coordinator	100%
6	Schedul e 6, Conditi on 5	Ensure plans are updated within three months of submission of this IEA and otherwise in accordance with the requirements of Schedule 6, Condition 5.	Non- compliant (admin)	Site interviews conducted 12 April 2022	Refer to discussion for Schedule 2, Condition 23 and Schedule 3, Condition 9. Failure to complete a review and (as necessary) a revision of the relevant plans has resulted in an administrative non-compliance with clauses (c) and (d). Corrective action 7: Ensure plans are updated within three months of submission of this IEA and otherwise in accordance with the requirements of Schedule 6, Condition 5.	Agree Delta Coal will review all relevant management plans within 3 months of submission and revise plans requiring amendment within 6 weeks.	Review: 12 October 2022 Revise: 23 rd November 2022 All plans reviewed or revised, revised plans submitted to stakeholders for consultation and/or approval.	Environmental Compliance Coordinator	100%
7	Schedul e 6, Conditi on 13	Ensure that the most up to date management plans are uploaded onto the website.	Non- compliant (admin)	Delta Coal Website (https://www.deltac oal.com.au/)	A review of the documentation on the website found that it generally contained the information listed in this clause. The information was up to date, and generally easy to find. There were however some documents on the website that were not the most up to date versions available. These were: Benthic Communities Management Plan Seagrass Management Plan Built Features Management Plan Noise Management Plan This therefore constitutes a non-compliance against clause (b) of this condition. Corrective action 8: Ensure that the most up to date management plans are uploaded onto the website.	Agree Management Plans identified in the action have had the most recent approved version updated on the website.	Completed 11 July 2022	Environmental Compliance Coordinator	100%



		Table 2 – Recommendations Percentage Percentage												
Recommendation Number	Condition	Details	Compliance status	Relevant evidence	Commentary	Delta Coal Comments	Proposed Completion Date	Person Responsible	Percentage Complete					
Environmental Pr	1							,						
1	P 1.1	As part of updates required to the AQMP, update Figure 3 to show the location of the meteorological station.	N/A	Air Quality and Greenhouse Gas Management Plan (V2 – dated 21 January 2022), including DPE approval 21/03/2022 Noise Management Plan (Rev 2– Dated 12 March 2014)	Delta Coal operate a meteorological station that collects data continually. Whilst not a non-compliance, the AQGGMP does not show the location of the meteorological station.	Agree Weather station location will be identified in figure 3 in Delta Coal Air Quality and Greenhouse Gas Management Plan	Weather station location included in revised AQGHGMP, pending consultation and approval.	Environmental Compliance Coordinator	100%					
2	L2.4	There is an inconsistent naming convention for the discharge locations between sites. It is recommended that they are consistently referenced across management plans and annual reviews.	N/A	Annual Reviews for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022	-	Agree Delta Coal will use consistent naming conventions for discharge locations	23 rd November 2022 Discharge locations (EPA Point 1 and EPA Point 27) updated in Water Management Plan and reporting.	Environmental Compliance Coordinator	100%					
3	M2.2	To improve data capture for PM10, review possibilities of backup power supply for the system.	N/A	Air Quality and Greenhouse Gas Management Plan (V2 – dated 21 January 2022) Monitoring data for 2019, 2020, 2021 and 2022. Annual reviews for 2019, 2020 and 2021	A review of the monitoring data provided indicates that the development is monitoring in accordance with the requirements of this condition. The TEOM stopped recording data for a short period in December 2020 due to severe thunderstorms. The gap in monitoring is recorded as a non-compliance against this condition. Delta Coal have since rectified the system and no corrective action is required, The 2019 IEA recommended that the TEOM is set up with alarms and notifications when the short-term criterion for particulate matter is approached or exceeded. Delta Coal provided evidence that this has occurred, and this recommendation is considered closed out. The 2019 IEA recommendation to investigate back up power supply for the TEOM has not been carried out in the reporting period.	TEOM unit is connected to mains power supply. Delta Coal has reviewed the potential for installing a backup power supply and concluded that the installation of a separate generator is not proportionate to the incident.	N/A	Environmental Compliance Coordinator	100%					



					Table 2 – Recommendations				
Recommendation Number	Condition	Details	Compliance status	Relevant evidence	Commentary	Delta Coal Comments	Proposed Completion Date	Person Responsible	Percentage Complete
Development Conse	ent SSD-5465								
4	Schedule 2, Condition 22	The outcome of consultation is not included in the BMP, it is recommended a statement be added to indicate no comments were received to be included in the plan.	N/A	Biodiversity Management Plan (Rev 5 – Dated 1 December 2019)	Consultation requirements were generally in compliance with the requirements of this condition. The BMP was sent to the parties outlined in Schedule 3 Condition 20. No comments were received.	Agree Chain Valley Colliery Biodiversity Management Plan will be updated to include evidence of consultation. Plan currently submitted for consultation and being amended based on consultation comments (31/03/2023) prior to submission for approval.	23 rd November 2022	Environmental Compliance Coordinator	100%
5	Schedule 3, Condition 17 and Condition 18	The WMP has not been implemented as approved in relation to sewage management. Ensure the WMP is updated to reflect the changes to on-site sewage management, which are scheduled to be completed by 26 August 2022.	N/A	Water Management Plan (Rev 5– Dated 24 August 2021) Annual Review for 2019, 2020 and 2021 Monitoring data for 2019, 2020, 2021 and 2022 Site inspection on 12 April 2022 Servicing records	2019 IEA Recommendation: Include additional detail in the Water Management Plan regarding sewage management. Include an update of sewage system during the audit period in the Annual Review. Ensure servicing is completed and records kept onsite. 2022 IEA Findings: The wastewater system was viewed during the site audit. The sewage system installation is proposed to be completed by 26 August 2022 as per condition U1.1 and U1.2 of EPL 1770. An update on the progress of this project is included in Section 12.2 of the Annual Review, In regard to the recommendation from the 2019 IEA, additional details have been included in the WMP regarding the wastewater system. The proposed upgrades are not discussed as at the time of audit they have not been constructed.	Agree Chain Valley Colliery Water Management Plan will be updated to include sewage system upon completion. Status as of 31/03/2023: Pending completion of Sewer Connection, delayed due to government exchange of land ownership.	23 rd November 2022	Environmental Compliance Coordinator	0%
6	Schedule 3, Condition 18	Ensure a maintenance schedule is established to ensure dams and drainage lines are free of silt and water storage is maximised.	N/A	Water Management Plan (Rev 5– Dated 24 August 2021) Site inspection on 12 April 2022	2022 IEA findings: The WMP includes a Water Balance that adequately fulfils the requirements of clause (a). The Water Balance has been updated since the previous IEA fulfilling the recommendation. Surface water management is described in Section 4 and satisfies the requirements of (b). Inspection and maintenance are described in Section 5.8. The implementation of the plan on site was generally adequate. It is noted that maintenance schedules are currently not established for desilting dams on site. Therefore the recommendation of the previous IEA is still applicable.	Agree Delta Coal will develop and implement a maintenance schedule for desilting on-site dams and drains. Water Management Plan updated and approved with maintenance schedule for desilting dams and drains.	23 rd November 2022	Environmental Compliance Coordinator	100%



	Table 2 – Recommendations										
Recommendation Number	Condition	Details	Compliance status	Relevant evidence	Commentary	Delta Coal Comments	Proposed Completion Date	Person Responsible	Percentage Complete		
7	Schedule 6, Condition 1	Include a requirement in the EMS to notify landowners of exceedances 'as soon as practical'. Define a time period for as 'soon as practical'.	N/A		2019 IEA Recommendations: Prepare a cross referencing table outlining where sub conditions have been covered. Ensure plans are reviewed as per Schedule 6 Condition 5. Include Schedule 5 Condition 2 requirement in the EMS to notify landowners of exceedances 'as soon as practical'. Define a time period for as soon as practical. 2022 Findings: The EMS document provides an overview of the strategic framework and statutory approvals for the development in Appendix 3 and 4. The Environmental policy is provided in Appendix 1. The roles and responsibilities for implementation are outlined in Section 3.10. Community communication is adequately discussed in Section 4. Emergency response is described in Section 5.2 and 5.3. Noncompliance and incident response is adequately described in Section 5.4. The EMS adequately outlines the Environmental Management Plans required under this consent in Section 3.1. Monitoring requirements briefly covered in Appendix 7. In regard to the recommendations of the previous audit, cross referencing tables are provided in Appendix 3 and Appendix 4. The EMS has been reviewed within the reporting period and is compliant with the required revision timeframe. The recommendation from the previous audit to notify land owners has not been incorporated into the EMS. This therefore remains outstanding. Recommendation 7: Include a requirement in the EMS to notify landowners of exceedances 'as soon as practical'. Define a time period for as 'soon as practical'.	Landowner notification will be included in the Delta Coal Environmental Management Strategy to inform affected land owners as soon as practical and define this timeframe. Delta Coal Environmental Management Strategy revised to include landowner notification pending stakeholder consultation and approval.	November 2022	Environmental Compliance Coordinator	100%		



	Table 2 – Recommendations											
Recommendation Number	Condition	Details	Compliance status	Relevant evidence	Commentary	Delta Coal Comments	Proposed Completion Date	Person Responsible	Percentage Complete			
8	Schedule 3, Condition 27	Ensure the RMP required by SSD-5465 is updated to consider the requirements of the RMP and Annual Rehabilitation Report and Forward Program currently being prepared (as now required by the NSW Resources Regulator instead of a MOP) and documents where topsoil will be stored and the estimated volumes required for rehabilitation.	N/A		2022 findings: A review of the MOP found them compliant with the requirements of SSD-5465. The RMP was also found to be generally compliant with the requirements of SSD-5465. There were no areas of the site under active rehabilitation over the reporting period. General maintenance vegetation maintenance and weed management have been undertaken. It is noted Delta are in the process of preparing a Rehabilitation Management Plan (RMP) and Annual Rehabilitation Report and Forward Program (as now required by the NSW Resources Regulator instead of a MOP from 2 July 2022). This RMP is recommended to ensure to discuss topsoil storage and estimated volumes required for rehabilitation.	Delta Coal is preparing a Rehabilitation Management Plan to meet the requirements of amendment to Schedule 8A of the Mining Regulation 2016. The Management Plan will be provided to stakeholders including DPE and the Resources Regulator for approval. Rehabilitation Management Plan completed in accordance with Schedule 8A Mining Regulation reforms, plan publicly available on Delta Coal Website.	1 October 2022	Environmental Compliance Coordinator	100%			
9	Schedule 3, Condition 9	The outcomes of the noise mitigation study currently being completed should be captured in a revised noise management plan and reflect any changes to monitoring, as relevant.			It is understood Delta Coal are currently in the process of undertaking a noise mitigation study in consultation with DPE – Compliance, the results of which should assist in further mitigating and managing noise from the site, particularly during adverse meteorological conditions. The outcomes of this study should be captured in a revised noise management plan and reflect any changes to monitoring, as relevant.	Phase 1 of the noise mitigation study is currently underway, to be provided to DPE by the 30 th September 2022. If required, phase 2 of the study will be commenced based on outcomes of phase 1. Following completion of the study and acceptance by DPE, Delta Coal will revise the noise management plan to include findings of the study. Status at 31/03/2023: Noise Mitigation Options Assessment rejected by DPE with further information required. Delta Coal undertaking further works to complete the study and will update the NMP following acceptance by DPE.	30 th September 2022	Environmental Compliance Coordinator	40%			
10			Т		Actions still relevant from the 2019 IEA		24 st		4000/			
10	Schedule 4, Condition 1-4	Assess the triggers from the Extraction Plans e.g. ANOVA/ANOSIM level is approaching 5% in the biannual monitoring reports.			Still relevant action from the 2019 Audit 2022 IEA Finding: Review of relevant document indicates this comment has not been closed during the audit period.	Delta Coal is will complete a bi-annual benthic statistics assessment and update the predictive model in 2022. The results will be compared to triggers in the Extraction plan.	31 st December 2022	Environmental Compliance Coordinator	100%			
						Delta Coal completed a bi-annual statistical evaluation of benthic communities monitoring data in 2022. No impact to benthic communities was observed due to mining induced subsidence.						



					Table 2 – Recommendations				
Recommendation Number	Condition	Details	Compliance status	Relevant evidence	Commentary	Delta Coal Comments	Proposed Completion Date	Person Responsible	Percentage Complete
11	Schedule 4, Condition 2	Develop a TARP when updating the Benthic Communities Management Plan. This should address the wording of Schedule 4 Condition 2 SSD 5465. A series of triggers should be developed based on quantitative data and this should be reported in the biannual monitoring reports and the Annual Review. An example of a trigger would be '% change in organisms between monitoring events'.			The recommendation of the previous audit to ensure that Trigger Action Response Plans (TARPs) are added into the management plans has not been followed though in the audit for the AQMP, HMP, Seagrass Management Plan, Benthic Communities Management Plan and WMP. A noncompliance with clause (c) of this condition is recorded in Section 4.3. Therefore, the recommendation for TARPs to be included in management plan updates.	Delta Coal will develop and include a TARP within the Benthic Communities Management Plan, including triggers from both monitoring and statistical evaluation. Revised Benthic Communities Management Plan including TARP submitted for consultation and approval.	23 rd November 2022	Environmental Compliance Coordinator	100%



Appendix 12: 2022 Chain Valley Colliery - Coal Haulage Records

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DOCUMENT UNCONTROLLED WHEN PRINTED						



Chain Valley Colliery 2022 Coal haulage (Via Roadways)

Last Update: 05/	01/	2023
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Week Ending	Coal Transport via Public Roads (t)	Coal Transport via Private Roads (t)
09/01/2022	0	0
16/01/2022	0	0
23/01/2022	0	0
30/01/2022	0	0
06/02/2022	0	0
13/02/2022	0	0
20/02/2022	0	0
27/02/2022	0	0
06/03/2022	0	0
13/03/2022	0	0
20/03/2022	0	0
27/03/2022	0	0
03/04/2022	0	0
10/04/2022	0	0
17/04/2022	0	0
24/04/2022	0	0
01/05/2022	0	0
08/05/2022	0	0
15/05/2022	0	0
22/05/2022	0	0
29/05/2022	0	0
05/06/2022	0	0
12/06/2022	0	0
19/06/2022	0	0
26/06/2022	0	0
03/07/2022	0	0
10/07/2022	0	0
17/07/2022	0	0
24/07/2022	0	0
31/07/2022	0	0
07/08/2022	0	0
14/08/2022	0	0
21/08/2022	0	0
28/08/2022	0	0
04/09/2022	0	0
11/09/2022	0	0
18/09/2022	0	0
25/09/2022	0	0
02/10/2022	0	0
09/10/2022	0	0
16/10/2022	0	0
23/10/2022	0	0
30/10/2022	0	0
06/11/2022	0	0
13/11/2022	0	0
20/11/2022	0	0
	0	0
27/11/2022		
04/12/2022	0 0	0 0
11/12/2022		
18/12/2022	0	0
25/12/2022	0	0
01/01/2023	0	0



Appendix 13: DPIE Letter – 2021 Annual Review Approval

To be Provided

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		1	Environmental Compliance Coordinator	Page 114 of 114		
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