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CHAIN VALLEY COLLIERY

MINIWALL S4 EXTRACTION PLAN (CVC-EP-MWS4)

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Table of Contents

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2 Development of the plan

2.1 Purpose

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2.2 Background

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[illegible]

[illegible] 3 [illegible] 3 [illegible] Mi[illegible]ister [illegible] *Environmental Planning and Assessment Act 1979* [illegible]

2.3 Key legislation, policy and guidelines

[illegible] DC's [illegible] guide[illegible] [illegible]

- [illegible] *Guidelines for the Preparation of Extraction Plans* [illegible] – [illegible]
- [illegible]
- [illegible] *Protection of the Environment Operations Act 1997* [illegible]
- [illegible] *Mining Act 1992* [illegible]

2.4 Development consent

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[illegible] 5465, DC received Secretary's approval to perform first [illegible] Mi[illegible] [illegible]

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2.5 Consultation

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Table 1: Consultation summary

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Stakeholder	Comments	Response
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2.6 Subsidence predictions and impact review

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3 Overview

3.1 Mine planning and design

Area covered by this extraction plan

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Proposed mine layout

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Table 2: Mine plan changes

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Mining domains

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Mining parameters

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Table 3 – Projected coal recovery within S4

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Table 4 – Miniwall S4 panel geometry

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Table 5- Miniwall S4 Fassifern Seam parameters and development roadway geometry

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Table 6- Miniwall S4 estimated mining schedule

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Consideration of previous working and multi-seam interactions

[illegible]

- [illegible]
- [illegible]

[illegible]

Consideration of other features

[illegible]

[illegible]

3.2 Subsidence predictions

Overview

[illegible] the Australian Coal Industry's Research [illegible] *Review of industry subsidence data in relation to the influence of overburden lithology on subsidence and an initial assessment of a sub-surface fracturing model for groundwater analysis* [illegible]

[illegible]

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Table 7 - Predicted Subsidence Effects (Strata2 2019)

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Lake bed fracturing

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Sub-surface fracturing

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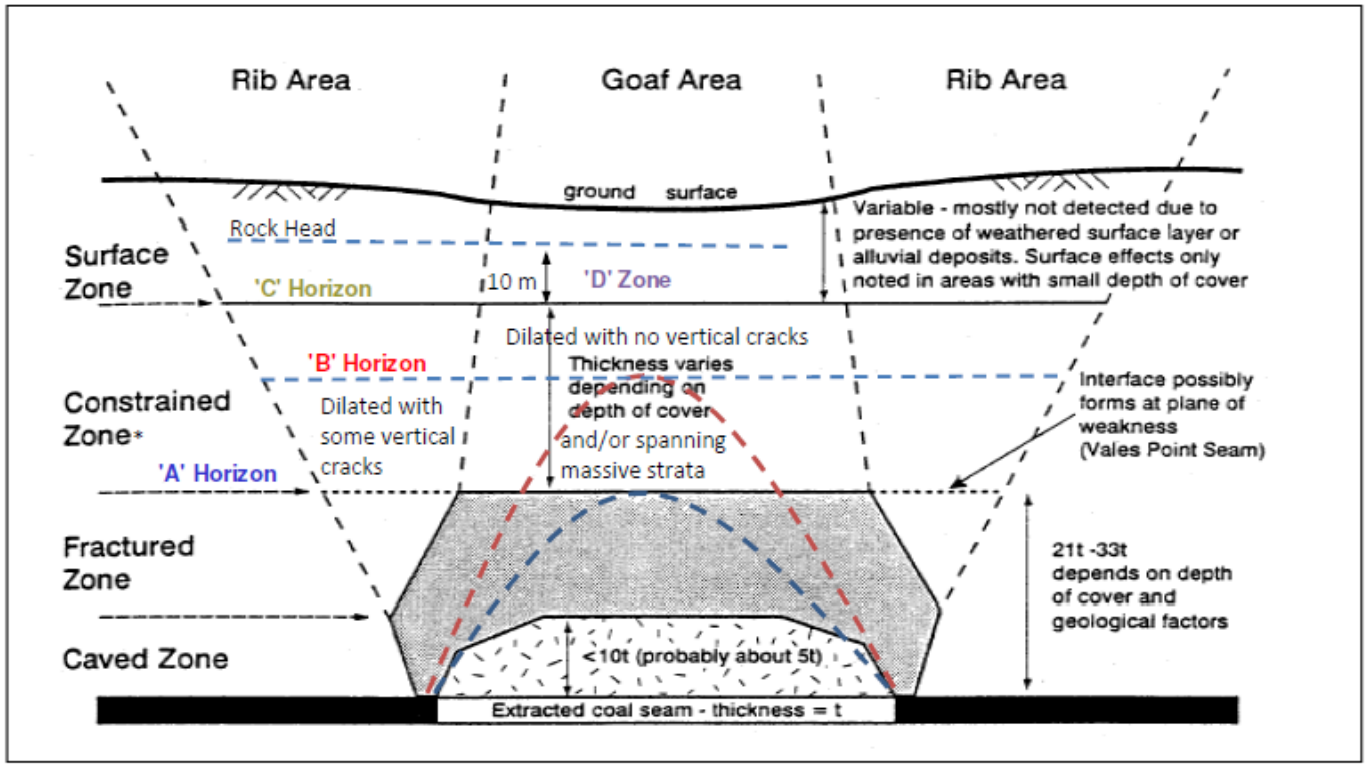

Zones in the Overburden according to Forster (1995)

* - Constrained Zone generally means B-Zone, but may include C-Zone , depending on W/H ratio and geology

DgS	Engineer:	S.Ditton	Client:	LakeCoal - Chain Valley Colliery CHV-002/1	
	Drawn:	S.Ditton			
	Date:	23.11.12	Title:	Schematic Model of Overburden Fracture Zones in **Forster, 1995** Model (based on Piezometric Data Above High Extraction Panels in the Newcastle Coalfield)	
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS	Figure No: 34.2

Figure 1 - Overburden fracture zones (Source: Ditton 2013)

Table 8 - Predicted heights of fracturing above Miniwall S4 (Source: Strata2 2019)

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Potential environmental consequences

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Table 9 - Navigation marker predicted subsidence parameters

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3.3 Performance objectives

Development consent conditions

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Other regulatory requirements

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3.4 Subsidence management strategies and measures

Overview

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Mine design elements

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Remediation strategies

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Figure 2 – Subsidence monitoring and management framework

Adaptive management strategy

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Procedure for investigation of incidents

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Procedure for quality assurance and review

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4 Extraction Plan Guidelines and Component plans

4.1 Overview

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4.2 Water Management Plan

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4.3 Biodiversity Management Plan

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[illegible]

[illegible]

[illegible] CVC's [illegible]

4.4 Heritage Management Plan

CVC's [illegible]

[illegible]

[illegible]

4.5 Built Features Management Plan

CVC's [illegible]

[illegible] outside CVC's approved performance criteria, DC will investigate and [illegible]

4.6 Public Safety Management Plan

[illegible]

[illegible]

[illegible]

[illegible] CVC's [illegible]

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4.7 Rehabilitation Management Plan

[illegible]

[illegible] **Appendix 12** [illegible]

4.8 Risk assessment

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4.9 Compensation and offsets

[illegible]

5 Subsidence monitoring program

5.1 Overview

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5.2 Monitoring frequency and review

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6 Implementation

6.1 Reporting

Incident reporting

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Regular reporting

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Annual reporting

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6.2 Document review

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6.3 Responsibilities

[illegible]

Table 12: Roles and responsibilities for the implementation of this EP

Role	Responsibilities
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
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7 Document control

7.1 Records

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7.2 Document control

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Table 13: Document revision details

Version	Date	Details of revision	Company	Reviewed by/ Authorised by
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8 References

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9 Abbreviations

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Appendix 1 Consultation

From: Chris Armit Sent: Fri 20/12/2019 4:57 AM
To: 'rog.hcc@environment.nsw.gov.au'; 'Resources Regulator'; 'Margaret MacDonald-Hill'; 'scott.carter@dpi.nsw.gov.au'; 'Geoffrey Keech'; Melissa Sawatske; 'dpi.cabinet@dpi.nsw.gov.au'; 'cassandra.mcnamara@dpi.nsw.gov.au'; 'Matthew.Montgomery@finance.nsw.gov.au'; 'Ray Ramage'; 'dan.adams@planning.nsw.gov.au'; 'Robert Gibson'; 'Joanna Pajkowska'; 'landuse.enquiries@industry.nsw.gov.au'; 'water.referrals@dpi.nsw.gov.au'; 'Mitchell Isaacs'; 'Danielle.Allen@centralcoast.nsw.gov.au'; 'EPA RSD Hunter Region Mailbox'; 'Steve Clair'
Cc: Tim Chisholm; 'David Richards'; Chris Nicholas; 'David Hill'; Dave McLean; 'Flood, Justin'; Everett, Greg; Colin Phillips; 'Gurney, Steve'; 'Joel Curran'; Katie Weekes
Subject: Miniwall S4 Extraction Plan draft for comment and associated MP status

Dear All,

The draft Miniwall S4 Extraction Plan document has been uploaded onto the Delta Coal website (https://www.deltacoal.com.au/environment/chain-valley-colliery/ch) for your comment.
After 28 days and the inclusion/consideration of your comments the S4 Extraction Plan document will be uploaded onto the DPIE planning portal.

The associated management plans were submitted on the below dates to the relevant stakeholders and comments have been received, thank you for your comments on these.
The management plan review for comment process nominally ends December 31 and the management plans will being updated with comments and added to the planning portal for assessment/approval.

Associated Management Plan	Date submitted to stakeholders
CVC Public Safety MP	25/11/19
CVC Built Features MP	20/11/19
CVC Water MP	1/12/19
CVC Rehabilitation MP	19/11/19
CVC Benthic Communities MP	17/11/19
CVC Seagrass MP	14/11/19
CVC Heritage MP	1/12/19
CVC EMS	1/12/19
CVC Biodiversity MP	1/12/19

As always, happy to go through any comments you have in person or over the phone.

Thanks for your collective assistance over 2019 and look forward to working with you all again in 2020. Happy Holidays !

Regards,
Chris

NSW GOVERNMENT

Resources Regulator

Our ref: MAAG0005800
LETT0003617

Great Southern Energy Pty Ltd
Level 7, 287 Elizabeth Street
SYDNEY NSW 2000
Attn: Chris Nicholas

Dear Chris Nicholas

ML 1051, ML 1052, ML 1308, MPL 1349, MPL 1389, MPL 1400 (1906), Part CCL 706, CCL 707, MPL 337 (1973), Great Southern Energy Pty Ltd, ML 1370 & ML 1632 (1992) (held by Centennial Myuna Pty Ltd); CCL 719 & CCL 721 (1973) (held by Centennial Mannering Pty Ltd), CCL 722 (1973) (held by Centennial Munmorah Pty Ltd) - Approval of Mining Operations Plan

NOTICE OF APPROVAL

Pursuant to the relevant Condition of ML 1051 (1906), ML 1052 (1906), ML 1308 (1906), MPL 1349 (1906), MPL 1389 (1906), MPL 1400 (1906), Part CCL 706 (1973), CCL 707 (1973), MPL 337 (1973), CCL 719 (1973), CCL 721 (1973), CCL 722 (1973) the Mining Operations Plan (MOP) that was submitted to the Resources Regulator within the Department of Planning, Industry & Environment (Resources Regulator) on 8 January 2020 (Department Reference: MAAG0005800) is approved for the period from the date of this approval until 31 December 2020.

The Regulator notes that workings associated with S4 Miniwall are included in MOP with the extraction plan not yet currently endorsed by the Department of Planning, Industry & Environment . The Regulator reminds Great Southern Energy Pty Ltd of the obligation to ensure the relevant extraction plan has been endorsed by the prior to commencement.

It is the responsibility of the Authorisation Holder to ensure that all mining and mining related operations described in this MOP are as approved within the relevant Project Approval or Development Consent and all necessary approvals, consents or permits required under the relevant NSW or Commonwealth regulations have been obtained prior to carrying out the operations.

It is the responsibility of the Authorisation Holder to fulfil their obligations and commitments to the rehabilitation outcomes and performance standards as approved by the relevant consent authority to ensure the rehabilitation outcomes identified are achieved.

ASSESSED DEPOSIT

Approval of this MOP has triggered a review of the assessment of the security deposit required to secure funding for the fulfilment of rehabilitation obligations under the listed Mining Authorisation Number(s). Notice of the change in the security deposit condition related to this MOP approval will be provided separately.

DEFINITIONS

Resources Regulator
516 High Street MAITLAND NSW 2320 Australia | PO Box 344 HRMC NSW 2310 Australia
Tel: 1300 814 609

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In this letter, words have the meaning given to those terms in the Mining Act 1992, unless otherwise specified below.

Authorisation Holder means the holder of the relevant authorisation(s).

Mining Operations Plan means the project, mining and mining related operations described in the Mining Operations Plan - Amendment 1 prepared by Great Southern Energy Pty Ltd and dated 23 December 2019.

Signed under delegation from the Minister for Resources and the Secretary of the NSW Department of Planning, Industry and Environment

If you require additional information, please contact the Resources Regulator on 1300 814 609 (Option 2, then 5), or via email at nswresourcesregulator@service-now.com.

Yours sincerely,

Peter Ainsworth
Manager Environmental Operations
Mining Act Inspectorate
Resources Regulator
NSW Department of Planning, Industry & Environment

14 February 2020

Other copies provided by email to: Chris Armit

From: Geoffrey Keech [mailto:gkeech@lakemac.nsw.gov.au]
Sent: Thursday, 12 December 2019 3:41 PM
To: Chris Armit
Cc: Melissa Sawatske
Subject: LMCC response to Delta Coal Mannering Colliery and Chain Valley Colliery management plans consultation

Hi Chris,

Thankyou for providing Council the opportunity to comment on your management plans. I provide the following feedback:

Plan	LMCC Comments
CVC Rehabilitation Management Plan	Any infrastructure (slabs, pits, pipes, etc.) that is to be abandoned and covered over should be mapped and this map made available to any future user or purchaser of the site. Spelling mistake "mircobat"
CVC Benthic Communities Management Plan	No comments
CVC Seagrass Management Plan	*Page 25, Table 5 – Environment and Community Coordinator ' Send annual Seagrass Monitoring Reports to DPI Fisheries and……' there is information missing here with respect to who the reports would be sent to.*
CVC Built Features Management Plan	No comments – no identified built features fall within the LMCC boundary or jurisdiction. Central Coast Council should provide comment for the dwellings at Summerland Point.

For future iterations of these plans, could you please send the plans to Council@lakemac.nsw.gov.au addressed to "Development Assessment and Certification officer." The plans will be allocated to a DAC officer to coordinate comments from the relevant sections of Council.
It would help us if you can include a note about the purpose of the consultation (as per the "Audit and Review" section of the management plans), and ideally send a copy that has been marked up with the changes that have occurred, as this allows us to focus quickly on the relevant changes.

Geoffrey Keech
Development Planner
LAKE MACQUARIE CITY
T 02 4921 0025 M 0429 124 904
E gkeech@lakemac.nsw.gov.au
lakemac.com.au

From: Ray Ramage <ray.ramage@planning.nsw.gov.au> Sent: Wed 27/11/2019 9:
To: Chris Armit
Cc: Phil Steuart
Subject: RE: Miniwall S4 Draft Public Safety Management Plan

Chris,

I have reviewed the draft Public Safety Management Plan (PSMP). I believe my comments in relation to the navigational marker also apply to the PSMP.

1. Potential subsidence outside the angle of draw could occur should there be any interaction with overlying workings, therefore the location of such workings should be considered.
2. Another issue, which I failed to mention previously in relation to the marker, is that should CVC elect to use components of the extraction plan in the HRA notification there should therefore be consistency with the WHS laws. Most importantly selection of risk controls (management plans) should be based on hazard identification and risk assessment. It is not clear from the two management plans I have reviewed that a risk assessment has been undertaken.
3. Related to the point above if the PSMP (or any other management plan from the EP) are to be used in a HRA notification then references to "Statutory Requirements" should also include WHS law. Planning law does not modify obligations under WHS law and consequently should the PSMP fail in its purpose regulatory action would be undertaken by RR under WHS law regardless of any planning approval.

Regards

Ray Ramage
Senior Mine Safety Officer (Subsidence Engineering)
Resources Regulator| Department of Planning, Industry and Environment
T 02 40636485 | M 0422 551 293 | E ray.ramage@planning.nsw.gov.au
8 Hartley Drive, Thornton NSW 2322

www.resourcesregulator.nsw.gov.au

From: Ray Ramage <ray.ramage@planning.nsw.gov.au> Sent: Mon 25/11/2019 10:19
To: Chris Armit
Cc: Phil Steuart; Gang Li
Subject: RE: CVC MWS4 Built Features Management Plan - Lake Macquarie (NLM045)

Chris,

Thanks for the update, particularly the info on tiltmeters.

I have reviewed the built features management plan for the purposes of consultation under SSD-5465.

The only comment I would make is that as houses & moorings along the shoreline have been identified and the critical control for these is mine layout and associated predicted angle of draw it would be beneficial to include the Wallarah Seam workings (refer in Fig 5 of the BFMP). It has been discussed at length in the past that the overlying workings have the potential to create subsidence outside the angle of draw.

Regards

Ray Ramage
Senior Mine Safety Officer (Subsidence Engineering)
Resources Regulator| Department of Planning, Industry and Environment
T 02 40636485 | M 0422 551 293 | E ray.ramage@planning.nsw.gov.au
8 Hartley Drive, Thornton NSW 2322

www.resourcesregulator.nsw.gov.au

From: Robert Gibson <Robert.Gibson@environment.nsw.gov.au> Sent: Fri 10/01/2020 4:40 PM
To: Chris Armit
Cc: Nicole Davis
Subject: RE: Miniwall S4 Extraction Plan draft for comment and associated MP status

Dear Chris,
Thank you for your e-mail of 20 December 2019 with a copy of the draft Miniwall S4 Extraction Plan for the Chain Valley Colliery for comment. Biodiversity and Conservation Division (BCD) notes that this document has been prepared to meet the requirements of Condition 7, Schedule 4 of the consent for SSD-5465, and is to be prepared in consultation with several Government agencies, including BCD. BCD has reviewed the draft Extraction Plan and has no comment to make on it.

If you have any questions about this advice then please call me on 4927 3154 to discuss.

Kind regards,

Robert

Robert Gibson
Regional Biodiversity Conservation Officer, Hunter Central Coast Branch

Biodiversity and Conservation Division | Department of Planning, Industry and Environment
T 02 4927 3154 | **E** robert.gibson@environment.nsw.gov.au
Level 4, 26 Honeysuckle Drive, Newcastle, NSW 2300
www.dpie.nsw.gov.au

Our ref: DOC19/1013209-1
Your ref: SSD-5465 (MOD 2)

Chris Armit

Environmental and Community Coordinator
Chain Valley Colliery
Delta Coal
Off Construction Road (Off Ruttleys Road)
MANNERING PARK NSW 2259
CArmit@deltacoal.com.au

Dear Mr Armit

Chain Valley Colliery (SSD-5465 MOD 2) – review of the Benthic Communities Management Plan, Seagrass Management Plan and Rehabilitation Management Plan

I refer to your e-mails dated 14, 17, and 19 November 2019 in which the Delta Coal provided the Biodiversity and Conservation Division (BCD) of Department of Planning, Industry and Environment (The Department) with copies of three updated management plans for the Chain Valley Colliery. These management plans must be prepared '…in consultation with…' BCD to meet Schedule 3, Condition 27; Schedule 4, Condition 7(h & i); and Table 8 of the current consent for the mine (SSD-5465 MOD 2). The management plans are the:

- *Chain Valley Colliery Benthic Communities Management Plan: Environmental Management Plan* (dated 14 November 2019)
- *Chain Valley Colliery Seagrass Management Plan: Environmental Management Plan* (dated 17 November 2019), and
- *Chain Valley Colliery Rehabilitation Management Plan* (dated 19 November 2019)

BCD makes no comment on the *Chain Valley Colliery Benthic Communities Management Plan* or the *Chain Valley Colliery Seagrass Management Plan*. However, in relation to the *Chain Valley Colliery Rehabilitation Management Plan* BCD makes one recommendation: that the bushland rehabilitation is targeted to create recognisable Plant Community Types from the local or adjoining Interim Biogeographical Regionalisation of Australia region. This will further refine the completion criteria for species diversity, plant density and plant cover; contained in Table 4 of the plan.

If you require any further information regarding this matter, please contact Robert Gibson, Regional Biodiversity Conservation Officer, on 4927 3154 or via email at rog.hcc@environment.nsw.gov.au

Yours sincerely

N Davis

NICOLE DAVIS
A/Senior Team Leader Planning
Hunter Central Coast Branch
Biodiversity and Conservation Division
3 December 2019

Transport for NSW

8 December 2019

Chris Armit
Environmental and Community Coordinator
Chain Valley Colliery
Off Construction Rd (Off Ruttleys Rd)
Mannering Park NSW 2259

email: CArmit@deltacoal.com.au

Dear Mr Armit

CVC MWS4 Built Features Management Plan - Lake Macquarie (NLM045)

Thank you for your correspondence dated 20 November 2019 requesting comment on the draft Chain Valley Colliery Miniwall S4 Built features management plan and specifically the Pelican Rock Navigational Marker as the main nearby built feature.

Transport for NSW (TfNSW) Maritime is responsible for the ongoing maintenance of safe navigation throughout NSW under the Marine Safety Act 1998. As such, proposals like this are reviewed to ensure that any disruption to navigation for vessels is minimised as much as is practical.

The project documentation provided has been assessed as having minimal impact on the safety of navigation to vessels operating in this area and Maritime has no objections to the proposed works nor any concerns with the built features management plan.

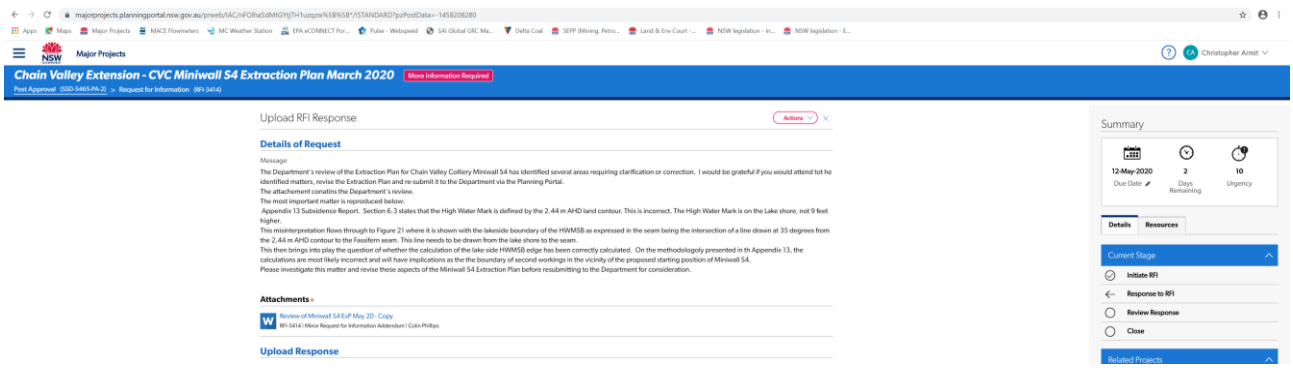
TfNSW Maritime advises the following for your reference:

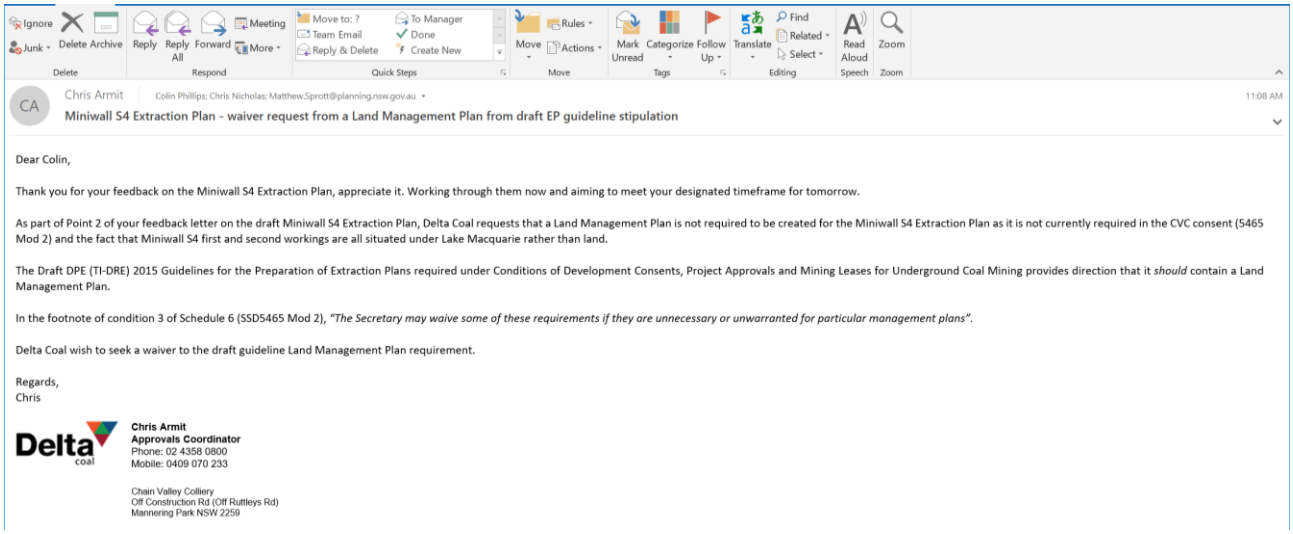
1. Any works impacting on navigation during the construction phase must seek TfNSW Maritime support 21 days prior to works commencing. A full scope of works including dates is to be provided to navigationadvicenorth@rms.nsw.gov.au.
2. All associated work boats to comply with the relevant NSW Marine Legislation for survey, registration and safety equipment, and comply with the Marine Safety (Domestic Commercial Vessels) National Law Act 2012.
3. Vessels must exhibit lights and shapes in accordance with International Regulations for Preventing Collisions at Sea.

For more information, please contact me at navigationadvicenorth@rms.nsw.gov.au or my contact details below.

Yours sincerely

Lynda Hourigan
Project Officer North
Maritime





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CA — Chris Armit — Colin Phillips; Chris Nicholas; Matthew.Sprott@planning.nsw.gov.au — 11:08 AM

Miniwall S4 Extraction Plan - waiver request from a Land Management Plan from draft EP guideline stipulation

Dear Colin,

Thank you for your feedback on the Miniwall S4 Extraction Plan, appreciate it. Working through them now and aiming to meet your designated timeframe for tomorrow.

As part of Point 2 of your feedback letter on the draft Miniwall S4 Extraction Plan, Delta Coal requests that a Land Management Plan is not required to be created for the Miniwall S4 Extraction Plan as it is not currently required in the CVC consent (5465 Mod 2) and the fact that Miniwall S4 first and second workings are all situated under Lake Macquarie rather than land.

The Draft DPE (TI-DRE) 2015 Guidelines for the Preparation of Extraction Plans required under Conditions of Development Consents, Project Approvals and Mining Leases for Underground Coal Mining provides direction that it *should* contain a Land Management Plan.

In the footnote of condition 3 of Schedule 6 (SSD5465 Mod 2), *"The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans".*

Delta Coal wish to seek a waiver to the draft guideline Land Management Plan requirement.

Regards,
Chris

Delta coal
Chris Armit
Approvals Coordinator
Phone: 02 4358 0800
Mobile: 0409 070 233

Chain Valley Colliery
Off Construction Rd (Off Ruttleys Rd)
Mannering Park NSW 2259

DPIE Review	Response
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Appendix 2 Development consent requirements

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Table A2: Requirements from SSD-5465

Condition No.	Requirement	Relevant section of this document
	Schedule	
8	*The Applicant shall prepare an Extraction Plan for all second workings on site, to the satisfaction of the Secretary. Each Extraction Plan must:* *Be prepared by suitably qualified and experienced persons whose appointment has been endorsed by the Secretary*	**This document** **Section 2.4**
	Be approved by the Secretary before the Applicant carries out any second workings covered by the plan	**Section 2.4** **Appendix 16**
	Include detailed plans of existing and proposed first and secondary workings and any associated surface development, including any applicable adaptive management measures	**Section 3.4**
	Include detailed performance indicators for each of the performance measures in Tables 8 and 9	**Sections 3.3 & 4.0**
	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	**Section 2.5 and 3.2** **Appendix 12**
	Describe the measures that would be implemented to ensure compliance with the performance measures in Tables 8 and 9, and manage or remediate any impacts and/or environmental consequences	**Sections 3.4 & 4.0**
	Include a Built Features Management Plan, which has been prepared in consultation with DRE 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 other 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*	**Section 4** **Appendix 9**
	Include a Built Features Management Plan, which has been prepared in consultation with DRE 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 other public infrastructure and all classes of other built features* *Has been prepared following appropriate consultation with the owner/s of potentially affected feature/s*	**Section 9** **Appendix 9**

	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	
	Include a Benthic Communities Management Plan, which has been prepared in consultation with OEH, 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, 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 of 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 subsidence 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*	**Section 4.3** **Appendix 7**
	Include a Seagrass Management Plan, which has been prepared in consultation with OEH, 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* *A program to predict and manage subsidence impacts and environmental consequences to seagrass beds to ensure the performance measures in Table 8 are met*	**Section 4.3** **Appendix 8**
	Include a Public Safety Management Plan, which has been prepared in consultation with DRE, to ensure public safety	**Appendix 10**
	Include a Subsidence Monitoring Program which has been prepared in consultation with DRE, 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 consequencesInforms the contingency plan and adaptive management process*	**Section 5** **Appendix 13**
	Include a contingency plan that expressly provides for adaptive management where monitoring indicates that there has been an exceedance of any performance measures in Tables 8 and 9, or where any such exceedance appears likely	**Section 3.4.2** **Appendix 4**
	Include appropriate revisions to the Rehabilitation Management Plan required under Condition 28 of Schedule 3	**Appendix 12**
	Include a program to collect sufficient baseline data for future Extraction Plans	**Section 5**

Appendix 3 Extraction Plan Risk Assessment

WRAC Risk Assessment

Workplace Risk Assessment & Control

RA00290 – Miniwall S4 Extraction Plan Subsidence Management Risk Assessment

Site: Chain Valley Colliery

Date: 04/07/2019

No:	RA 00290 - Miniwall S4 Extraction Plan Subsidence Management		
Topic	Miniwall S4 Extraction Plan Subsidence Management		
Venue	Chain Valley Colliery		
Requested by:	Chris Armit Environment and Community Coordinator	**Date:** 04/07/2019	**Time allowed:** 1.5 hours
Facilitator	Chris Armit Environment and Community Coordinator		

Relevant Risk Assessment Documents/Procedures/Safety Alerts/Safety Bulletins

- S4 Subsidence Predictions report
- S2/S3 Extraction Plan Risk Assessment

Persons participating in Risk Assessment

Name	Position	Years' Experience in Industry	Signature
Chris Armit	Environment and Comm Co-ord	19	
DAVID HILL	GEOTECH/SUBS. CONSULT	40	
Tim Chisholm	Registered Mine Surveyor	13	
Chris Nicholas	Tech Services Manager	14	

Purpose

This risk assessment has been conducted to assess and document potential surface and sub-surface subsidence risks associated with mining of Northern Mining Domains (NMD) Miniwall S4.

Objectives and Scope

The objectives of this risk assessment are to:

- Identify hazards and assess the risk associated with environmental, public safety and surface built feature impacts from extraction.
- Ensure compliance with the WHS (Mines) Regulation 2014 Clause 67 Subsidence:

  (1) In complying with clause 9, the mine operator of an underground coal mine must manage risks to health and safety associated with subsidence at the mine.

  (2) Without limiting subclause (1), the mine operator must ensure that:

  (a) So far as is reasonably practicable, the rate, method, layout, schedule and sequence of mining operations do not put the health and safety of any person at risk from subsidence, and

  (b) Monitoring of subsidence is conducted, including monitoring of its effects on relevant surface and subsurface features, and

  (c) Any investigation of subsidence and any interpretation of subsidence information is carried out only by a competent person, and

  (d) All subsidence monitoring data is provided to the regulator in the form and at the times required by the regulator, and

  (e) So far as reasonably practicable, procedures are implemented for the effective consultation, co-operation and co-ordination of action with respect to subsidence between the mine operator and relevant persons conducting any business or undertaking that is, or is likely to be, affected by subsidence.
- Meet (where applicable) the standards for assessing and managing risks of subsidence as outlined in the "Managing Risks of Subsidence Guideline", February 2017.
- Place a particular focus on recently updated subsidence predictions and recommendations for the area including a review of factors behind the exceedance of subsidence predictions over the MW 1 to 12 area.
- Identify the existing and potential controls to reduce the risk to a reasonable practicable level.

The scope of the risk assessment focuses on the extraction area defined by a 35 degree angle of draw or to the predicted 20mm subsidence contour of S4 (see **Figure 1**). The level of monitoring strategy required will be commensurate with the assessed level of risk (i.e. after controls are put in place) or potential consequence. The corresponding residual risk will determine if these controls are sufficiently acceptable.

The list of surface and sub-surface features outlined in Appendix B of the 2003 NSW Department of Mineral Resources Guidelines for Application for Subsidence Management Approvals, along with items outlined in the 2017 Managing Risks of Subsidence Guideline, have been used as a starting reference list of features for assessment. All features on the list were assessed as to whether they exist within the defined extraction plan area. Where a feature is not noted in the WRAC assessment, it has not been identified within the area of interest.

Figure 1- NMD S2 to S4 Extraction Impact area due to Fassifern Miniwall Mining

Risk Assessment Process

1. Hazard identification
2. Identified hazards were evaluated with regard to consequence and then the Likelihood of that consequence outcome was assessed, assuming existing controls to be effectively implemented.
3. Risk rankings were derived.
4. Additional controls were proposed where possible for medium and high risks and the hazards were re-evaluated to arrive at the residual risk.
5. Likelihood and consequence were assessed in accordance AS/NZS ISO 31000:2009 Risk Management – Principles and guidelines.
6. This risk assessment was conducted in general compliance with MDG1010 and MDG1014.
7. As low as reasonably practicable (ALARP) is determined from WHS Act 2011, Section 18.

8. Hazardous Manual Tasks should be identified and controlled to a reasonable practicable level of risk using the Risk Assessment Worksheet for Hazardous Manual Tasks Form and actions recorded in this risk assessment.

9. Actions and outcomes from the risk assessment are recorded with a due date of action completion and responsible person.

10. Risk Assessments are monitored and reviewed as detailed by the Delta Coal Site Work Health and Safety Management System.

Risk Assessment Checklist based on Hazard / Energy Types

Energy Type	POTENTIAL HAZARDS			
	To People	To Equipment	To Production	To The Environment
Electrical	• Electric Shock • Burns • Smoke Inhalation	• Unplanned movement • Fire • Circuit Damage	• Supply fails causing shutdown • Inadequate supply causing process slowdown	• Fire
Mechanical	• Crushed • Struck by Moving or Flying Objects • Caught Between Moving Objects	• Collision • Breakdown • Unplanned Movement • Breakages • Vibration	• Fails & Causes Shutdown • Slows Down Production	• Physical Damage • Fire
Chemical	• Burns • Skin Irritation • Ingestion • Inhalation (Toxic atmospheres) • Explosion (Mixing incompatible)	• Fire • Internal Damage • Corrosion	• Causes Delays or Shutdowns (Not enough, wrong type to much)	• Spillage (Water contamination, soil contamination, air pollution, vegetation destroyed)
Pressure (Fluids/Gases)	• Fluid Injection • Crush • Respiratory Problems	• Unplanned Movement • Poor Performance • Breakdown	• Equipment Failure Shutdown (No fluids or to much fluids, no gases or to much gases)	• Contamination (Dust, fuel/oil, dirty water0
Radiation	• Burns • Eye Damage (welding flash) • Internal problems		• Source fails (Causing delays or shutdown)	• Contamination
Thermal	• Burns • Heat Exhaustion • Frostbite	• Overheating • Freezing	• Shutdown (Overheating or freezing)	
Biochemical	• Sprains • Strains		• Slowdown due to loss of staff	
Noise/Vibration	• Hearing damage	• Mechanical damage	• Slowdown due to people not accessing area	• Community complaints
Biological	• Illness • Disease		• Shutdown due to lack of people	
Gravitational	• Falling from Heights • Objects falling on Personnel	• Rollover • Collapse • Failure • Damage from fall • Damage from objects falling	• Objects falling causing slowdown or shutdown	• Contamination

Risk Matrix

HIERARCHY OF CONTROL		LIKELIHOOD			
Elimination	Do we still have to do this?	A	Almost certain to happen	FREQUENCY	1 per week to 1 per month
Substitution	Is there another way or product?	B	Likely to happen at some point		1 per month to 1 per year
Redesign/Engineer	Can the equipment or process be modified?	C	Moderate, possible; heard of so it might happen		1 per year to 1 per 10 years
Isolation/Guarding	Will guarding or some type of barrier help?	D	Unlikely, not likely to happen		1 per 10 years to 1 per 100 years
Administration	Will a written procedure and/or training help?	E	Rare, practically impossible		Less than 1 per 100 years
PPE	Is personal protective equipment adequate?				

MAXIMUM REASONABLE CONSEQUENCE

CONSEQUENCE	INJURY (I)	ENVIRONMENTAL (E)	LOSS (L)
1 - CRITICAL	Could kill, permanently disable	Regional environmental impact/ecosystem damage. Impact causing mine or business closure. E.g. Major release off site with long term detrimental effect	Could cause very major damage > $3M
2 - HIGH	Could cause serious injury (major LTI)	Substantial environmental damage which could result in major financial loss and/or prosecution. E.g Off-site release resulting in local ecosystem damage	Could cause major damage $500K - $3M
3 - MEDIUM	Could cause typical MTC/LTI	Substantial temporary or minor long term damage, release immediately contained with outside assistance eg. A minor water discharge or large hydrocarbon spill. Legal non-compliance.	Could cause moderate damage $100K - $500K
4 - LOW	Could cause first aid injury	Temporary or minor damage, non-compliance with internal environmental target, no legal breach, eg. Minor spill	Could cause damage $20K - $100K
5 - INSIGNIFICANT	Couldn't cause injury	No detrimental effect, low financial loss, negligible environmental impact	Couldn't cause damage, or <$20K damage

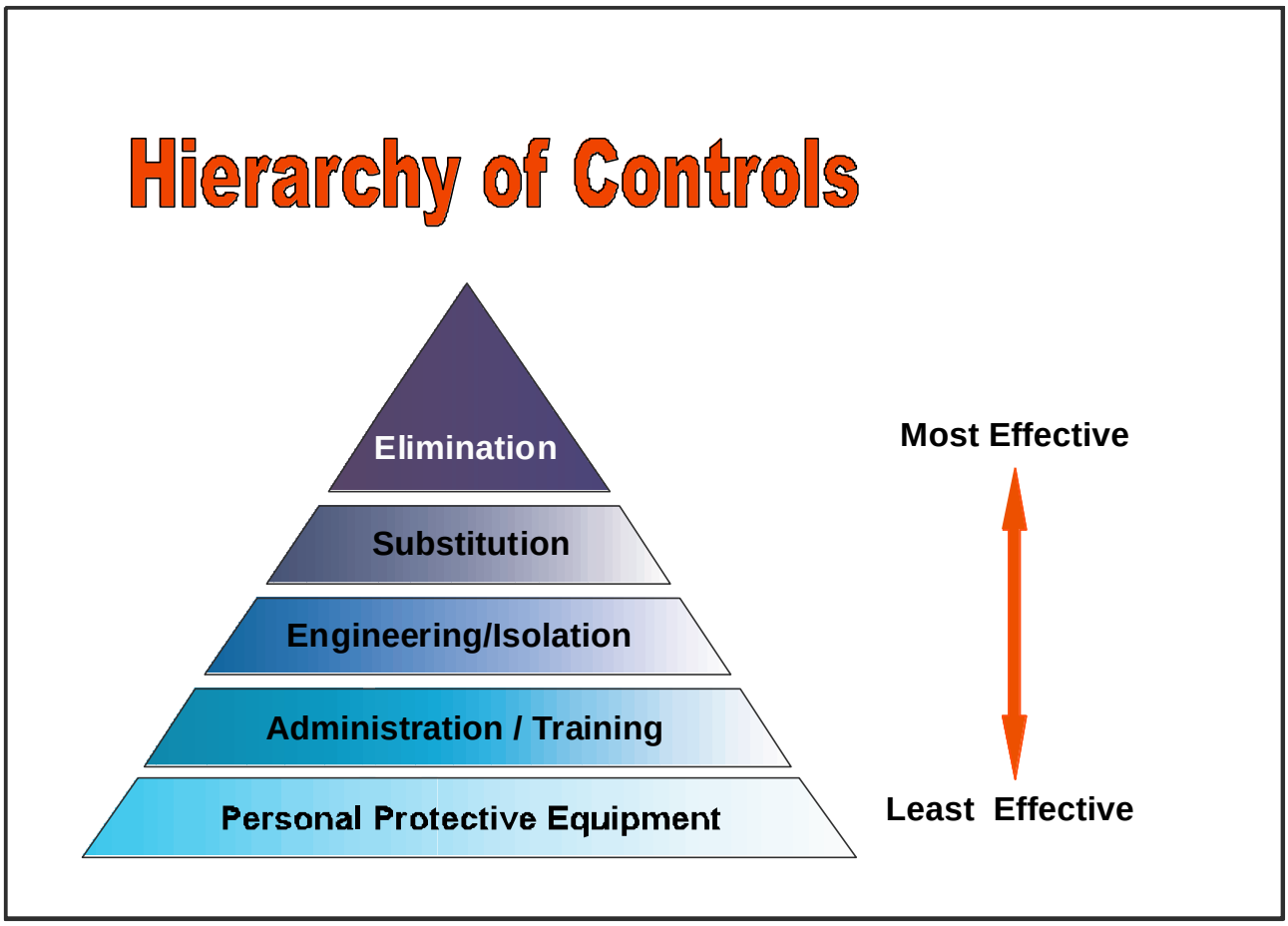
Risk Score Matrix

RISK SCORE	RISK	WHAT SHOULD I DO?
1 to 3	Critical	STOP WORK Immediate action required, inform senior management
4 to 10	High	Risk Assessment required. Action plan required, senior management attention needed
11 to 15	Medium	Specific monitoring of procedures required management responsibility must be specified
16 to 25	Low	Manage through routine procedures

CONSEQUENCE	LIKELIHOOD: A- Certain	B - Likely	C - Moderate	D - Unlikely	E - Rare
1 - Critical	1	2	4	7	11
2 - High	3	5	8	12	16
3 - Medium	6	9	13	17	20
4 - Low	10	14	18	21	23
5 - Insignificant	15	19	22	24	25

Least Effective ↕ Most Effective

Hierarchy of Controls (as per WHS Regulations 2011 Clause 36)



HIERARCHY OF CONTROLS 1-6 Descending Order (as per WHS Regulations 2011 Clause 36)	
Elimination	Remove the hazard from the workplace (Re-Design)
Substitution	Substituting (wholly or partly) the hazard giving rise to the risk with something that gives rise to a lesser risk. (Alternative product / plant)
Isolation	Isolating the hazard from any person exposed to it. Use barriers to shield or isolate the hazard (Guards on machines, enclosures for noises)
Engineering controls	Design & install equipment to counteract or lessen the hazard
Administrative controls	change to a system of work, a process or a procedure to lessen the hazard

Personal Protective Equipment	ensuring the provision and use of suitable personal protective equipment

Hazard Analysis and Risk Assessment

The risk management methodology as described in WHS Act 2011, WHS Regulations 2011, WHS Code of Practice WHS Act 2011, Section 274, Code of Practice –How to Manage Work, Health and Safety Risks 2011, MDG1010 and AS/NZS ISO 31000:2009 is used to identify the various processes and activities at Delta Coal sites.

Risk analyses shall be completed for each activity based on the following matrix. The subsequent risk ranking shall then determine the frequency of re-assessments.

Likelihood	Consequences
A. Almost certain to happen	1. Permanently disable.
B. Like to happen at some point	2. Could cause serious injury (Major LTI)
C. Moderate, possible, heard of so it might happen	3. Could cause Medical Treatment Case/ LTI
D. Unlikely, not likely to happen	4. Could cause First Aid Treatment
E. Rare, practically Impossible	5. Could not cause injury

Likelihood and Consequences are applicable to Table 1 below.

		LIKELIHOOD				
CONSEQUENCE		A – Certain	B – Likely	C – Moderate	D – Unlikely	E - Rare
	1 - Critical	1	2	4	7	11
	2 - High	3	5	8	12	16
	3 - Medium	6	9	13	17	20
	4 - Low	10	14	18	21	23
	5 - Insignificant	15	19	22	24	25

Facts

- Extraction is to occur in the Fassifern seam utilising miniwall extraction methods and solely beneath Lake Macquarie (ie outside the High Water Mark Subsidence Barrier and Seagrass Protection Barrier).
- S4 extraction depth of cover ranges between an effective depth of 160 to 171m. The panels are at >35^0 angle of draw to the foreshore.
- The S4 miniwall has a void width of 97m and an inter panel pillar width of 40m.
- No extraction is planned within the High Water Mark Subsidence Barrier (HWMSB) and Seagrass Protection Barrier (SPB)
- Updated predictions for subsidence over the MW1 to 12 area of 720mm were exceeded in the MW7 to 10 area with up to 1100mm recorded (a further 150mm of creep movement could be expected). The subsidence model has since been reviewed and amended to align with this increase, and to gain an understanding of the potential mechanisms behind the increase. This model and information has been utilised to develop a mine plan and updated predictions for the NMD such that predicted subsidence is planned to remain within the approved 780mm for the domain allowing for anticipated longer term creep.
- A detailed subsidence assessment has been undertaken for miniwalls S2 and S3 by Mine Subsidence Engineering Consultants (MSEC). The assessment has indicated that the subsidence results over the miniwalls will result in approximately 290mm of vertical subsidence and 6mm/m tilt. Predicted vertical subsidence at the sea grass beds/moorings and jetties are predicted to be less than 20mm. The expected subsidence at Pelican rock is expected to be in the order of 90mm.
- Strata2 Consulting has undertaken a detailed subsidence assessment for miniwall S4. The assessment has indicated that the subsidence result over the miniwall S4 will result in approximately 296mm of vertical subsidence and 4 mm/m tilt. Predicted vertical subsidence at the sea grass beds/moorings and jetties are predicted to be less than 20mm. The expected subsidence at Pelican Rock is expected to be in the order of 130mm.
- Strata2 Consulting has undertaken a detailed geotechnical design report for the miniwall layout which has formed the basis for the mine design used in the subsidence assessment.
- Delta Coal has successfully mined Miniwall S1 in the NMD with subsidence monitoring results at the foreshore well within predictions.
- Delta Coal has completed a rock head survey of the NMD which has formed the basis for the key assumptions used in the technical reports.
- The location of the maximum predicted subsidence is located beneath Lake Macquarie within the FAS working footprint (ie outside the foreshore and mapped seagrass areas) **Figure 1**.

Assumptions

- Employees are trained and assessed in relevant contents of the Delta Coal site WHSMS as a minimum.
- Compliance with the Environmental Protection Act 1994, Environmental Planning and Assessment Act 1979, Work Health and Safety Act 2011 and Work Health and Safety Regulations 2011, Code of Practice –How to Manage Work, Health and Safety Risks 2011, AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines.
- Compliance with the Delta Coal Environmental Management System
- Compliance with the Work Health and Safety Act 2011 and Work Health and Safety Regulations 2011, Code of Practice –How to Manage Work, Health and Safety Risks 2011, AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines.

Monitoring and Review

Delta Coal site monitoring and review processes should encompass all aspects of the risk management process for the purposes of:

- ensuring that controls are effective and efficient in both design and operation;
- obtaining further information to improve risk assessment;
- analyzing and learning lessons from events (including near-misses), changes, trends, successes and failures;
- Identifying emerging risks.

References

- AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines
- MDG1010 – Risk Management Handbook for the Mining Industry
- MDG1014 - Guideline to reviewing a risk assessment of mine equipment and operations
- Work Health and Safety Act 2011
- Work Health and Safety Regulations 2011
- Codes of Practice –WHS Act 2011, Section 274.
- Work Health and Safety Mines Act 2013
- Work Health and Safety Mines Regulations 2014

- AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines
- MDG1010 – Risk Management Handbook for the Mining Industry
- MDG1014 - Guideline to reviewing a risk assessment of mine equipment and operations
- Environmental Protection Act 1994
- Environmental Planning and Assessment Act 1979
- DGS, 2017. Multi-Seam Mining Feasibility Study for the Proposed Miniwalls CVB to CVB4 at Chain Valley Colliery
- EMM, 2015. Chain Valley Colliery- Modification 2- SoEE
- EMM, 2019. Chain Valley Colliery- Modification 3 - SoEE
- EMM, 2013. Chain Valley Colliery Mining Extension project 1- EIS
- Lake Coal, 2013. Chain Valley Colliery Extraction Plan MW7 to MW12
- NSW DMR, 2003. Guideline for Applications for Subsidence Management Approvals
- NSW DRE Mine Safety, 2017. Guideline Managing Risk of Subsidence
- PHMP 00021- Mannering and Chain Valley Collieries Principal Hazard Management Plans
- Subsidence PHMP Risk Assessment Dated 15/12/16
- Miniwall S1/N1 Extraction Plan and associated Risk Assessment

Definitions

Hazard

Means a situation or thing that has the potential to harm a person. Hazards at work may include: noisy machinery, a moving forklift, chemicals, electricity, working at heights, a repetitive job, bullying and violence at the workplace.(reference Code of Practice –How to Manage Work, Health and Safety Risks 2011)

Hazardous Manual Task

Defined in the WHS Regulations 2011, means a task that requires a person to lift, lower, push, pull, carry or otherwise move, hold or restrain any person, animal or thing involving one or more of the following:

- repetitive or sustained force
- high or sudden force
- repetitive movement

- sustained or awkward posture
- exposure to vibration.

Musculoskeletal disorder

Defined in the WHS Regulations 2011, means an injury to, or a disease of, the musculoskeletal system, whether occurring suddenly or over time. It does not include an injury caused by crushing, entrapment (such as fractures and dislocations) or cutting resulting from the mechanical operation of plant.

Risk Assessment
Risk management process applied to a scope of work, overall activities, equipment and machinery to determine how often specified events may occur and the magnitude of their consequence. When applied to a specific and sequential set of job steps/activities this may be referred to as a Job Safety Analysis.

Risk

Is the possibility that harm (death, injury or illness) might occur when exposed to a hazard. (Reference Code of Practice –How to Manage Work, Health and Safety Risks 2011)

Risk control

Means taking action to eliminate health and safety risks so far as is reasonably practicable, and if that is not possible, minimising the risks so far as is reasonably practicable. Eliminating a hazard will also eliminate any risks associated with that hazard. .(reference Code of Practice –How to Manage Work, Health and Safety Risks 2011)

WRAC
Workplace Risk Assessment & Control

Subsidence
Movement of the ground surface as a result of readjustments of the overburden due to collapse or failure of underground mine workings and/or compression of remnant pillars

Subsidence Effects
The term used to define the subsidence and differential subsidence parameters (i.e. subsidence, tilt, strain and horizontal displacement) that may or may not have an impact on natural or man-made surface and sub-surface features above a mining area

Subsidence Impacts
The impact that a subsidence effect has on natural or man-made surface and sub-surface features above a mining area

Tilt
The rate of change of subsidence between two points (A and B), measured at set distances apart (usually 10 m).

Strain

The change in horizontal distance between two points at the surface after mining, divided by the pre-mining distance between the points, may be tensile, compressive or shear.

Rock Head
The geological boundary in the overburden between competent rock and unconsolidated sediments and weathered rock

Abbreviations

ALARP	As low as reasonably practicable (ALARP) - determined from WHS Act 2011, Section 18.
CVC	Chain Valley Colliery
DISRD	Department of Industry, Skills and Regional Development
EMP	Environmental Management Plan
FOS	Factor of Safety
JSA	Job Safety Analysis
LTA	less than adequate
LAK	Delta Coal
MC	Mannering Colliery
MSD	Musculoskeletal Disorder
MSMFI	Multi-seam Mining Feasibility Investigation
PCP	Principle Control Plans
PMHMP	Principle Mining Hazard Management Plans
PPE	Personal protective Equipment
STD	Standard
STF	Slip/Trips/Falls
SMP	Safety Management Plan
SWP	Standard Work Procedure

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- analyzing and learning lessons from events (including near-misses), changes, trends, successes and failures;
- Identifying emerging risks.

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SMP	Safety Management Plan
SWP	Standard Work Procedure

Risk Table

The hazards were analysed and risks derived. The existing control mechanisms were identified prior to establishment of risk. Proposed risk reductions were discussed and agreed and a residual risk determined based on implementation of existing and propose d risk reductions. Consequences assessed through this risk assessment were taken as the reasonable practicable level of risk considering Injury to Personnel as a primary consideration and Environmental Impact and Financial Loss as a secondary consideration as defined in the Risk Assessment Matrix.

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
1.	**Natural Features**													
1.1a	Groundwater	Loss of groundwater from aquifers due to subsidence induced fracturing impacts users or dependant ecosystems	• Sub-critical Mine design (panel width, chain pillar width and extraction height to limit height of hydraulic fracturing) • Strata 2 Mine Design Report • Existing extraction has already influenced groundwater levels (minimal further impact predicted) • Avg dewatering volume is within predictions. • Ground water assessment (SEE) • GWMP • Operational water management TARP and underground water make monitoring.	E	D	3	17	Update the GWMP for S4 Extraction Plan application Implement recommendations				ALARP	E&C Coordinator	30/09/19

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
1.1b		Abnormal groundwater loss due to extraction of miniwall panel	• Strata 2 Mine Design Report • Documented experience indicates that dykes and normal faults with throws of up to 3m have no appreciable impact on subsidence development or overburden hydraulic conductivity • Sub-critical Mine design (panel width, chain pillar width and extraction height to limit height of hydraulic fracturing) • Existing extraction has already influenced groundwater levels (minimal further impact predicted) • Avg dewatering volume is within predictions • Subsidence and Water Management TARP • Ground water assessment (SEE) • GWMP	E	D	3	17					ALARP		

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
1.1c		Impact on registered groundwater bores in proximity to extraction effects their ongoing use (GW24575)	• Minimal impact based on assessment and existing mining (SEE) • Sub-critical Mine design (panel width, chain pillar width and extraction height to limit height of hydraulic fracturing)	E	D	4	18	Monitor yields, saturated thickness and quality where access granted Check groundwater bores register Provide alternative water supply until impacted bore recovers where proven to be related to mining impact or as required by the secretary	D	5	22	LOW	E&C Coordinator	If triggered

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
1.2a	Sea/Lake	Increased lakebed cracking resulting in impacts outside predictions	• Sub-critical Mine design (panel width, chain pillar width and extraction height to limit height of hydraulic fracturing) • Geological mapping of known structures incorporated into the mine design and assessed. • Detailed subsidence assessment by Strata 2. Predictions are significantly less than the EA approved limits. • Thickening of Teralba Conglomerate reduces fracture heights • Extensive subsidence model including bathymetric survey • Subsidence monitoring program • No previous evidence of significant irregularities around geological structures in previous MW areas	E	D	3	17					ALARP		

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
1.3a	Shoreline	Increased flooding risk due to subsidence	• HWMSB/Mine Design Report • Subsidence assessment (<20mm predicted) • Subsidence monitoring program • Contingency Plan	E	E	2	16					ALARP		
1.3b		Foreshore ecology impacted by increased flooding or erosion	• HWMSB/Seagrass Protection Barrier Mine Design • Subsidence assessment (<20mm predicted) • Subsidence monitoring program including 6 monthly bathymetric surveys	E	E	3	20	Undertake remediation of any mining affected sections of foreshore in consultation with relevant authorities/landowners.				ALARP	E&C Coordinator	If triggered
1.3c		Changes in lakebed depth and wave climate result in increased erosion	• HWMSB/Mine Design • Low wave height environment (SEE) • Subsidence assessment (<300mm vertical subsidence predicted) • monitoring program	E	E	4	23					ALARP		

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
1.4	Ecosystems (Seagrass)	Increased depth from subsidence reduces presence/health of seagrass beds	• Sub-critical Mine design (panel width, chain pillar width and extraction height to limit height of hydraulic fracturing) • Seagrass mapping (no threatened species identified in extraction plan area) • Seagrass Management Plan and monitoring program • SPB/Mine design report • Subsidence assessment (<20mm predicted) • Subsidence monitoring program	E	D	4	21					ALARP		
1.5	Ecosystems (Benthic Communities)	Increased depth from subsidence reduces colony numbers/health	• Benthic surveys (6 monthly) • Benthic Communities Management Plan • Subsidence assessment (<300mm predicted) • Subsidence monitoring program • Predictive modelling and assessment	E	D	4	21					ALARP		

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
1.6	Threatened and Protected Species (Loggerhead and Green Turtles)	Increased depth from subsidence results in reduction in food source (seagrass)	• Annual Seagrass mapping • SPB/Mine Design Report • Subsidence Assessment (<20mm Predicted) • Mobile and no impact predicted to food source	E	E	5	25					ALARP		
1.7	Cliff/Steep Slope(Frying Pan Point)	Horizontal movements of cliff face results in rock failure	• Sub-critical Mine design (panel width, chain pillar width and extraction height to limit height of hydraulic fracturing) • Subsidence assessment (Strata2) • Subsidence monitoring program • HWMSB/Mine Design	E	E	5	25					ALARP		

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
1.8	Rock outcrops within lake (adjacent S2)	Change in depth results in public safety risk	• Subsidence assessment (<130mm predicted) • No direct undermining of the outcrop or marker • Subsidence monitoring program updated to include Pelican Rock Navigational Marker • Built Features Management and RMS Consultation	I	E	2	16					ALARP		
2.	**Public Utilities**													
2.1	Telecommunication line	Nil. Outside extraction area	•											
2.2	Services	Services not identified within impact area during original SEE impacted by subsidence	• Dial before you dig has confirmed no services located within subsidence affectation area (>20mm). All services located landward from high water mark.	L	E	3	20					ALARP		

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
3. Public Amenities														
	Nil		•											
4. Farm Land and Facilities														
	Nil		•											
5. Industrial, Commercial and Business Establishments														
	Nil													

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
6. Areas of Archaeological and/or Heritage Significance														
6.1	AHIMS sites (adjacent extraction plan area)	Arch sites near foreshore impacted by flooding or erosion increases due to subsidence	• Locations identified (approx.) via AHIMS register • No sites located adjacent to mining footprint on AHIMS register • Heritage Management Plan (EMP-D-16371) • HWMSB (no impact predicted) • Subsidence assessment (<20mm) • Subsidence monitoring program	E	E	4	23	• Review previous Archaeological surveys and requirement for further surveys for subsidence monitoring				ALARP	EC Coordinator	
7. Items of Architectural Significance														

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
	Nil													
8. Permanent Survey Control Marks														
8.1	State Survey Marks/Permanent Survey Marks	Survey marks near foreshore effected by horizontal/vertical movement	• HWMSB/Mine Design • Subsidence assessment • Subsidence monitoring program • Built Features Management Plan	E	D	4	21	Reviews subsidence monitoring program for horizontal and vertical monitoring of state survey marks.				ALARP	Mine Surveyor	31/12/19
9. Residential Establishments														

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
	Nil		•											
10. Other identified items requiring particular assessment														

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
10.1a	Public Safety	Shallow water buoy (or other markers including sailing markers) within extraction plan area impacted due to subsidence resulting public safety risk	• Subsidence assessment • Strata 2 Mine Design Report. • Marker locations visually assessed and mapped and within seagrass area. • RMS consulted as part of previous Extraction Plan. • Keep CCC informed of actions taken in relation to public safety risks	I	D	3	17					ALARP		
10.1b		Jetties within extraction plan area impacted due to subsidence	• Subsidence assessment (<20mm predicted) due to mine design principles • Consultation program / community notifications • Visual assessment undertaken • Subsidence monitoring program	E	D	4	21	Consultation with affected landholders - send out notification letters Keep CCC informed of actions taken and progress.				ALARP	Mine Surveyor E&C Coordinator	31/12/19 Quarterly

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
		Moorings within extraction plan area impacted due to subsidence	• Limited moorings adjacent the EP area • Strata 2 S4 Subsidence assessment • Majority of moorings within seagrass boundary (<20mm subsidence).Negligible change • Subsidence monitoring program	E	D	4	21					ALARP		
10.2	Consultation	LTA community, stakeholder or agency consultation results in concerns over impact	• CCC • Website • Newsletter • Regular meetings with relevant authorities • Extraction Plan Guidelines • Landowner notifications to be sent out.	E	C	4	18	Review notification requirements for secondary extraction for affected stakeholders				ALARP	Mine Surveyor/EC Coordinator	31/12/19

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
10.3a	Subsidence Impact (general)	Subsidence predictions exceeded results in increased impact/community concern/ breach of conditions	• Sub-critical Mine design (panel width, chain pillar width and extraction height to limit height of hydraulic fracturing) • Strata 2 Subsidence Assessment • Extensive subsidence model including bathymetric survey • Subsidence monitoring program	E	D	3	17	Extend foreshore monitoring where access is granted Organise appropriate land access to conduct monitoring Investigate potential for additional floor and roof cores to be undertaken in the NMD to improve understanding of geological conditions Review mine design and contingency plans/adaptive management measures in each management plan/TARP are adequate	E	3	20	Low	Mine Surveyor Mine Surveyor Technical Services Manager Technical Services Manager	31/03/20 31/12/19 31/3/20

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
10.3b	Subsidence Impact (general)	Known or unknown geological structures in the workings increases subsidence impact	• Geological database and mapping from old and existing workings • Strata 2 Mine Design Report • Known major structures incorporated into the updated geological and subsidence model • Strata Failure Management Plan • All pillars squat pillars thus confinement not reduced by structures • Subsidence monitoring to date has not indicated significant variation in areas of geological structure • Subsidence monitoring program	E	D	3	17					ALARP		

10.3c	Subsidence Impacts (Height of Fracturing)	Height of fracturing exceeds predictions leading to impacts on groundwater/ingress into mine workings due to direct hydraulic connectivity with the Lake.	• Sub-critical mine design (panel width, chain pillar width and extraction height to limit height of hydraulic fracturing) • Lake Bed rock head survey undertaken and used to inform Mine Design and Subsidence Assessment report. • Constrained zone thickness is greater than or equal to 12T • Strata 2 Mine Design Report • Experience from inbye end of Miniwall 12 at Chain Valley at similar rock head thickness did not result in increased water make or signs of direct connectivity at higher levels of subsidence • Strata 2 Subsidence Assessment Report • No overlying workings in the NMD • Geological mapping and site model • Subsidence monitoring program • Avg dewatering volume is within predictions • Ground water assessment (SEE)	E	D	3	17	Bathymetric survey to be undertaken at the end of S2 and end of S3 panel.				ALARP	Mine Surveyor	28/02/20

No	Activity	Potential Hazard	Existing Controls	Cons I,E,L	Likelihood	Consequence	Risk Rank	Proposed Controls	Likelihood	Consequence	Risk Rank	Risk Level	Responsible Person	Due Date
			• GWMP • Operational water management TARP											
10.3d	Overall S2 to S4 Subsidence Risk (consideration of all risks and required controls)	Irregular subsidence due to Failure/yield of pillars or floor resulting in subsidence exceedance /impacts	• Mine design Report (panel width, pillar width and extraction height results in limited subsidence of <300mm) • Panels designed to exclude direct extraction and indirect interconnection with major fault plane/dip • Only three extraction panels separated by 40m wide (solid) pillars. • Subsidence assessment • Subsidence monitoring program • Subsidence management TARP • No previous evidence of significant subsidence irregularities around geological structures in previous MW areas	E L I	D D D	3 3 3	17 17 17	Consider taking floor cores along the north mains to determine claystone thickness/properties to confirm consistency with design assumptions. Review Subsidence Management TARP after S2 panel, if greater than normal triggered. Revise predictions and management strategies as required Bathymetric survey to be undertaken at the end of S2 and end of S3 panel.				ALARP	Technical Services Manager Technical Services Manager Mine Surveyor	28/02/20 Post S2 (indicative 28/2/20) 28/02/20

Actions

No	Clause(s) No from RA Tables	Action	Person responsible for Action	Action timeframe	Comments	Database Action No	Responsible Person signature
1.	1.1.a	Update the GWMP for S4 Extraction Plan application	C Armit	30.09.2019	Has been completed.		
2	1.1.c	Monitor yields, saturated thickness and quality where access granted Check groundwater bores register Provide alternative water supply until impacted bore recovers where proven to be related to mining impact or as required by the secretary	C Armit	31.03.2020			
3	1.3.b	Undertake remediation of any mining affected sections of foreshore in consultation with relevant authorities/landowners.	C Armit	If triggered			
4	6.1	Review previous Archaeological surveys and requirement for further surveys for subsidence monitoring	C Armit	30.09.2019	Has been completed. CRA approved by NPWS for MWS4 subsidence line.		
5	8.1	Review subsidence monitoring program for horizontal and vertical monitoring of state survey marks.	T Chisholm	31.03.2020			
6	10.1.b	Consultation with affected landholders - send out notification letters	T Chisholm	31.03.2020			
7	10.1.b	Keep CCC informed of actions taken and progress.	C Armit	31.12.2019	Has been completed. CCC was notified in Nov 2019.		

8	10.2	Review notification requirements for secondary extraction for affected stakeholders	C Armit	31.03.2020			
9	10.3.a	Extend foreshore monitoring where access is granted Organise appropriate land access to conduct monitoring	T Chisholm	30.04.2020			
10	10.3.a 10.3.d	Investigate potential for additional floor and roof cores to be undertaken in the NMD to improve understanding of geological conditions Consider taking floor cores along the north mains to determine claystone thickness/properties to confirm consistency with design assumptions.	C Nicholas	31.03.2020			
11	10.3.a	Review mine design and contingency plans/adaptive management measures in each management plan/TARP are adequate	C Nicholas	31.03.2020			
12	10.3.c and 10.3d	Bathymetric survey to be undertaken at the end of S2 and end of S3 panel.	T Chisholm	28.02.2020			
13	10.3.d	Review Subsidence Management TARP after S2 panel, if greater than normal triggered. Revise predictions and management strategies as required	C Nicholas	31.03.2020			

[Chris Armit] **[Signature]** **[17/12/19]**

(Dave McLean)	**[Signature]**	**[Date]**

MDG 1014 Review Checklist

RISK ASSESSMENT REVIEW CHECKLIST

Risk Assessment Title: MINIWALL S4 EXTRACTION PLAN SUBSIDENCE MGMT ***Date:*** 17/7/19

Site: CHAIN VALLEY COLLIERY

1. Report

[Circle or Highlight Yes or No for the following]

1.1	Is there a description of the operation or equipment being assessed?	Yes / No
1.2	Is there a summary of the strategic, corporate and risk management context?	Yes / No
1.3	Is there a list of the people involved in the risk identification step, together with their organizational roles and experience relevant to the risk assessment topic?	Yes / No
1.4	Is there an adequately detailed outline of the approach used to identify the risks?	Yes / No
1.5	Is there an outline of the method used for assessing the likelihood and consequences of the risks?	Yes / No
1.6	Is there, discussion of the basis for defining either the safety standard to be achieved, or the level of risk management expenditure?	Yes / No
1.7	Is there a list of the main actions to be taken to reduce risks and to manage risks?	Yes / No
1.8	Is there a timetable for implementing the main actions?	Yes / No
1.9	Does the report specify a requirement for a working audit requirement after completion of all stages?	Yes / No

2. Process

	How do you rate the following? [Circle or Highlight Poor to Very Good]	Poor/Very Good
2.1	The range of expertise of team which did the study.	**1 2 3 4 5**
2.2	The appropriateness of the degree of detail of the study.	**1 2 3 4 5**
2.3	The comprehensiveness of the systematic approach.	**1 2 3 4 5**
2.4	The identification of the key risk scenarios to be addressed.	**1 2 3 4 5**
2.5	The basis for deciding the required safety level or effort.	**1 2 3 4 5**
2.6	The method for assessing likelihood and consequences.	**1 2 3 4 5**
2.7	The thoroughness of consideration of planned risk reduction actions.	**1 2 3 4 5**
2.8	The thoroughness of consideration of existing or planned risk controls.	**1 2 3 4 5**
2.9	The objectivity and balance of the study (ie not unduly optimistic or pessimistic)	**1 2 3 4 5**

Signed: 

Position: Environment and Community Coordinator Date: 17/07/19

Appendix 4 Subsidence Management Trigger Action Response Plan

Revision 1 - 12/05/2020

CHAIN VALLEY COLLIERY- SUBSIDENCE MANAGEMENT TRIGGER ACTION RESPONSE PLAN (TARP)

SUBSIDENCE MANAGEMENT NORTHERN MINING DOMAIN S2 - S4

		DETAILED PERFORMANCE INDICATORS	MONITORING REQUIREMENTS	CONTAINMENT / REMEDIATION MEASURES	ADAPTIVE MANAGEMENT MEASURES	CONTINGENCY PLANS
Triggers	SUBSIDENCE PARAMETERS (Input Variable Validation)	**Normal** Constrained Zone thickness (as per Strata2 Report CHV-006-Rev2) exceeds "12T + 10m" by at least 10m (refer to EP Table 10)	Miniwall supervisors to record extraction height each shift			
		Trigger Level 1 Constrained Zone thickness exceeds "12T + 10m" by <10m (refer to EP Table 10)	Mine Surveyor to confirm weekly that the average extraction height is ≤ 3.5m			Review mine plan and extraction height capabilities. Adjust extraction areas accordingly
		Trigger Level 2 Constrained Zone thickness is <12T (refer to EP Table 10)		**Cease extraction and review**	Reduce extraction height where feasible	Conduct risk assessment Review mine plan, including extraction height, geological mapping and panel geometry to confirm that sub-critical behaviour still applies
	SUBSIDENCE PARAMETERS (Bathymetric Survey)	**Normal** Subsidence ≤ 300mm	As per SM Program			
		Trigger Level 1 Subsidence > 300mm to ≤ 500mm	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 & update management plans if reqd	Review ability to limit further increases based on understood mechanisms
		Trigger Level 2 Subsidence >500m to <u>≤</u> 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 DPIE and RR Notify OEH, affected landholders or infrastructure owner	Implement further controls as applicable from review Update subsidence predictions based on monitoring data Update impact assessment on natural and built features	Review mine plan including panel width, pillar widths, extraction height and panel length in consultation with DPIE and RR Review and update Extraction Plan
	SUBSIDENCE PARAMETERS (Foreshore Survey over minimum of 2 adjacent pegs)	**Normal** <20mm recorded movement	Monitoring as per SM Program			
		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	
		Trigger Level 2 >20mm recorded movement (assoicated with mining)	Implement Ecological Monitoring program for HWMSB exceedance Increase frequency of subsidence parameter monitoring to until rates stabilises. Then as per SM program	**Cease extraction in panel in question until review conducted in consultation with DPIE and DRE** Notify DPIE and RR Notify OEH, affected landholders or infrastructure owner	Investigate cause of exceedance (ie validate impact due to FAS extraction or not). Update subsidence predictions based on monitoring data Update impact assessment on natural and built features	Provide offsets for any ecological communities or threatened species in the HWMSB if impacts detected Review mine plan including panel width, pillar widths, extraction height in consultation with DPIE and RR Review and update Extraction Plan
	BUILT FEATURES	**Normal** No damage requiring remediation	Monitoring as per Subsidence Monitoring Program RSM routine monitoring navigation markers			
		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 NSW Transport if impacted Notify DPIE and RR Notify potentially affected landholders or infrastructure owner. Provide temporary water if required		Develop BFMP in conjunction with owner for built features surrounding potential impact area
		Trigger Level 2 Impact to built feature	Monitoring as per BFMP	**Cease extraction in panel in question until review conducted in consultation with DPIE and RR** Assist owner with information to aid in MSB claim in accord with BFMP	Update impact assessment based on observed damage	Review mine plan including panel width, pillar widths in consultation with DP&E and DRE Review and update Extraction Plan

Version 0 - 01/11/2019

CHAIN VALLEY COLLIERY- SUBSIDENCE MANAGEMENT TRIGGER ACTION RESPONSE PLAN (TARP)

SUBSIDENCE MANAGEMENT NORTHERN MINING DOMAIN S2 - S4

		DETAILED PERFORMANCE INDICATORS	MONITORING REQUIREMENTS	CONTAINMENT / REMEDIATION MEASURES	ADAPTIVE MANAGEMENT MEASURES	CONTINGENCY PLANS
Triggers	**PUBLIC SAFETY (Foreshore area and steep slopes)**	**Normal** No impact	Monitoring as per SM Program and Public Safety MP Increase visual inspection to forthnightly about N4 until satisfied no change in public risk			
		Trigger Level 1 Subsidence parameters exceeded such that Fassifern workings indicated to have potential impact on foreshore	Increase visual inspection of foreshore to daily until public safety risk quantified as low Inspect foreshore in vicinity of steep slopes and retaining walls for signs of movement ASAP. Implement TARP as required.		Review potential of flooding and drainage impacts about foreshore or stability concerns at steep slopes/ retaining walls. Undertake risk assessmentas to such	
		Trigger Level 2 Area around foreshore becomes unstable / 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 in vicinity of other steep slopes and retaining walls for signs of movement ASAP. Implement TARP as required.	**Cease extraction in panel in question until review conducted in consultation with DP&E and DRE** 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 ECO as to result of inspection Geotechnical Engineer to inspect area ASAP. Notify Council and NSW Transport Notify OEH, DPIE and RR	Implement longer term safety controls	Foreshore stabilisation of unsafe areas in consultation with LMCC/CC Council and RR Flooding and drainage rectification works in consultation with infrastructure owner
	BENTHIC COMMUNITIES	**Normal** 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 Arrange a peer review of the monitoring results and statistical analysis			
		Trigger Level 2 ANOVA/ANOSIM <5%	Undertake follow up monitoring at affected sites to obtain confirmation of impacts. Incident Report to be completed and distributed to relevant agencies	Notify DPIE-Fisheries, LMCC and DPIE	Consult with relevant authorities about monitoring and management controls	Consult with relevant authorities to identify if offsets are required and how these are to be implemented.
	SEAGRASS	**Normal** Negligible impact	Monitoring as per Seagrass MP			
		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 DPIE-Fisheries, LMCC and DPIE	Consult with relevant authorities about monitoring and management controls	Consult with relevant authorities to identify if offsets are required and how these are to be implemented.
	WATER INFLOW	Ongoing monitoring of water inflows and site water management through operational Water Management and Monitoring TARP process				
Responsibilities	**Environment Compliance Officer**	Coordinate and undertake all environmental monitoring as outlined in TARP Implement TARP actions in consultation with regulatory agencies as/if required Notify the relevant Government agencies and other affected parties of exceedance of performance measures Coordinate Subsidence Review as a part of Annual Environmental Reporting Arrange for subsidence prediction and impact updates as required Update Extraction Plan as required Audit public safety controls regularly				
	Mine Surveyor	Coordinate subsidence monitoring as outlined in TARP Review subsidence monitoring results against TARP triggers Inform relevant stakeholders as to subsidence monitoring trends and exceedances				
	Mine Manager	Ensure adequate financial and personnel resources are made available for implementation of this plan Review and approve required mine plan changes				

Appendix 5 Water Management Plan

Delta coal	Doc Owner: **Environment and Community Coordinator** Doc No:

CHAIN VALLEY COLLIERY

Water Management Plan

ENVIRONMENTAL MANAGEMENT PLAN

Reviewed	Sally Callander - EMM Consulting
	Chris Armit - EMM Consulting
	Katie Weekes – EMM Consulting
Authorised by:	Chris Armit
	Environment and Community Coordinator
Date:	1 December 2019

Table of contents

1 Introduction

1.1 Purpose

The Water Management Plan (WMP) addresses the requirements for Development Consent SSD-5465 and EPL 1770.

The purpose of the WMP is to:

- guide the management of surface and groundwater resources throughout the operational life of the mine;
- address the relevant conditions of the development consent;
- meet the requirements of EPL 1770, including Pollution Reduction Programs (PRP's) that have been implemented on site;
- address the relevant commitments made within the Surface Water Assessment (SWA) (GSSE, 2013) and Environmental Impact Statement (EIS) (EMM, 2013); and
- address legislative requirements and guidelines relevant to the WMP.

The WMP incorporates the following components as required by SSD-5465:

- a Water Balance;
- a description of Surface Water Management;
- a Surface Water Monitoring Plan;
- a Ground Water Monitoring Plan; and
- a Water Management Review.

1.2 Background

Chain Valley Colliery (CVC) is an underground coal mine located on the southern side of Lake Macquarie approximately 60 km south of Newcastle and 80 km north of Sydney (see **Figure 1**). The pit-top is located approximately 1 km south-east of the township of Mannering Park at the southern extent of Lake Macquarie.

In August 1960, J&A Brown and Abermain Seaham Collieries Ltd commenced clearing the present site with drift and shaft sinking starting a few months later. Production of coal from the Wallarah Seam, commenced with the first delivery to the adjacent Delta Electricity's Vales Point Power Station (VPPS) in April 1963.

LakeCoal was formed in 2001 to acquire BHP Billiton's 80% share in the Wallarah Coal Joint Venture (WCJV), the remaining 20% share was owned by Sojitz. In October 2006, Peabody Energy, a US listed company acquired LakeCoal Pty Limited.

In November 2009 LDO Coal Pty Limited purchased LakeCoal Pty Limited. LDO Coal is a consortium consisting of LD Operations, AMCI and private investors. In March 2011 the 20% share in the WCJV which Sojitz held was acquired by LDO Coal shareholders through the entity Fassi Coal Pty Ltd. The WCJV had operated the Wallarah, Moonee and Chain Valley underground coal mines and the Catherine Hill Bay Coal Preparation Plant, all located at the southern end of Lake Macquarie. At the time of LakeCoal's acquisition by LDO Coal, both the Wallarah and Moonee mines were closed.

In 2013 the owners of Mannering Colliery (MC) and CVC entered into an agreement which enabled LakeCoal to operate the MC until 2022. LakeCoal became the operator of MC effective 17 October 2013, with the underground link between CVC and MC completed in October 2017.

LakeCoal was placed into Voluntary Administration on 3 October 2018. The receivers continued operation of the mines in the period 3 October 2018 to 1 April 2019. As of 1 April 2019, Great Southern Energy Pty Ltd (trading as Delta Coal, DC) own and operate the two underground coal mines, CVC and MC. Mining is currently undertaken at CVC, with the coal being transported underground to MC where the coal is crushed and screened and sent directly to VPPS.

1.3 Operations

CVC is an underground coal mine which extracts coal through both first workings and miniwall extraction methods (second workings). ROM coal from both the first and second workings is transported out of the mine via a conveyor system, where it is sized and transported by surface conveyor systems to product bins.

The surface infrastructure comprises limited facilities at the 14 hectare pit top area adjacent to the Vales Point Power Station, off Construction Road at Mannering Park, and another 0.3 hectare area at the ventilation facility situated at Summerland Point. Both the pit top and ventilation facilities have remained largely unchanged since their establishment.

Modification 2 to Development Consent SSD-5465 allowed for minor vegetation clearing/disturbance adjacent to some infrastructure at CVC's pit top and the ventilation fan site at Summerland Point to enable the extension/establishment of asset protection zones (APZs) for bushfire protection purposes.

The above operations have potential impacts which were addressed in the SWA (GSSE, 2013). To address these, the SWA (GSSE, 2013) identified the following key objectives for surface water management at CVC:

- the prevention of the flow of pollutants into watercourses and the sedimentation on receiving waters, being Swindles Creek to the east of the pit top and Lake Macquarie;
- the control of discharges from the site to ensure that all discharges are within the water volume and quality criteria set out in EPL 1770;
- to minimise site potable water usage requirements and maximise runoff water reuse; and
- to ensure there is sufficient water available to meet Chain Valley Colliery's water requirements.

1.4 Consultation

The original WMP (GSSE, 2012) was prepared in consultation with the former NSW Office of Water (NOW), DTIRIS (Division of Resources & Energy (DRE)) and Wyong Shire Council. The previous WMP (GSSE, 2012) was submitted on the 23 August 2012 and approved by the Director-General on the 6 November 2012.

The 2015 revision of the WMP was prepared in consultation with the (former) NOW and the Environment Protection Authority (EPA) and incorporates outcomes of correspondence with EPA in relation to the variation of the EPL. Comments on the WMP were received from NOW on the 5 December 2014 and requested a change to the groundwater drawdown trigger to 2m over a 2 month period, which is consistent with the minimal impact considerations of the NSW Aquifer Interference Policy, this change has been made within the Groundwater Management Plan (**Appendix B**).

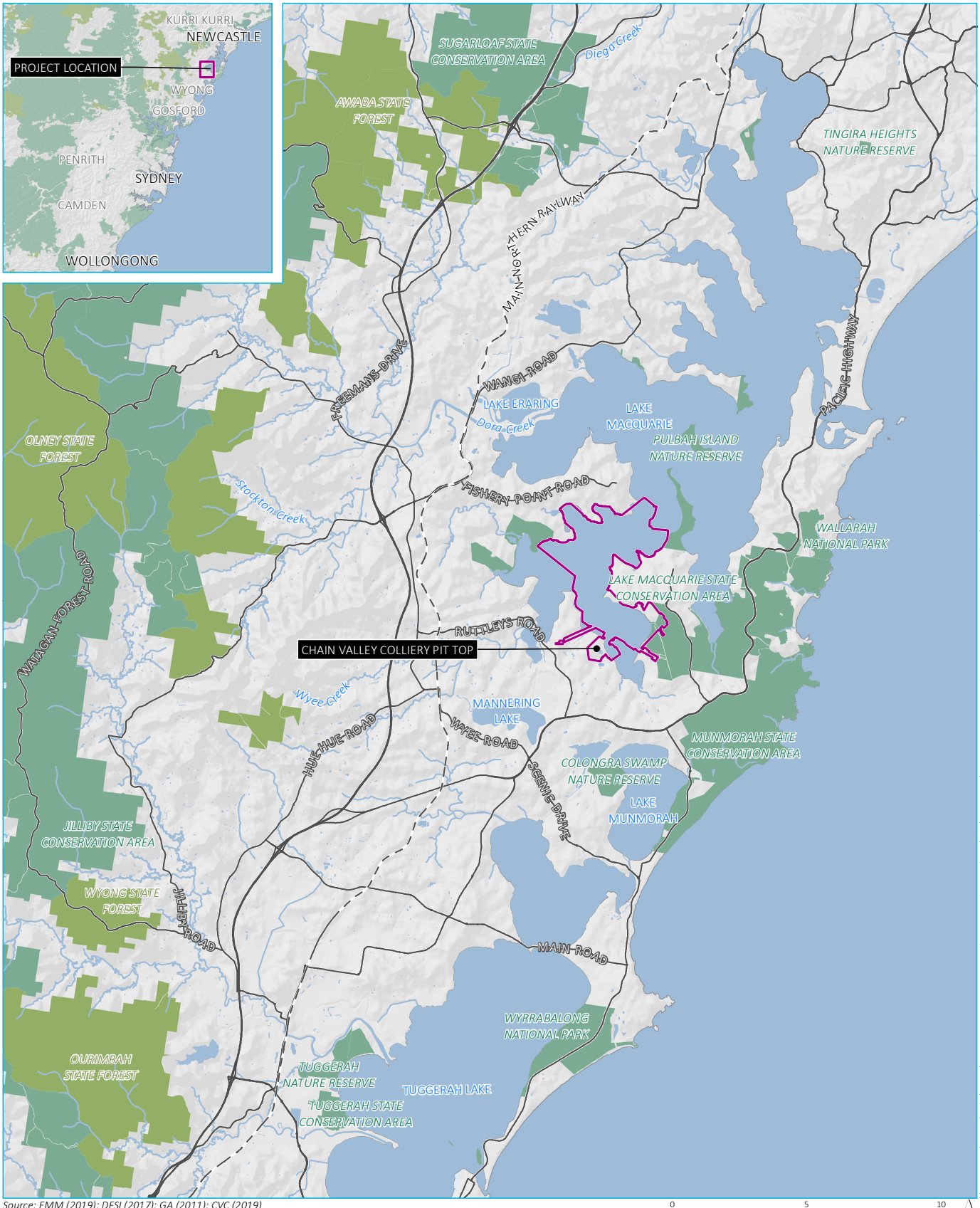
Comments were also sought from the EPA and subsequently requested via email in December 2014. On the 12 June 2015 the EPA responded stating that "The Environment Protection Authority ("EPA") encourages the development of such plans to ensure that proponents have met their statutory obligations and designated environmental objectives. However, EPA does not review these documents as our role is to set environmental objectives for environmental / conservation management, not to be directly involved in the development of strategies to achieve those objectives. The EPA has not reviewed this report and accordingly offers no comments in relation to it".

In accordance with Schedule 3, Condition 18 of development consent SSD-5465 the WMP has been prepared by suitably qualified and experienced persons, Sally Callander (EMM Consulting), Andrew Dawkins (Geoterra) and Chris Armit (EMM Consulting), whose appointment has been endorsed by the Director-General.

A draft revision of the WMP was provided to DPI - Water, EPA and DPIE on 26 November 2019. A summary of the comments received and amendments subsequently made to the document prior to finalisation are detailed in **Table 1**. Evidence of consultation is provided in **Appendix 1**.

Table 1: Consultation Summary

Stakeholder	Comments	Response/Action
NSW DPIE		
NSW EPA		
DPI - Water		



Source: EMM (2019); DFSI (2017); GA (2011); CVC (2019)

0 5 10 km

GDA 1994 MGA Zone 56

N

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KEY

- Chain Valley Colliery development consent boundary
- Rail line
- Main road
- Watercourse/drainage line
- Waterbody
- NPWS reserve
- State forest

CVC regional context

Chain Valley Colliery
Figure 1

EMM
creating opportunities

2 Summary of the Statutory Approval Requirements

2.1 Key Legislation, Policy and Guidelines

A number of legislative requirements, government policies and guidelines relating to water management are applicable and have been addressed in detail within the SWA (GSSE, 2013). The key items of legislation and the relevant approval documents to this WMP are:

- *Water Act 1912 and Water Management Act 2000* - LakeCoal applied for a 4,443 ML/year groundwater license on the 5th October 2011 under the *Water Act, 1912* to pump water from the underground workings to the sedimentation and pollution control ponds at the pit top. The license (WAL41508) was subsequently granted on the 12 March 2013;
- *Protection of the Environment Operations Act 1997* (POEO Act) - Chain Valley Colliery has an existing EPL 1770 under the POEO Act for the discharge of water from site;
- *Environmental Planning and Assessment Act 1979* (EP&A Act) - On 23rd December 2013 development consent SSD-5465 was issued for the *Chain Valley Extension Project*, which has been modified twice by approval on the 27 November 2014 and 16 December 2015; and
- *Mining Act 1992* – Delta Coal holds numerous mining authorities under the Mining Act 1992, a list of all leases held is contained within the Environmental Management Strategy (OMP-D-16374), the most relevant for the WMP is Mining Purposes Lease 1349 as it pertains to the surface facilities area.

The relevant aspects of these approval documents are addressed further below.

Key policies and guidelines which are relevant to the preparation and implementation of this WMP include:

- Australian and New Zealand Environment Conservation Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC Guidelines), October 2000;
- Department of Environment and Conservation (DEC), Approved Methods for the Sampling and Analysis of Water Pollutants in NSW, March 2004;
- Managing Urban Stormwater: Soils and Construction (the Blue Book), Volume 1 and Volume 2E – Mines and Quarries (Landcom, 2004 and Department of Environment and Climate Change (DECC), 2008;
- NSW Water Quality and River Flow Objectives, September 1999;
- NSW State Rivers and Estuaries Policy, 1993;
- NSW Groundwater Quality Protection Policy, adopted in 1998;
- The NSW State Groundwater Dependent Ecosystems Policy, adopted in 2002;
- NSW Groundwater Quantity Management Policy;

- Australian Government, Charter: National Water Quality Management Strategy, 2018;
- Australian and New Zealand Environment Conservation Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), National Guidelines for Sewerage Systems - Effluent Management, 1997; and
- NSW Department of Environment and Conservation (DEC), Environmental Guidelines: Use of Effluent by Irrigation, 2004.

2.2 Development Consent (SSD-5465)

This plan has been prepared in accordance with Schedule 3, Condition 21 of SSD-5465, which states the requirements of the WMP and what it must address. Surface and groundwater related requirements of SSD-5465, including specific requirements that are to be addressed in this plan, and where they are addressed, are detailed in **Appendix 2**.

In accordance with Schedule 2, Conditions 2 and 2A, in addition to carrying out the works in accordance with the conditions of SSD-5465, DC will also carry out works generally in accordance with the Environmental Impact Statement (EIS), Statement of Environmental Effects (SEE) (Mod 1), SEE (Mod 2), Project Layout Plans, and Statement of Commitments.

2.3 Mining Leases

MPL 1349, is the most relevant lease to this WMP as MPL 1349 relates to the surface facilities. MPL 1349 contains the following provision with respect to surface water management.

> *2. The proponent shall implement all practical measures to prevent and/or minimise any harm to the environment that may result from the construction, operation or rehabilitation of the development.*
>
> *18. Operations must be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, unless otherwise authorised by a relevant approval, and in accordance with an accepted Mining Operations Plan. For the purpose of this condition, water shall be taken to include any watercourse, waterbody or groundwater and perform any instructions given by the Director-General in this regard.*

2.4 Environmental Protection License (EPL 1770)

CVC operates under EPL 1770 issued by the Environment Protection Authority (EPA) under the POEO Act. The EPL has been modified a number of times, most recently on the 1 April 2019 for the transfer from Lake Coal Pty Ltd to Great Southern Energy Pty Ltd (trading as Delta Coal). Water related requirements of the EPL, including specific requirements that are to be addressed in this management plan and section references within the WMP are detailed in **Appendix 2**. A 5 year anniversary review of EPL 1770 is being undertaken during the review of this document.

2.5 Maximum Harvestable Right Dam Capacity

Under the NSW *Water Management Act 2000*, landholders are permitted to capture, store and use a portion of the rainfall runoff on their property. The right to harvest rainfall is determined by geographic location and is typically 10% of the total rainfall runoff for the property and storage is calculated under the Maximum Harvestable Right Dam Capacity (MHRDC) provision. Dams that exceed this capacity or are greater than a certain size must be licenced.

Where dams are used to control pollution or effluent, there are exemptions to the licencing requirements. This is the case for the pollution control dams at CVC where the dams are exempt from the MHRDC calculation.

3 Water Balance

A comprehensive site water balance has been prepared for the site and is described in detail within the SWA (GSSE, 2013). This section of the WMP provides a summary of the water balance to enable the key inputs and outputs to be understood along with the water balance results. It also describes the implications of the proposed changes to site water management described in **Section 4.4**.

For more detailed information on the site water balance refer to the SWA (GSSE, 2013).

3.1 Water Balance Model

A detailed 'daily time-step' water balance model was used to represent the Chain Valley Colliery water balance using GoldSim Version 10.50 (GoldSim Technology Group LLC). This software is a graphical, object-oriented system simulation software for completing either static or dynamic systems. GoldSim is commonly used to undertake 'daily time step' water balance simulations for coal mines within NSW due its enhanced modelling capability and flexibility compared to spreadsheet models that have predominately been used in the past. The Chain Valley Colliery water cycle, as simplified and modeled in GoldSim is shown in the schematic water flow diagram as shown on **Figure 2**.

3.2 Data (Model Inputs and Outputs)

3.2.1 Rainfall Runoff

The dataset developed for the water balance used information from the Wyee and Norah Head weather stations. There are other stations in the general vicinity, however these stations were selected due to their proximity to the CVC and length and completeness of the data, which together, provide over 100 years of rainfall data.

The pit top area was segregated into four distinct catchments which were further broken up into eight sub-catchments for the purpose of the CVC water balance.

The daily step GoldSim model was used to estimate the surface water runoff from different sub catchments at the pit top area. The runoff coefficients adopted are considered conservative but reflect the large impermeable area in the catchment which includes laydown areas, compacted roads and coal stockpile areas. The free water surfaces of the pollution control dams and the roofed areas were modelled as completely impervious areas, capturing all precipitation.

Catchment areas as modeled within the GoldSim model are provided in **Table 2**.

Table 2: Pit Top Catchment Areas

Major Catchment Name	Sub-Catchment Name	Catchment Area (ha)
Carpark (Catchment 1)	Carpark (not modelled)	NA
Storage Yard (Catchment 2)	Oil Water Separator	0.15
	Workshop (Roof)	0.24
	Old Bath House (Roof)	0.11
	Pit Top Storage Yard	3.03
Stockpile (Catchment 3)	CHP Stockpile	5.34
Pollution Control Dams (Catchment 4)	Dams D1 to D6	0.41
	Dams D7 to D13	1.97
Total catchment reporting to pollution control dams (excluding carpark)		**11.25**

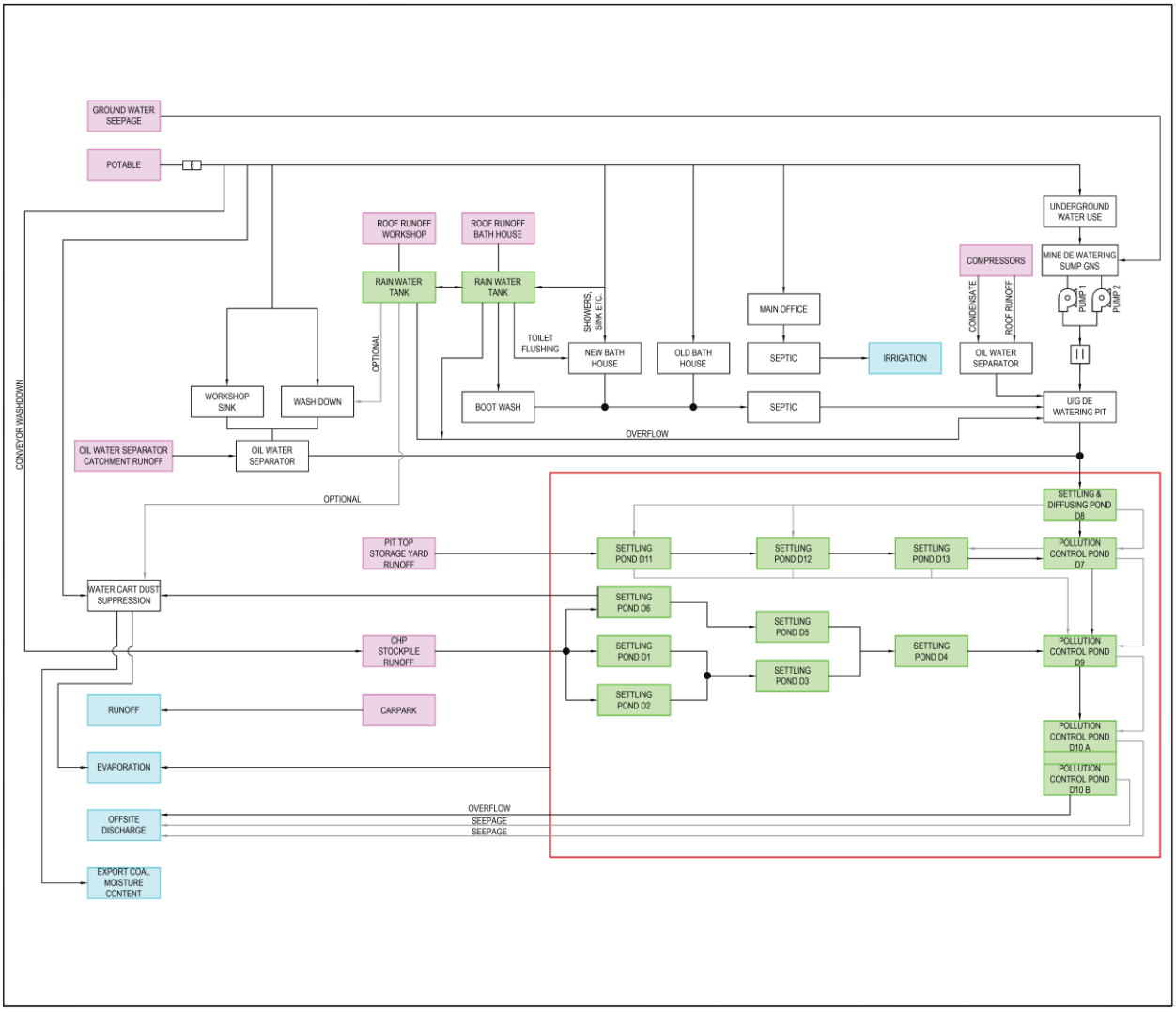


Figure 2: GoldSim schematic water flow diagram

3.2.2 Evaporation

Evaporation data was obtained from the Peats Ridge weather station on Waratah Road (station number 61351), approximately 33km south-west of the site. This was the closest meteorological weather station to the CVC with over 25 years of evaporation information. Evaporation data from this weather station was adjusted for the change in site conditions from the measuring site to the sedimentation dams by multiplying the average monthly rates by a pan coefficient of 0.7.

Evaporation from the pollution control dams was calculated using a daily step within the GoldSim model similar to the runoff model calculations. This model used the evaporation rate, modified by the pan coefficient, and the surface area of the dams, which was calculated using survey data.

3.2.3 Underground Water Extraction

The Groundwater Assessment (Geoterra, 2013) predicted that the average daily water volumes pumped from the coal face would increase from approximately 7.3 ML/day to 10.5 ML/day. This estimated pumping rate is an average value and therefore pumped flow rates may exceed this value on occasions. It should be noted however, that this average daily volume was calculated as an 'end of mining' estimate and can be considered a 'worst case' prediction of groundwater inflow rates. It is not expected to occur for the majority of the project life.

The annual groundwater make from the mine is estimated at approximately at 1,817 ML/yr, or 4.98 ML/day (Geoterra, 2019).

Pump rate information provided by LakeCoal indicates that the two existing underground dewatering pumps from the Great Northern Seam sump have a maximum pumping rate of 75 L/sec and 75 L/sec respectively. This equates to a total maximum pumping rate from underground of approximately 12.96 ML/day.

However, within the EIS (EMM, 2013) LakeCoal committed to limiting the main underground pumps to a maximum pump out rate of 10.5 ML/day (equivalent to the predicted average daily volume that will need to be pumped from the coal face during the later stages of the project). This limit was put in place during September 2014, using the site Citect system to automatically stop the one of the underground pumps when 9.5 ML has been pumped and stopping the second pump if a total of 10.5 ML in any day has been pumped. The pumps are only able to be restarted the following day. This limit can however be temporarily disabled by authorised persons in the event of unacceptable risk (e.g. flooding and risk to employee health and safety), which was a requirement of the site risk assessment completed.

When not pumping, water accumulates underground in a number of storages that exist within both the Great Northern and Wallarah Seams, these are discussed in **Section 4.3**.

3.2.4 Pollution Control Dam Characteristics

Information pertaining to the GoldSim modelling of the sedimentation dams was obtained from survey data. This information is shown in **Table 3**. It should be noted that the volume of dam D6 was not available and was estimated based on a 1 m depth, the measured surface area and standard stage/storage relationships. Dams D1 to D6 and D7 to D13 were each modelled as single storages to simplify the water balance processes at the site.

Table 3: Pollution Control Dam Capacities (as modelled in GoldSim)

Dam	Volume (m^3)
D1	80
D2	51
D3	284
D4	547
D5	770
D6	568
Total dams D1 to D6	**2300**
D7	3856
D8	2933
D9	3796
D10	4802
D11	297
D12	229
D13	168
Total dams D7 to D13	**16081**

3.2.5 Loss of Water through Coal Export

During mining and conveying, the moisture content in the coal increases due to the use of water sprays at the coal face and at transfer points along the conveyor system. A review of the CVC coal analysis data indicates that the inherent (air dried) moisture content of the coal from underground is approximately 2.7%.

This same data indicates that the total moisture of the CVC coal that is exported is approximately 7.3%, which means that around 4.6% of this total moisture content is added to the coal prior to export. This equates to 69,000 tonnes of additional water at the proposed maximum rate of production of 1.5 Mtpa. Therefore, approximately 69.0 ML of water is exported from the CVC every year, or 188.9 kL/day.

3.2.6 Additional Data

A limited amount of water usage and flow monitoring data at CVC was available for the water balance investigation. However, where historic information was lacking, data and operational information was made available to best derive estimates of the respective water balance parameters (flow rates, water usage, etc.). Additional data, as used in the water balance model, is shown in **Table 4**, as well as comments/assumptions on how this data was derived.

Table 4: CVC Supplied and Derived Data

Parameter	Value	Comments/Assumptions
Potable Water: Underground (includes increase of 25% to account for any additional underground potable water demand)	139.583 ML/yr	Average of underground potable water from monitored water use with an additional 25% to account for increased potable water used underground.
Potable Water: Main Office	211 L/day	Includes shower, sink and toilet facilities. Shower (26 L/day): Assumes 9 L/min, 10 min/person, 2 showers per week. Toilet (154 L/day): Assumes 12 employees, employees at work 5 days/week, 6 L/toilet flush, average employee flushes 3 times/day (at work). Sink (31 L/day): Assumes 12 employees, 1.2 L/wash, employees at work 5 days/week, employees use sink 3 times/day.
Potable Water: Workshop	3724 L/day	Includes equipment washdown and sink use. Equipment Washdown (3712 L/day): Assumes 1-hour wash/day, 1.031 L/sec flow rate. Sink (12 L/day): Assumes 1.2 L/wash, 1 sink used 10 times per day.
Potable Water: Old Bath House	24 L/day	Includes sinks facilities. Sinks (24 L/day): Assumes 1.2 L/wash, 2 sinks each used 10 times per day.
Potable Water: New Bath House (Showers, Sink)	8519 L/day	Includes shower and sink facilities (assumes rainwater tank water used for toilets flushing). Shower (8190 L/day): Assumes 9L/min, 10 min/person, average of 91 shift ends / day (calculated from shift information provided by DC). Sink (329 L/day): Assumes 160 employees, 1.2 L/wash, employees at work 4 days/week, employees use sink 3 times/day.

Potable Water: Conveyor Washdown	11.135 kL/day	Assumes it is used 3 hrs/day, 1.031 L/s flow rate.
Bootwash Water Demand	273 L/day	Assumes it is used 3 L/person/shift, average of 91 shift ends / day (calculated from shift information provided by DC).
New Bath House Toilet Flushing Demand	1097 L/day	Assumes 160 employees, employees at work 4 days/week, 4 L/toilet flush (reduced for urinals), average employee flushes 3 times/day (at work).
Dust Suppression Demand	11.28 ML/yr	Calculated from available water cart records (3/01/2012 to 11/05/2012).
Combined Rainwater Tank Capacity	30 kL	Estimated rainwater tank capacity.

3.3 Water Balance Results

3.3.1 Expected Discharge from Chain Valley Colliery

As noted in **Section 3.2.3**, DC limits the main underground pumps to a maximum pump out rate of 10.5 ML/day. As such, the GoldSim model was run (using a deterministic simulation) assuming that the pumps from the Great Northern Seam sump were constantly pumping at this 10.5 ML/day rate. This scenario assumes that adequate capacity is available in the underground workings to effectively store water during periods when the groundwater inflow rate exceeds the underground dewatering rate. This is further discussed in **Section 4.3**. It should be noted that assuming a constant underground pump rate of 10.5 ML/day is a 'worst case' scenario and is only predicted to occur, on occasions, near the end of the project life.

Key statistics from the GoldSim modelling, assuming a constant discharge from underground of 10.5 ML/day, include:

- daily average discharge through the LDP1 of 10.716 ML/day;
- maximum discharge through LDP1 of 35.124 ML/day; and
- likelihood of LDP1 volumetric limit exceedance on any given day of 4% (or approximately 15 times per year).

The prediction that rainfall events will regularly result in discharges above the EPL LDP limit of 12.161 ML/day is further discussed in **Section** Error! Reference source not found.. During the period 2016 to 2019, there have been 3 discharges above the LDP volumetric limit of 12.161 ML/day. Two occurred during 2016 and one in August 2019. All were reported to the EPA and DPIE.

3.3.2 Potable Water Use

The total amount of potable water used at the CVC was investigated in the GoldSim model, with and without the committed water savings measures (as described in **Sections 4.7**) in order to quantify how much potable water these measures are likely to save at the site. GoldSim modelling estimates that the potable water used in the pit top area will be reduced from 55.9 kL/day to 23.7 kL/day with an overall saving of 32.3 kL/day (11.8 ML/year) as a result of water saving measures being implemented.

This equates to an approximate reduction in total potable water of 8.9% (for current levels of potable water use) and 7.4% (allowing for a 25% increase in the underground potable water use as a result of the proposed future mining works).

3.4 Water Supply and Security

All water required for operational activity has historically been sourced from the single potable water supply connection from the Central Coast Council town-water system. This connection is considered a secure source of water as it is only a small portion of the total water consumed annually by the Central Coast and no viable alternative sources have been identified. Further discussion on water savings and alternative water supply is contained in **Section 4.7**.

No water is obtained from unregulated water sources listed in the *Water Sharing Plan for the Central Coast Unregulated Water Sources 2009*.

4 Surface Water Management

4.1 Overview of Water Management System

The water management at the CVC pit top is primarily focused on erosion and sediment control, however there are a number of water management components including the underground de-watering, oil water separator system, the effluent management train and the operation of the pollution control dams.

All water required for operational activity is sourced from the single potable water supply connection from the Central Coast Council town-water system. All excess water from the underground workings is pumped to the Great Northern Seam sump. This water is then pumped to the surface and discharged into the site's pollution control dams.

A combination of surface slope and earth diversion drains on the eastern and northern boundaries results in the majority of the site draining east towards the pollution control dams. A small catchment (i.e. carpark and access road) discharges off-site to the west and north. Other than the carpark catchment, the site's pollution control dams receive all rainfall runoff from the pit top, amenities water and underground mine water, as well as workshop and wash down water after treatment by an oil separator. A system of 13 pollution control dams have been constructed from a mixture of earth, crushed rock, recycled brick and stone. The dams are interconnected through a series of overflow pipes and spillways which allows water to circulate through each dam before reaching the site discharge point. The dams provide improvement to the site wastewater and runoff quality prior to discharge to Lake Macquarie (via Swindles Creek).

4.2 Potable water

All water used for underground mining purposes by CVC is potable water and used in equipment, for cleaning, and dust control. To quantify the estimated volume of water consumed underground a flow/volume meter is installed on the underground water line.

Water is made available throughout the underground workings to satisfy statutory obligations for the production of underground coal. Water is consumed mainly by the following processes.

- when cutting coal at the coal face - to reduce respirable dust and propensity for frictional ignition of coal dust and methane gas;
- when transferring coal along the underground conveyor system and at transfer points - to reduce dust make;
- for use in cleaning;
- for use in equipment; and
- for emergency firefighting purposes.

Water used in the pit top operations is consumed by amenities, dust suppression and wash down.

4.3 Underground Water

In addition to the potable water, naturally saline groundwater migrates into the underground workings of the mine. This water is pumped to or collects in a sump within the Great Northern Seam, from there it is pumped to the pollution control dams on the surface. This water is not used for operational purposes due to its high salinity and subsequent potential effects on mine machinery and equipment.

As mentioned in **Section 3.2.3**, DC has limited the main underground pumps to a maximum pump out rate of 10.5 ML/day. To facilitate restrictions to pumping rates, underground water can be stored within both the Great Northern and Wallarah Seams. The underground storage volumes have been assessed and estimated at the following capacities:

- Great Northern Seam – North East Sump, ~ 100 ML;
- Great Northern Seam - Shaft Headings Sump, ~ 200 ML;
- Great Northern Seam - Sump Headings, ~ 5 ML; and
- Wallarah Seam – Wallarah Sump/Storage Location, 150 to 200 ML.

Details on groundwater management are contained in the Groundwater Management Plan (GwMP) (GeoTerra, 2019) which is in **Appendix 3**.

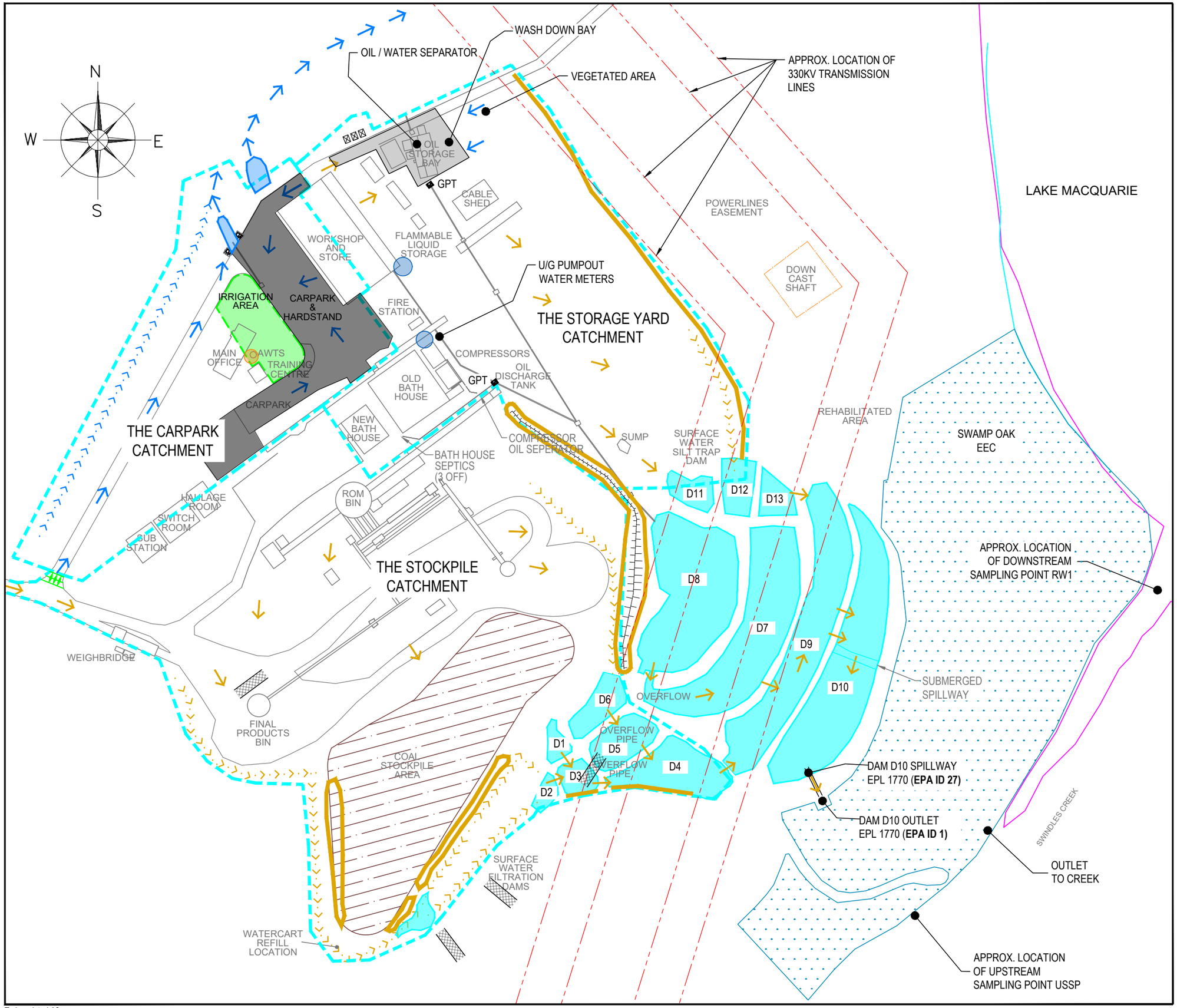
4.4 Surface Water Catchments and Controls

For the purpose of the WMP runoff from the pit top area is managed as 4 catchment areas including:

- Catchment 1 (Carpark) – carpark, office building and partial runoff from the workshop roof;
- Catchment 2 (Storage Yard) – rear storage yard and oil water separator;
- Catchment 3 (Stockpile) – stockpile, entry road and bathhouse form the third catchment; and
- Catchment 4 (Sedimentation Dams) – pollution control dams.

The above catchments and the major drainage structures are shown on **Figure 3.**

Figure 3: Water Management Structures



LEGEND:

- STOCKPILE AREA
- EXISTING BUND LOCATION
- TEMPORY BUND LOCATION
- CLEAN WATER DIVERSION CHANNEL
- DIRTY WATER DIVERSION CHANNEL
- CLEAN WATER FLOW ARROWS
- DIRTY WATER FLOW ARROWS
- BUND/CHANNEL CATCHMENT SEPARATION
- CATCHMENT BOUNDARIES
- POWER LINES
- WATER BASIN
- PROTECTED WETLAND AREA
- SURFACE MAINTENANCE STRATEGY AREA
- IRRIGATED TREATED WASTE WATER AREA
- RAINWATER TANKS
- AERATED WASTE TREATMENT SYSTEM (AWTS)

0 50 100m

Scale 1:2000

FIGURE 3

WATER MANAGEMENT STRUCTURES

CHAIN VALLEY COLLIERY
WATER MANAGEMENT PLAN

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Checked: KW

Delta coal

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4.4.1 Catchment 1

Catchment 1 (carpark catchment) is a relatively clean catchment as a large portion of this area is vegetated, and there are areas of offices and sealed roads. However, the carpark is unsealed (gravel hardstand) and some sediments accumulate on the surface.

The key control methods implemented in Catchment 1 include:

- clean water diversion channel runs down the north-western perimeter of the pit top to divert any off-site run-on into the natural drainage channel. This is the only major clean water diversion channel required on-site with the remaining topography such that small bunds are sufficient to prevent overland flows entering the site;
- a concrete spoon drain at the intersection with the main site entry road directs dirty runoff from the entry road toward the weighbridge within the storage yard catchment and prevents it from entering this catchment;
- regular sweeping of the carpark surface to remove accumulated sediment;
- kerb and guttering on the access road provides the perimeter drainage directing runoff to the sediment treatment basins within this catchment; and
- utilisation of two small basins, the first is in line with main drainage outlet of the carpark and the second is beside the workshop adjacent to the carpark. Both basins allow coarse sediment to be removed prior to discharge into the natural drainage channel and are shown on **Figure 3**.

4.4.2 Catchment 2

Catchment 2 (storage yard catchment) includes the main storage yard, the majority of which is gravelled hardstand for equipment storage. This area also includes the vehicle wash down bay and bunded areas which drain to the oil water separator within this catchment.

The key control methods implemented in Catchment 2 include:

- there is no off-site water flowing into this catchment and subsequently clean water diversion is not required;
- an earth bund is installed along the eastern perimeter of the catchment which contains all dirty water runoff; and
- a large portion of this storage yard area drains south-east via overland flow into the pollution control dams D11, D12 and D13 which function as primary settling dams before discharging into the main mine water treatment system (i.e. dams D7 to D10);

- the remainder of the catchment (e.g. bathhouse, workshop and treated water) enters various inlet pits and drains south-east via the pit and pipe network into the main mine water treatment system via dams D8; and
- an oil water separator to treat runoff from the bunded hydrocarbon storage areas and vehicle wash down bay (see **Section 4.10**).

4.4.3 Catchment 3

Catchment 3 (stockpile catchment) includes the main entry/haul road, weighbridge (no longer in use), coal handling (including ROM bin) and coal stockpiles (also no longer in use).

The key control methods implemented in Catchment 3 include:

- perimeter bunding along south-west perimeter to prevent clean water entering this area and dirty water leaving the site;
- bunding and surface grading around the water cart fill location to directed runoff to a stockpile catch drain;
- bunding and drainage around the weigh bridge to directed runoff to a stockpile catch drain;
- runoff is contained by two main stockpile catch drains that surround the stockpile. Runoff from this area contains a significant amount of coal fines and there are in-line sumps within the catch drains to trap coarse material before it enters the series of pollution control dams below the stockpile; and
- runoff from this catchment area reports to the pollution control dams D1 to D6 which function as primary settling dams before discharging into the main mine water treatment system (i.e. dams D7 to D10).

4.4.4 Catchment 4

This catchment contains all the pollution control dams (i.e. D1 to D13) which receive runoff from the storage yard area, the stockpile area, pumping of water from underground, and rainfall directly into the dams. The management of this catchment is described in **Section 4.5**.

4.5 Management of Pollution Control Dams

Effective management of surface water runoff relies heavily on the use of pollution control dams for the detention of dirty water as well as mine water. All surface water runoff potentially containing sediment, septic treated bathhouse wastewater, treated water from the oil water separator and underground mine water is captured by the site's pollution control dams prior to discharge under EPL 1770. These dams have been constructed with a mixture of earth, crushed rock, crushed recycled brick and stone and are interconnected through a series of overflow pipes and spillways. The dams discharge through the LDP into native vegetation

and flow to Swindles Creek prior to draining into Lake Macquarie on the western shoreline of Chain Valley Bay.

Water is directed through the treatment dams from a number of main inlet locations. Runoff from the stockpile area and the storage yard enters the pollution control dams as described above for those catchments. The underground mine water is pumped to a pit adjacent the compressor house and is combined with the septic treated wastewater from the bathhouse, the treated compressor condensate water and some surface runoff.

From this pit the water is piped to D8 for settling and diffusion. Water within D8 enters D7 via a spillway at the southern end of D8. However, due to the imperfect nature of the dam's construction an unknown amount of water diffuses through the dam wall. The water in D7 flows into D9 in a similar manner, in D9 the underground water is combined with the runoff from other areas on site. The primary spill from D9 to D10 is at the northern end of D9. Once in D10 the water flows over a shallow buffer spillway to the main discharge spillway and offsite at the LDP. A real time monitoring system on the final spillway was installed in February 2015, with monitoring data sent every 30 minutes via 3G to an online database where data can then be viewed or downloaded.

The dams provide improvement to the site wastewater and runoff quality through the settlement of fines and suspended solids and prevention of off-site discharge of hydrocarbon spills prior to discharge to Lake Macquarie. Based on the volume of the dams and the average daily discharge, the estimated residence time of the water in the pollution control dams is 1 – 2 days. The storage capacity of these dams is provided in **Section 3.2.4**.

4.6 Erosion and Sediment Control / Ground Disturbance

Erosion and sediment control are predominately managed through the implementation of the primary controls described above within the surface water management systems. In addition to these controls, temporary erosion and sediment controls are implemented for any construction disturbance that is not contained with the surface water management system. The primary objective is to ensure that appropriate procedures and programs of work are in place to meet the requirements of Managing Urban Stormwater: Soils and Construction (the Blue Book), Volume 1 and Volume 2E – Mines and Quarries (Landcom, 2004 and Department of Environment and Climate Change (DECC), 2008).

4.6.1 Soils

CVC surface facilities are situated at the southern end of Lake Macquarie. This area is principally comprised of the Doyalson soil landscape with small parts on the Wyong soil landscape. The Doyalson soil landscape is characterised by gently undulating rises on Munmorah Conglomerate with broad crests, ridges and long gently inclined slopes.

Local relief is up to 30 metres and slope gradient is less than 10%. Doyalson soils are strongly acidic soils of low fertility with slight to high erodibility. The Wyong soil landscape is characterised by broad, poorly drained deltaic floodplains and alluvial flats of Quaternary sediments. Local relief is less than 10 metres and slope gradient is less than 3%. Wyong soils are strongly acidic, poorly drained, impermeable soils of very low fertility with saline subsoils.

There is also the potential for acid sulfate soils (ASS) to be present, with probability of occurrence increasing with proximity to the shoreline of Lake Macquarie (see **Section 4.8**).

4.6.2 Potential Impacts

As there is expected to be very little disturbance to ground surfaces and generally restricted to limited construction activities associated with the mines pit top, erosion impacts will be minimal. Construction activities would typically be in areas of relatively flat land at the pit top, with mitigation measures to be put in place to control mobilisation of disturbed soils at the time of, and immediately following, the construction activity.

The greatest potential for soil exposure and movement of soil would occur during any construction activities within areas outside of the pit top water management system (such as at the ventilation shaft site). Exposed soil may be mobilised, leading to erosion, fugitive dust emissions and potential sedimentation of Lake Macquarie. The following sections provide control measures to prevent adverse impacts on surrounding catchment areas and receiving waters.

4.6.3 Standard Erosion and Sediment Controls

Erosion and sediment controls are to be implemented across the CVC for all phases of the operation including construction, operation and maintenance activities to mitigate impacts on watercourses and the surrounding environment. Where activities are contained with the pit top surface water management system, erosion and sediment control will be achieved through the controls described in the previous section.

Where soil disturbance activities are outside of these controls, standard erosion and sediment control techniques and management principles are used in accordance with the requirements of Managing Urban Stormwater: Soils and Construction Vol. 1 and Vol. 2E - Mines and Quarries (referred to as the Blue Book in this Plan) (Landcom, 2004 and DECC, 2008).

For activities at CVC, a 'Permit to Clear or Disturb Land' is required prior to disturbance. This permit includes requirements to have water management and erosion controls in place prior to disturbance.

4.6.4 Construction Erosion Management Plan

Where soil disturbance activities are outside of the surface water management system, erosion and sedimentation shall be effectively controlled through the development of a Construction Erosion Management Plan (CEMP) prior to undertaking large scale disturbances (i.e. greater than 2,500 m^2). The CEMP shall be consistent with the Blue Book (Landcom, 2004 and DECC, 2008) and would include the following key principles:

- conducting best practice land clearing procedures for all proposed disturbance areas including:
    - coordinating construction activities to minimise exposure of disturbed soils to the elements; and
    - topsoil stripping procedures to reduce deterioration in topsoil quality and dust generation.
- appropriate storage of topsoil stockpiles in areas away from roadways and other drainage lines;
- appropriate design of access tracks;
- use of diversion structures to separate 'clean' water runoff from disturbed areas runoff, to minimise volumes of sediment-laden and mine water for management;
- ensuring sediment-laden runoff is treated via designated sediment control devices;
- topsoiling, reshaping and revegetation of disturbed areas as soon as possible following the completion of construction activities;
- temporary erosion and sediment controls to be in place prior to any construction activity outside of an existing dirty water management system; and
- implementing an effective maintenance program for the site.

The above principles are addressed in further detail in **Appendix 4**.

4.7 Water Savings

CVC seeks continual improvement in relation to water consumption, potential improvements in water efficiency, alternative water sources and options for recycling and reuse. The following measures are implemented on site:

- use of a road sweeper to clean roads (as opposed to more frequent washing of roads with a water cart);
- rainwater tank installed on the workshop;
- repair works to aging pipelines to reduce losses from leakage; and
- trial use of chemical dust suppressant to reduce water cart usage.

The primary use of potable water is to supply underground activities. The water storage within the dirty water dams is not suitable for supply to underground machinery.

4.8 Acid Sulfate Soils

The ASS risk map for coastal NSW shows a high probability of occurrence of ASS below the pollution control dams, and down to the shoreline of Lake Macquarie.

Disturbance of ASS would be avoided wherever practicable. Where ASS has the potential to be disturbed, an ASS management plan would be prepared. Any ASS disturbed would be tested and handled in accordance with the ASS management plan and would be treated or disposed of to an appropriately licensed facility. For activities at CVC, a 'Permit to Clear or Disturb Land' is required prior to disturbance which includes requirements to manage the disturbance of ASS.

4.9 Sewerage Disposal and Management

There are two sources of domestic wastewater located at the pit top facilities. The first source is generated in the administration office building and the second is generated in the bathhouse and operations area. Both wastewater streams are treated by separate treatment systems. The administration office treatment system is an aerated wastewater treatment system (AWTS) while the bathhouse system is a traditional 3 part septic.

Following treatment, the office wastewater is sprayed onto the grass surrounding the office building via a spray irrigation system. The bathhouse wastewater is discharged to the pollution control dams. Both systems have a quarterly monitoring and maintenance schedule in place that is undertaken by an external wastewater treatment system service contractor.

EPL 1770 also has a limit for faecal coliforms of 200 CFU/100 mL at the LDP. This is monitored for and reported on monthly. In addition, effluent stream monitoring is undertaken quarterly (monitoring parameters are detailed in **Section 5.3**) and annual soil sampling of the effluent irrigation area is undertaken, as per **Section 5.6**.

4.10 The Oil Water Separator

Water that is likely to be contaminated with oil and grease, such as runoff from the oil storage facilities, diesel tank storage, workshop / maintenance areas and wash bay is directed to and treated by an oil water separator.

The system includes a packed bed oil separation system where solids are removed in the grit trap and oily water is drawn from the sump through a floating skimmer, into the packed bed oil separator by a non-emulsifying pump. The system has a capacity of 2000 L/hr of through flow. The waste oil is collected in a container and the treated water flows by gravity to the pollution control dams.

A separate oil water separation system is installed on the condensate drain from the compressors on site. This system consists of an in-ground tank where water is passed through and under over a weir arrangement and then discharged to the pollution control dams.

Inspections and maintenance of the separation systems occurs regularly, in addition to water quality monitoring and analysis for total oil and grease at all monitoring points as per **Section 5.3**.

5 Monitoring

To ensure the continued functionality of the surface water management system and to assist CVC identify any potential issues with the system, an on-going water monitoring program is implemented, inclusive of water quality and stream health monitoring.

5.1 Baseline Water Quality Monitoring Data

CVC collates and maintains an up to date database of surface water quality monitoring data for all sampling at the mine. A summary of the baseline water quality data available for the site is presented in Section 3.5.2 of the SWA (GSSE, 2013).

5.2 Impact Assessment Criteria and Trigger Levels

5.2.1 Surface Waters

Table 5 provides water quality parameters and relevant limits to be measured at the LDP as per EPL 1770.

Table 5: Water Quality Monitoring Limits for Chain Valley Colliery

Parameter	Trigger Value	Source
Faecal coliform	200 colony forming units per 100 millilitres	EPL 1770
pH	6.5-8.5	EPL 1770
TSS	50 mg/L	EPL 1770

5.2.2 Underground Water

Groundwater monitoring is described within the GwMP provided in **Appendix 3.**

5.3 Surface Water Monitoring and Frequency

DC will continue to monitor as required by the EPL and also undertake monitoring beyond the requirements of the EPL. The monitoring locations, parameters to be monitored and the required frequency are detailed in **Table 6** with the position of these monitoring locations shown on **Figure 4**. Surface water quality monitoring summary plots for LDP1 for the period from January 2012 to December 2018 are presented in **Appendix 5**.

Table 6: Surface Water Quality Monitoring Locations and Frequency

Identification	Type of Monitoring Point	Parameter	Frequency	Sampling Method
Outlet to Creek (OTC)	Operational (where discharged water enters Swindles creek)	pH Total suspended solids Biochemical Oxygen Demand Faecal Coliforms Enterococci Total oil and grease Electrical Conductivity Total Nitrogen Total Phosphorus Anionic Surfactants	Monthly (min 4 weeks)	Grab sample
Dam 10 Outlet LDP1 and LDP27	EPL 1770 Licensed Discharge Points 1 (Dam piped discharge) and 27 (Dam spillway)			
USSP	Baseline Data (Swindles Creek Upstream of Site)			
RW1	Baseline Data (Swindles Creek Downstream of Site)			

All monitoring of waters should be undertaken in accordance with Approved Methods for Sampling and Analysis of Water Pollutants in NSW (DECCW, March 2004). Additionally, pollutant concentration measurements shall be determined in micrograms per litre and within ANZECC concentration limits unless noted otherwise.

Figure 4: CVC Surface Water Monitoring Locations

5.4 Stream Health Channel Flow and Riparian Vegetation Monitoring

A program to monitor creek line channel stability and health of riparian vegetation within Swindles Creek is undertaken along a short length of the downstream watercourse. Observations of stream health and stability are undertaken quarterly and recorded on the CVC *'Creek Stability Inspection'* form.

Monitoring of Swindles Creek, as per the creek stability form, includes multiple photographic points at representative locations. Photos are taken over multiple inspections in a repeatable manner, with the inspection specifically including:

- general observations of water quantity and quality;
- documenting locations and dimensions of significant erosive or depositional features;
- documenting evidence of erosion and exposed soils;
- noting general indicators of stream health, including abundance of flora and fauna; and
- a review and comparison of results to previous inspections.

Where degradation or adverse erosion is occurring, additional investigations will be undertaken to assess whether the impacts may be associated with the operation of the mine and ameliorative actions undertaken as required. In addition, further riparian vegetation monitoring will be undertaken in accordance with the Biodiversity Management Plan.

5.5 Groundwater Monitoring Program

Details of the groundwater monitoring program is contained in the GwMP in **Appendix 3**, which includes monitoring of mine inflows and private bore water levels.

5.6 Effluent Monitoring

In accordance with *Environmental Guidelines: Use of Effluent by Irrigation* (DEC, 2004), quarterly monitoring of the irrigated effluent from the AWTS at the administration building is undertaken. The parameters that are monitored are identified in **Table 7**.

Soil monitoring (of the surface soil and soil profile adjacent to the administration building) is also undertaken in accordance with *Environmental Guidelines: Use of Effluent by Irrigation* (DEC, 2004). Soil monitoring is undertaken annually using hand auger to assess soils within the irrigation area. The parameters monitored and frequency of monitoring is identified in **Table 8**, which is more frequent than the recommended sampling frequency.

Table 7: Monitoring of CVC AWTS Effluent Stream

Identification	Type of Monitoring Point	Parameter	Frequency	Sampling Method
AWTS	Effluent from AWTS	pH Electrical Conductivity Sodium Adsorption Ratio Total Dissolved Solids Total Suspended Solids Total Phosphorus Total Nitrogen Faecal Coliforms Enterococci Total Oil and Grease Biochemical Oxygen Demand	Quarterly	Grab sample

Table 8: Soil Monitoring at CVC

Monitoring Location	Parameter	Frequency of Sampling	
		Surface Soil	Soil Profile
Effluent Irrigation Area	pH	Annually	Annually
	Electrical Conductivity (EC) (dS/m)	Annually	Annually
	Nitrate-N	Annually	Annually
	Total N	Annually	Annually
	Available P	Annually	N/A
	Total P	Annually	Annually
	Exchangeable Sodium Percentage	Annually	Annually
	Heavy Metals & Pesticides	Annually	N/A
	P sorption	Annually	Annually

5.7 Additional Operational Monitoring

In addition to the other monitoring described above, DC also undertakes periodic surface water quality monitoring for dams within the site. This additional monitoring allows the performance of the surface water management system to be assessed for various areas around the site. CVC is also committed to monitoring water usage onsite. Water usage is currently monitored through the following:

- metering of the potable supply to site;
- monitoring of the volume of water pumped from the Great Northern Seam sump to the surface and
- maintaining records of the water cart operation, including fill times.
-

5.8 Inspections and Maintenance

All water management structures will be inspected regularly. **Table 9** contains the inspection schedule used to ensure the water management structures are functioning effectively throughout CVC. The inspections will also determine the scheduling of maintenance required for the structures.

Table 9: Inspection Schedule for Water Management Structures

To Be Inspected	Frequency
All water management structures	Monthly
Works In Progress (including temporary erosion and sediment control structures)	Weekly

In addition to these inspections, regular water quality monitoring is undertaken as described above. The results of this monitoring with regards to total suspended solids will assist in assessing the effectiveness of the water management system, along with highlighting any possible areas that need to have additional controls added or improve the function of existing controls.

All water management structures will be maintained in a functioning condition. Where controls are observed to be not functioning correctly, the controls will be restored to meet the required standard. The maintenance and monitoring of specific features of the site are described in the sections below.

5.8.1 Sediment Dams

Visual inspections of the sediment dams are undertaken to determine the clarity of the water and if any maintenance is required. The inspections also enable correct scheduling of de-silting works and prompt repairs and/or replacement of damaged works. When required, the silt from dams is removed and stored so that it is not able to be washed back into the dam. Documented inspections of the above are part of the Monthly Environmental Inspection which is scheduled via a work order (part of the CVC maintenance management system).

De-silting of dams is scheduled to occur annually. However, the schedule may be amended based on the above inspections and identified requirements.

5.8.2 Drainage Channels

For clean water diversions, any signs of erosion along the length of the drains should be noted and remedial works undertaken as required. Where significant erosion is observed, additional erosion controls are constructed e.g. establishment of vegetation cover, use of temporary sediment devices until the vegetation is established, scour protection (rock-armouring or erosion blanket) of the channel surface.

Where dirty water drainage channels contain in-line sumps, these will be cleaned on a regular basis depending on the accumulation of material within the sumps.

5.8.3 Temporary ESC Structures

Regular visual checks will be made of any temporary erosion and sediment controls (ESC) such as sediment filter fences, sandbag weirs etc. to ensure that they are functioning adequately. Structures will be repaired where required.

5.8.4 Roads and Hard Stand Areas

A water cart will be used around the site to ensure dust is kept to a minimum. This will be undertaken on an as needs basis, with more regular use during the warner months. The use of chemical dust suppressant is also being trialed to reduce water usage.

5.8.5 Washbay Oil Water Separator

The packed bed oil separator system is designed to minimise maintenance and servicing. As oil separator systems are critical for the reliable prevention of oil contamination, regular inspections/servicing are important. It is critical that the mechanisms be regularly checked for operation to prevent environmental contamination. Preventative maintenance may also prevent failures before they occur by detecting trends in functionality.

This system has specific weekly and monthly work orders that ensure the system is serviced and maintained.

All accumulated waste oils and solid material shall be disposed of periodically by a licensed operator. The weekly waste management inspection will determine waste oil levels and disposal requirements.

5.8.6 Compressor Condensate Oil Water Separator

Excess oil from the compressors and surrounds is contained, piped to a collection tank which is inspected weekly to ensure the system is serviced and maintained.

Any accumulated waste oil is then removed for recycling by licensed and approved waste management contractors.

5.8.7 Carpark

The carpark hardstand area shall be regularly maintained to minimise the generation of sediment. The maintenance strategy shall include the immediate removal or shaping of material that might result in concentrated flow paths by maintaining a smoothly graded surface. A water cart will be used around the site (as required) to ensure dust is kept to a minimum. A street sweeper is used a monthly basis to sweep the sealed entrance roads.

5.8.8 Underground Flow Monitoring Devices

Water flow monitoring appliances have been installed in the mine to measure pumped water volumes to and from the mine workings. These appliances shall be maintained in good working order, and if required, the mine will supply a test certificate to certify the current accuracy of the appliances furnished by the manufacturer or by some duly qualified person or organisation.

5.9 Data Recording and Publication

Recording of monitoring data will be undertaken in accordance with the requirements outlined in EPL 1770. DC will collate and maintain an up-to-date database of surface water quality monitoring data for all sampling at the mine. Monitoring results will be interpreted as they are received in order to ensure water quality is maintained within the desired parameters.

A summary of results, including daily volumetric discharge and water quality results, will be prepared monthly and made publicly available on the DC website (www.deltacoal.com.au) in accordance with the requirements of *Protection of the Environment Operations Act, 1997*.

The results will also be compared to relevant site operations and meteorological conditions to further interpret the results. This comparison between samples, sampling periods and against other factors will assist in identifying whether the activities on the site are in fact affecting the water quality of the local catchment.

Results of surface water quality monitoring will be reported in the Annual Review. The results will also be made available to the Community Consultative Committee members on a regular basis as part of the Environmental Monitoring and Reporting process, as well as to the Central Coast Council and Lake Macquarie City Council (LMCC).

6 Reporting

6.1 Regular Reporting

The water monitoring results will be reviewed on a monthly basis to confirm compliance with the conditions specified in **Section 5** or ensure corrective action is taken where results or trends indicate non-compliance or risk of future non-compliance.

A summary of monthly environmental monitoring results will be published on the DC website.

6.2 Annual Review

The water monitoring results will be reviewed on a monthly basis to confirm compliance with the conditions specified in **Section 5** or ensure corrective action is taken where results or trends indicate non-compliance or risk of future non-compliance.

The results will also be included in the Annual Review. The Annual Review will include:

- a summary of monitoring results,
- comparison against the water quality criteria;
- summary of previous years monitoring results;
- comparison against predictions in the Environmental Impact Statement (EIS);
- identify any trends in water quality/quantity;
- identify any non-conformances over the year; and
- describe any actions currently implemented or planned to ensure compliance with the water quality impact criteria.

The Annual Review will be forwarded to the relevant authorities including the DPIE, EPA and WaterNSW. The Annual Review will also be forwarded to members of the Community Consultative Committee and local Councils (Central Coast and Lake Macquarie) and will also be placed on the CVC website.

The EPA will be provided with an annual return, including monitoring details, as required by EPL 1770.

6.3 Incident or Non-Compliance Response and Reporting

Following detection or notification of an incident, site personnel at CVC will immediately focus on the mitigation of any potential environmental harm. Should potential or actual harm to the environment be identified, the appropriate regulatory authority shall be immediately notified, and remediation measures applied. Where ameliorative actions may reduce the threat or harm to the environment, action will be undertaken immediately to mitigate or rectify the issue. These actions will be followed by an investigation into the cause of the incident.

If monitoring reveals that, as a direct result of CVC operations, levels have exceeded the relevant criteria outlined in **Section 5,** DC will conduct an investigation into the source of the non-compliance. As detailed in Condition 7, Schedule 6 of SSD-5465, relevant agencies will be notified by phone or email at the earliest opportunity of an incident that causes or threatens to cause material harm to the environment. For all other incidents, relevant agencies will be notified by phone or email as soon as practicable.

An investigation will consider any activities and plant operation or other factors that may have caused or contributed to the incident or non-compliance. This will include a review of rainfall data, an investigation regarding the water source, and an inspection of all relevant pollution control structures to ensure they are functioning correctly. Aspects to be inspected include:

- integrity of all structures to capture/convey flows as designed;
- level of sediment in pollution control dams and drains;
- amount of vegetation (reeds) in pollution control dams, which may affect the pH of the water;
- the location of the water source; and
- the presence of any hydrocarbon spills underground or on the surface in the vicinity of pollution control structures.

The written report will be provided to any affected landowner and/or existing tenants, including tenants of mine owned properties, to the DPIE, EPA and any other relevant stakeholders within 7 days of the date of the incident or being made aware of the incident (such as receiving monitoring data). The report will:

- describe the date, time and nature of the observation;
- identify the cause (or likely cause) of the damage;
- describe what action has been taken to date; and
- describe the proposed measures to address the impacts and prevent further such occurrences.

DC will implement the recommendations of the investigation in order to address any future non-compliance issues. Additional details of the incident reporting process are provided in the Environmental Management Strategy.

The GwMP in **Appendix 3** contains the assessment triggers and ameliorative measures relevant to the groundwater monitoring.

Any incidents or complaints will be recorded and fully investigated to find root causes and corrective actions implemented where necessary. Additionally, the following measures will be undertaken:

- a review of management practices to systematically identify and implement options to modify site practices so as to ensure effective water management and erosion and sediment control activities in order to achieve the goals stated in this plan; and
- additional water quality monitoring may be conducted at a complainant's request at an appropriate frequency.

7 Stakeholder Management, Response and Training

7.1 Complaint Protocol

DC has a 24-hour telephone hotline (1800 115 277) for members of the public to lodge complaints, concerns, or to raise issues associated with the operation. This service aims to promptly and effectively address community concerns and environmental matters. All complaints are recorded and responded to.

The information recorded in the complaint register includes:

- date and time the complaint was lodged;
- personal details provided by the complainant;
- nature of the complaint;
- action taken or if no action was taken, the reason why; and
- follow up contact with the complainant.

7.2 Independent Review

As detailed in Condition 2, Schedule 5 of SSD-5465, an Independent Review can be requested by a landowner who "*considers the development to be exceeding the relevant criteria in Schedule 3".*

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

(a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the 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 Secretary and landowner a copy of the independent review

7.3 Dispute Resolution

If any disputes are not adequately addressed by the complaints handling process then they will be handled by the Environment and Community Coordinator. If the response of CVC is not considered to satisfactorily address the concern of the complainant, a meeting may be convened with the complainant, Mine Manager together with the Environment and Community Coordinator to determine any further options to reduce potential impacts.

Any actions agreed from the meeting will be implemented by CVC. After implementation of the proposed actions the complainant will be contacted and advice sought as to the satisfaction or otherwise with the measures taken.

If no agreed outcome is determined or the complainant is still not satisfied by the action taken, then an Independent Review may be requested by the complainant. If determined to be warranted by the Secretary, an independent review will be undertaken in accordance with the process identified in Schedule 5 of SSD-5465.

7.4 Training, Awareness and Competence

Training is an essential component of the implementation phase of this WMP. The Environment and Community Coordinator will ensure that training and awareness processes are implemented to manage, identify and minimise potential impacts of CVC and to ensure personnel are aware of their roles and responsibilities in terms of water quality management and erosion and sediment control.

Generally training at CVC consists of induction training for new starters and contractors along with environmental awareness training at two-year intervals and ongoing “toolbox” training for all permanent employees as required. Site inductions also specifically identify that no unauthorised clearing is to occur.

As the document owner, the Environment and Community Coordinator is the contact point for any person that does not understand this document or their specific requirements and will provide guidance and training to any person that requires additional training regarding this management plan.

8 Audit and Review

8.1 Overview

This document shall be reviewed, and if necessary revised, annually or within 3 months of the following;

- the submission of an Annual Review;
- the submission of an incident report;
- the submission of an independent environmental audit; and
- following any modification to the development consent or EPL.

8.2 Audits

Internal and external audits of this document and all other Environmental Management System documents are to be undertaken every three years. Improvements from the audit are to be incorporated in the site action database to ensure the actions are assigned to the relevant people and completed.

Audits shall be carried out by personnel who have the necessary qualifications and experience to make an objective assessment of the issues. The extent of the audit, although pre-determined, may be extended if a potentially serious deviation from this document is detected.

Any audit non-conformances and/or improvement opportunities will have corrective and preventative actions implemented to avoid recurrence, these actions will be loaded into the site Incident Database to ensure the actions are assigned to the relevant people and completed.

External audits will be conducted utilising external specialists and will consider this document and related documents. External auditors shall be determined based on skills and experience and upon what is to be accomplished.

An Independent Environmental Audit (IEA) was undertaken during June 2019. In accordance with SSD-5465 Schedule 6, Condition 9, IEA's will be scheduled for every three years thereafter (unless the Secretary directs otherwise) by an audit team whose appointment has been endorsed by the Secretary.

9 Records and Document Control

9.1 Records

Generally, the Environment and Community Coordinator will maintain all Environmental Management System records which are not of a confidential nature. Records that will be maintained include:

- monitoring data and equipment calibration;
- environmental inspections and auditing results;
- environmental incident reports;
- the complaints register; and
- licences and permits.

All records will be stored so that they are legible, readily retrievable and protected against damage, deterioration and loss. Records will be maintained for a minimum of 4 years or as otherwise required under any legislation, licence, lease, permit or approval.

9.2 Document Control

This document and all others associated with the Environmental Management System shall be maintained in a document control system which is in compliance with the site Document Control Standard which is available to all site personnel. Any proposed change to this document will be via the Environment and Community Coordinator. Details on document revisions are provided in **Table 10**.

Table 10: Document Revision Details

Version	Date	Details of Revision	Company	Reviewed by/ Authorised by
1	23/08/2012	Revision 1	LakeCoal	GSS Environmental Chris Ellis
2	21/07/2015	Revision 2	LakeCoal	Niche Environment and Heritage Chris Ellis
3	30/11/2019	Updated to Delta Coal format	Delta Coal EMM Consulting	Sally Callander Chris Armit Katie Weekes

10 Roles and Responsibilities

10.1 Responsibilities

All employees and contractors of Chain Valley Colliery are responsible for environmental management. However, various positions in the organisation have roles, responsibilities and authorities for managing environmental aspects, action plans, programs and controls.

Roles and responsibilities specific to completing the requirements of this WMP are identified in **Table 11**.

Table 11: Water Management Roles and Responsibilities

Role	Responsibilities
General Manager	• Ensure that adequate financial and personnel resources are made available for the implementation of the WMP.
Manager of Mining Engineering	• Overall responsibility for environmental compliance with Mining Lease, EPL, Development Consent and other mining approvals as they pertain to water management.
Environment and Community Coordinator	• Implementing the forward works program; • Planning for adequate resources to implement this site WMP. • Approving revised versions of this site WMP; • Co-ordination of external audits, corporate reporting and management; • Co-ordinate environmental monitoring, reporting, inspections, environmental training, authority liaison, maintaining complaints register and community liaison; • Allocation of resources within area of responsibility and budget; • The implementation and adherence to this site WMP; • Providing adequate training to employees and contractors regarding their requirements under this site WMP; • Contractor management; and • Delegating tasks associated with this site WMP when responsible personnel are absent.
Employees and contractors	• Comply with the requirements of this WMP.

11 References & Associated Documents

Documents used in the preparation of this management plan are detailed in **Table 12**.

Table 12: References and Associated Documents

Reference Type	Document
Australian standards	AS/NZS ISO 14001:2004 *Environmental management systems – Requirements with guidance for use* AS/NZS ISO 14004:2004 *Environmental management systems – General guidelines on principles, systems and support techniques*
Legislation and regulations	NSW EPA, EPL 1770 *Environment Protection License 1770* Development Consent SSD-5465 (Modification 2) dated 16 December 2015 for the Mining Extension 1 Project *Environmental Planning and Assessment Act 1979* *Mining Act 1992* *Protection of the Environment Operations Act, 1997* *Water Act 1912* *Water Management Act 2000*
Delta Coal documents	EMS 001 Mannering Colliery - Environmental Management Strategy. LakeCoal, 2017. Chain Valley Colliery Annual Review 2016. Doc No. REP 00025, 28 April 2017. LakeCoal, 2018. Chain Valley Colliery Annual Review 2017. Doc No. REP 00040, 30 March 2018. LakeCoal, 2019. Chain Valley Colliery Annual Review 2018. Doc No. REP 00058, 16 May 2019.
External documents	Australian and New Zealand Environment Conservation Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), National Guidelines for Sewerage Systems - Effluent Management, 1997. Australian and New Zealand Environment Conservation Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC

	Guidelines), October 2000. Australian Government, Charter: National Water Quality Management Strategy, 2018. DECCW, March 2004. Approved Methods for Sampling and Analysis of Water Pollutants in NSW. GEOTERRA, 2019, Groundwater Management Plan, Chain Valley Colliery. GEOTERRA, 2014, Groundwater Management Plan, Chain Valley Colliery. GEOTERRA, March 2013, Chain Valley Colliery Mining Extension 1 Groundwater Assessment. GSS Environmental, March 2013, Chain Valley Mining Extension 1 Project Surface Water Assessment. Landcom, 2004 and Department of Environment and Climate Change (DECC), 2008. Managing Urban Stormwater: Soils and Construction (the Blue Book), Volume 1 and Volume 2E – Mines and Quarries. NSW Water Quality and River Flow Objectives, September 1999. NSW State Rivers and Estuaries Policy, 1993. NSW Groundwater Quality Protection Policy, adopted in 1998. NSW Groundwater Quantity Management Policy. NSW Department of Environment and Conservation (DEC), Environmental Guidelines: Use of Effluent by Irrigation, 2004. The NSW State Groundwater Dependent Ecosystems Policy, adopted in 2002.

12 Definitions

ANZECC Australia New Zealand Environment Conservation Council

AWTS Aerated Waste Water Treatment System

DECCW Former NSW Department of Environment, Climate Change and Water

DP&E NSW Department of Planning and Environment (former)

DPIE NSW Department of Planning, Industry and Environment

DoI - Water NSW Department of Industry (Water)

DRE Division of Resources and Energy (within the Department of Trade and Investment, Regional Infrastructure and Services)

EPA Environment Protection Authority

EP&A Act Environmental Planning and Assessment Act 1979

EPL Environment Protection License

GwMP Groundwater Management Plan

LDP Licensed Discharge Point

LMCC Lake Macquarie City Council

MPL Mining Purposes Lease

Mt Million Tonnes

NOW NSW Office of Water (former)

OEH Office of Environment and Heritage

POEO Act *Protection of the Environment Operations Act 1997*

ROM Run of Mine

Secretary Secretary of the Department of Planning and Environment, or nominee

SSD-5465 Development Consent SSD-5465 (for the Chain Valley Colliery Mining Extension 1 Project)

TARP Trigger Action Response Plan

TSS Total Suspended Solids

WMP Water Management Plan

WSC Wyong Shire Council (now part of Central Coast Council)

Appendix 1: Consultation

Appendix 2: Development Consent Summary

Chain Valley Colliery Development Consent SSD-5465 Summary

This WMP has been prepared in accordance to Schedule 3, Condition 21 of SSD-5465, which states the requirements of the WMP and what it must address. **Table A1** outlines the requirements of the WMP and where this document addresses these requirements.

Table A1: Requirements from Chain Valley Colliery Development consent SSD-5465

Condition No.	Requirement	Relevant section of this document
	Schedule 2 Administrative Conditions	
18	***Updating and Staging Strategies, Plans or Programs*** *The Applicant must regularly review the strategies, plans and programs required under this consent and ensure that these documents are updated to incorporate measures to improve the environmental performance of the development and reflect current best practice in the mining industry. To facilitate these updates, the Applicant may at any time submit revised strategies, plans or programs for the approval of the Secretary.* *With the agreement of the Secretary, the Applicant may also submit any strategy, plan or program required by this consent on a staged basis. With the agreement of the Secretary, the Applicant may prepare a revision or stage of any strategy, plan or program required under this consent without undertaking consultation with all parties nominated under the applicable condition in this consent.* *Notes:* • *While any strategy, plan or program may be submitted on a staged basis, the Applicant must ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times.* • *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program.*	**Section 8**
	Schedule 3 Specific Environmental Conditions	
18	*The Applicant shall prepare and implement a Water Management Plan for the surface facilities sites to the satisfaction of the Secretary.* *This plan must be prepared in consultation with DPI Water and EPA, by*	**Section 1.4**

	suitably qualified and experienced persons whose appointment has been endorsed by the Secretary and submitted to the 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;*	**Section 3**
	(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 sulfate soils, if encountered;* • *activities that would involve ground disturbance at the site; and* • *monitoring and reporting procedures.*	**Section 4**
	(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;*	**Section 5**
	(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*	**Appendix A**
	(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*	**Appendix C**

	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 shall implement the approved management plan as approved from time to time by the Secretary. *NOTE: The Secretary may require the Applicant to implement upgrades and other changes identified under paragraph (e), in accordance with condition 4 of schedule 2.*	**This document**
	Statement of Commitments	
	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. Delta Coal 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 DPI 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.*	**GwMP in Appendix A**
	Although it is not anticipated that private bore yields would be impacted due to subsidence, should such a situation arise, Delta Coal would provide an alternative water supply until the impacted bore recovers.	**GwMP in Appendix A**
	Any monitored or reported adverse impacts on the yield, saturated thickness or quality of a private registered bore will be investigated by Delta Coal. 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, Delta Coal will enter into negotiations with the affected landowners and the Mine Subsidence Board 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;*	**GwMP in Appendix A**

	• *provision of access to alternative sources of water; and/or* • *compensation to reflect increased water extraction costs (e.g., 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. LakeCoal will:*	**This document**
	update the WMP to include any changes as a result of the proposed modification;	**This document**
	limit the main underground pumps to a maximum pump out rate of 10.5 ML/day within 12 months of approval;	**Section 3.2.3**
	request an amendment of EPL 1770 to include a condition on the daily discharge volume limit stating that "Exceedence 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";	**Section 1.1**
	undertake daily measurements of discharge volumes and report publically on a monthly basis via Delta Coal's website;	**Section 5.9**
	continue collection of baseline water quality data to aid in the development of appropriate discharge water quality trigger values;	**Section 5.3**
	engage a 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;	**Section 2.4**
	investigate water saving measures to minimise the amount of potable water required from WSC for Colliery operations;	**Section 4.7**
	quantify the groundwater storage capacity in the Great Northern and Wallarah Seams;	**Section 4.3**
	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;	**Section 5.6**
	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	**Section 5.4**
	record monitoring data in accordance with the Colliery's WMP and EPL 1770. Monitoring data will be interpreted as it is received to ensure	**Section 5.9**

	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 Wyong and Lake Macquarie Councils.	

CVC operates under EPL 1770 issued by the NSW EPA under the POEO Act. The EPL has been modified a number of times, most recently on the 2 April 2019. CVC has two Licensed Discharge Points (LDP) under EPL 1770. The main discharge point is defined in the EPL as Point 1 and referred to herein as Licensed Discharge Point 1 (LDP1). Licenced Discharge Point 27 is the spillway which rarely discharges.

Relevant sections of EPL 1770 detail water related requirements and are reproduced in **Table A2** below along with identification of where the requirements are addressed in this document.

Table A2: Environment Protection Licence 191 Water Quality Requirements

<table>
<tr><th>Condition No.</th><th>Requirements</th><th>Relevant section of this document</th></tr>
<tr><td>2</td><td>Discharges to Air and Water and Applications to Land</td><td></td></tr>
<tr><td>P1</td><td>Location of monitoring/discharge points and areas</td><td></td></tr>
<tr><td>P1.2</td><td>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.</td><td>Noted</td></tr>
<tr><td>P1.3</td><td>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
<table>
<tr><th>EPA Identi-fication no.</th><th>Type of Monitoring Point</th><th>Type of Discharge Point</th><th>Location Description</th></tr>
<tr><td>1</td><td>Discharge to waters Discharge quality and volume monitoring</td><td>Discharge to waters Discharge quality and volume monitoring</td><td>Discharge to waters and monitoring from final settlement pond via low level discharge identifed as EPA 1 on plan of the premises titled "EPL premises Plan Fig 1 Project Extents, Monitoring and Compliance Locations dated 12 March 2015 DOC15/83810.</td></tr>
<tr><td>27</td><td>Discharge to waters Discharge quality and volume monitoring</td><td>Discharge to waters Discharge quality and volume monitoring</td><td>Discharge to waters via concrete high level spillway from final settlement pond adjacent to EPA 1 on plan of the premises titled "EPL premises Plan Fig 1 Project extents, Monitoring and Compliance Locations" dated 12 March 2015 DOC15/83810.</td></tr>
</table></td><td>Section 5</td></tr>
<tr><td>3</td><td>Limit Conditions</td><td></td></tr>
<tr><td>L1</td><td>Pollution of Waters</td><td></td></tr>
<tr><td>L1.1</td><td>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.</td><td>Section 2</td></tr>
</table>

<table>
<tr><td>L2</td><td>Concentration Limits</td><td></td></tr>
<tr><td>L2.1</td><td>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.</td><td>Section 5</td></tr>
<tr><td>L2.2</td><td>Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.</td><td>Section 5</td></tr>
<tr><td>L2.3</td><td>To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.</td><td>Noted</td></tr>
<tr><td>L2.4</td><td>Water and/or Land Concentration Limits
Point 1, 27
<table>
<tr><th>Pollutant</th><th>Units of Measure</th><th>50 percentile concentration limit</th><th>90 percentile concentration limit</th><th>3DGM concentration limit</th><th>100 percentile concentration limit</th></tr>
<tr><td>Faecal Coliforms</td><td>colony forming units per 100 millilitres</td><td></td><td></td><td></td><td>200</td></tr>
<tr><td>pH</td><td>pH</td><td></td><td></td><td></td><td>6.5-8.5</td></tr>
<tr><td>Total suspended solids</td><td>milligrams per litre</td><td></td><td></td><td></td><td>50</td></tr>
</table></td><td>Section 5</td></tr>
<tr><td>L3</td><td>Volume and mass limits</td><td></td></tr>
<tr><td>L3.1</td><td>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.
<table>
<tr><th>Point</th><th>Unit of Measure</th><th>Volume/Mass Limit</th></tr>
<tr><td>1</td><td>kilolitres per day</td><td>12161</td></tr>
<tr><td>27</td><td>kilolitres per day</td><td>12161</td></tr>
</table></td><td>Section 5</td></tr>
<tr><td>L3.2</td><td>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.</td><td>Section 5</td></tr>
<tr><td>M2</td><td>Requirement to monitor concentration of pollutants discharged</td><td></td></tr>
<tr><td>M2.3</td><td>Water and/ or Land Monitoring Requirements</td><td>Section 5</td></tr>
</table>

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
pH	pH	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	pH	Daily during any discharge	Grab sample
Total suspended solids	milligrams per litre	Daily during any discharge	Grab sample

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. **Section 5**

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. **Section 5**

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

<table>
<tr><td>G2</td><td>Other general conditions</td><td></td></tr>
<tr><td>G2.1</td><td>Completed programs
<table>
<tr><th>Program</th><th>Description</th><th>Completed Date</th></tr>
<tr><td>Coal Mine Particulate Matter Control Best Practice</td><td>Requires licensee to conduct a site specific Best Management Practice (BMP) determination to identify ways to reduce particle emissions</td><td>28-September-2012</td></tr>
<tr><td>Assessment of Potential Impacts of Metals in wastewater</td><td>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.</td><td>23-October-2013</td></tr>
<tr><td>Air Quality Monitoring</td><td>The licensee must evaluate best locations and install monitoring devices as defined in Project Approval MP10_0161 under the Environent Planning & Assessment Act 1979.</td><td>31-December-2013</td></tr>
<tr><td>PRP4 - Upgrade to Clean and Dirty Water Management System</td><td>The licensee must review and upgrade separation of the Clean and Dirty Water Management System and review and upgrade bunding.</td><td>14-August-2015</td></tr>
<tr><td>PRP5 - Remediation of Dam Wall and Spillway formalisation</td><td>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</td><td>27-February-2015</td></tr>
<tr><td>PRP 6 Upgrade to Sewage Treatment Systems</td><td>Assessment of options for improved disinfection of effluent from STP on licenced premises.</td><td>06-January-2015</td></tr>
<tr><td>PRP7 Sewage Treatment System Concept Design</td><td>Provide the EPA with a Concept Design and Timetable for Implementation of Upgrade to the Sewage Treatment System</td><td>19-February-2016</td></tr>
</table></td><td>Noted</td></tr>
</table>

Appendix 3: Groundwater Management Plan (GwMP)

GeoTerra

DELTA COAL PTY LTD

CHAIN VALLEY COLLIERY
GROUNDWATER MANAGEMENT PLAN

CVC3-R3A
30 September 2019

GeoTerra Pty Ltd **ABN 82 117 674 941**

PO Box 220 Canterbury NSW 2193

Phone: 02 9787 9137 Fax: 02 9787 1874 Mobile 0417 003 502 Email: geoterra@iinet.net.au

Authorised on behalf of GeoTerra Pty Ltd:	
Name:	Andrew Dawkins
Signature:	
Position:	Principal Hydrogeologist

Date	Rev.	Comments
09.09.2019		Initial Draft
30.09.2019	A	Incorporate review comments

TABLE OF CONTENTS

FIGURES

TABLES

1. INTRODUCTION

This revised Groundwater Monitoring Program (GwMP) has been prepared in compliance with Schedule 3 (Condition 18D) of the Delta Coal Pty Ltd (DC) Chain Valley Colliery Extension Project Approval SSD 5465 for the addition of Miniwall S4.

This report is to be read in conjunction with the Water Management Plan prepared for Chain Valley Colliery (Delta Coal, 2019).

This GwMP includes:

- a groundwater water quality and quantity monitoring program;
- trigger levels for mining impacts on groundwater systems;
- procedures to be followed in the event that monitoring of groundwater indicates an exceedance of trigger levels;
- measures to mitigate, remediate and/or compensate for identified impacts;
- a protocol for the notification of trigger level exceedances, and;
- a contingency plan where, in the event of adverse effects on groundwater quality and/or quantity due to mining impacts, Chain Valley Colliery will provide an equivalent supply until the affected supply is restored, or as agreed with the landowner and the NSW Department of Industry - Water (DIW).

Groundwater related operations at Chain Valley Colliery include the:

- historic Great Northern and Wallarah seams bord and pillar workings;
- current Fassifern Seam development as well as miniwall workings; and
- water storage and management facilities owned and operated by Chain Valley Colliery.

Operation of the GwMP needs a high level of management input to operate Chain Valley Colliery within the relevant requirements and various water licences, particularly to ensure compliance with the water discharges authorised by Environment Protection Licence (EPL) 1770.

An essential part of the plan is monitoring of all groundwater inflows and extraction into and out of the underground with reliable flow meters, as well as monitoring of groundwater levels and water quality in private bores.

This information is necessary for periodical reviews of the groundwater management system and to support any updates/changes to licences.

The proposed mitigation measures minimise and manage the impacts of any potential adverse effects on local aquifers within the GwMP area.

The proposed mitigation measures minimise, where possible, the impacts of the proposed mining on the various groundwater sources, aquifers or groundwater dependent ecosystems that may be present in the Project Area.

1.1 Objectives

The objective of the GwMP is to operate Chain Valley Colliery so that the subsurface mining operations will be conducted in a manner which minimises the potential impacts on groundwater flow and quality, aquifer integrity, groundwater dependent ecosystems and other off-site groundwater related impacts.

In order to achieve this goal, the GwMP will be used to establish procedures to:

- measure, control, mitigate and repair potential impacts that could, or do, occur to the groundwater system overlying Chain Valley Colliery; and
- identify, measure, minimise or where possible, avoid potential significant adverse impacts that can result from mining and subsidence on the groundwater systems within the Project Area.

In addition, the GwMP will be used to:

- monitor groundwater system changes in relation to the leaseholder's mining activities;
- assess the pre and post-mining condition of groundwater systems in the lease area;
- ensure all relevant groundwater criteria are met;
- minimise and manage any impacts on the availability of groundwater to potentially impacted residents, landholders or other groundwater users;
- minimise adverse changes on groundwater dependent ecosystems, where present;
- provide a forum to record and discuss mining impacts; and
- provide an annual report on the monitoring, observations and actions conducted within the preceding 12 months to DIW.

These objectives will be met by:

- monitoring groundwater seepage and groundwater quality in the workings during mining within the mine lease area;
- installation of water monitoring appliance(s) to measure pumped water volumes to and from the mine workings. These appliances will be maintained in good working order. If required the mine will supply a test certificate to certify the current accuracy of the appliance(s) furnished by the manufacturer or by some duly qualified person or organisation. The mine water pumping records will be maintained and supplied to DIW at the end of the water year;
- ensuring that any tailwater drainage will not be allowed to discharge onto adjoining roads, crown land or other lands, or into any unauthorised stream, or any aquifer, by surface or subsurface drains or pipes or any other means without appropriate approval;
- ensuring that any groundwater extracted from the works will not be discharged into any watercourse or source of groundwater except in compliance with the Protection of the Environment Operations Act (1997);
- any works used for the purpose of conveying, distributing or storing groundwater from the works will not be constructed or installed so as to obstruct the free passage of floodwaters flowing in, to or from a river or lake;
- all groundwater extracted from the works will be used or applied only on such land, and for such purposes, as approved by DIW, and;
- providing a forum to report, discuss and record impacts to the groundwater system that involves the Chain Valley Colliery, stakeholders and DIW, as required.

1.2 Scope

The GwMP is to be used to protect, monitor and manage the condition of the groundwater system within the Chain Valley Colliery lease area that may potentially be impacted due to coal mining and mine subsidence.

The GwMP also applies to persons employed or engaged by Chain Valley Colliery when carrying out activities described by this plan.

This GwMP is to be read in conjunction with the current version of the Water Management Plan (WMP) which outlines the monitoring and management of specific factors relating to surface water and groundwater issues due to the predicted subsidence.

All other water management components not directly related to the GwMP are contained as part of the WMP.

The GwMP covers mining until completion of Domains 1 and 2, although the plan may be used beyond that benchmark with appropriate modification.

1.3 Definitions

For the purpose of this document, the area addressed in the GwMP is defined as the groundwater systems within the Chain Valley Colliery project approval area. The main features in the GwMP area shown in **Figure 1** include the:

- current Chain Valley Colliery workings in the Fassifern Seam;
- the proposed extraction within Domains 1 and 2; and
- the proposed extraction of Miniwalls S2, S3 and S4.

1.4 Limitations

This GwMP is based on current monitoring data and the proposed and approved operational aspects relating to Chain Valley Colliery. The relevant groundwater features have been identified from:

- existing studies;
- data supplied by Chain Valley Colliery representatives; and
- associated consultant's reports in the Lake Macquarie area.

The impacts of mining on the groundwater system have been assessed in previous studies (see references). However, it is recognised that prediction and assessment of changes to, and effects from, operation of the Colliery on the groundwater system can be relied upon only to a certain extent.

The groundwater study prepared for the Chain Valley Colliery Mining Extension 1 Groundwater Assessment (GeoTerra, 2013) determined there is a low potential for the mine's impacts on the groundwater system to exceed the predictions and assessments. However, the possibility of impacts above predictions has been considered in this plan.

The GwMP will not necessarily prevent impacts from the proposed mining, but does identify appropriate procedures to manage the impacts within tolerable limits and identifies procedures that can be followed should evidence of increased impacts and unacceptable risk emerge.

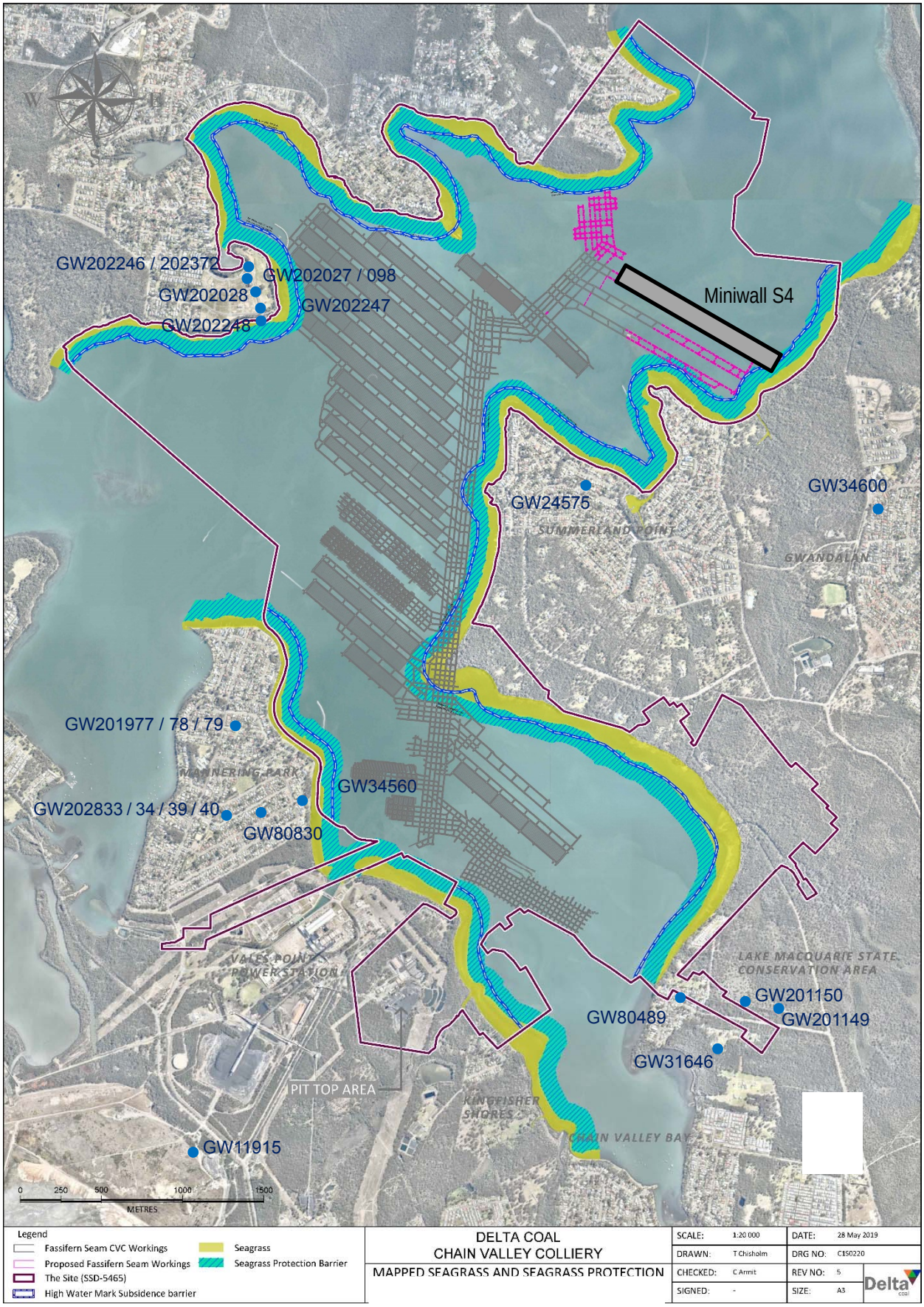

Figure 1 Chain Valley Colliery Project Approval Area and Groundwater Bores

2. LEGISLATION

The following sub-sections outline NSW statutory requirements that apply to the mining operation with respect to groundwater.

2.1 Water Management Act 2000

The key legislation for the management of water in the project area is the *Water Management Act 2000* (the Act), which regulates water use for rivers and aquifers where water sharing plans have commenced.

Under the Act, DIW has prepared a range of statutory water management plans covering aspects such as water sharing, water use, drainage management and floodplain management. In NSW, 36 water sharing plans have commenced, covering 80 percent of water currently extracted. The plans cover most of the regulated river systems (those controlled by major dams for rural water supplies), a number of unregulated river systems and the major inland alluvial aquifers.

The project area is located in the *South Lake Macquarie Water Source* section of the Water Sharing Plan - Hunter unregulated water sources.

The object of the Act is the sustainable and integrated management of the State's water for the benefit of both present and future generations. The Act provides arrangements for controlling land-based activities that affect the quality and quantity of the State's water resources. It provides for four types of approval:

- water use approvals – authorise the use of water at a specified location for a particular purpose, for up to ten years;
- water management work approvals;
- controlled activity approvals; and
- aquifer interference activity approvals – authorise the holder to conduct activities that affect the aquifer. This approval is for activities that intersect groundwater, other than water supply bores and may be issued for up to ten years.

For controlled activities and aquifer interference activities, the Act requires that the activities avoid or minimise impacts on the water resource and land degradation, and where possible the land must be rehabilitated.

2.2 State Groundwater Policy

The *NSW State Groundwater Policy* (Framework Document) was adopted in 1997 and aims to manage the State's groundwater resources to sustain their environmental, social and economic uses. The policy has three component parts:

- The *NSW Groundwater Quality Protection Policy*, adopted in December 1998;
- The *NSW State Groundwater Dependent Ecosystems Policy*, adopted in 2002; and
- The *NSW Groundwater Quantity Management Policy*.

2.2.1 Groundwater Quality Protection

The *NSW Groundwater Quality Protection Policy* (Department of Land and Water Conservation, 1998), states that the objectives of the policy will be achieved by applying the management principles listed below.

- all groundwater systems should be managed such that their most sensitive identified beneficial use (or environmental value) is maintained;
- town water supplies should be afforded special protection against contamination;
- groundwater pollution should be prevented so that future remediation is not required;

- for new developments, the scale and scope of work required to demonstrate adequate groundwater protection shall be commensurate with the risk the development poses to a groundwater system and the value of the groundwater resource;
- a groundwater pumper shall bear the responsibility for environmental damage or degradation caused by using groundwater that is incompatible with soil, vegetation and receiving waters;
- groundwater dependent ecosystems will be afforded protection;
- groundwater quality protection should be integrated with the management of groundwater quality;
- the cumulative impacts of developments on groundwater quality should be recognised by all those who manage, use, or impact on the resource; and
- where possible and practical, environmentally degraded areas should be rehabilitated and their ecosystem support functions restored.

2.2.2 Groundwater Dependent Ecosystems

The *NSW State Groundwater Dependent Ecosystems Policy* (Department of Land and Water Conservation, 2002) is specifically designed to protect valuable ecosystems which rely on groundwater for survival so that, wherever possible, the ecological processes and biodiversity of these dependent ecosystems are maintained or restored for the benefit of present and future generations. The policy defines Groundwater Dependent Ecosystems (GDEs), as *"communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater".*

Five management principles establish a framework by which groundwater is managed in ways that ensure, whenever possible, that ecological processes in dependent ecosystems are maintained or restored. A summary of the principles follows:

- GDEs can have important values. Threats should be identified and action taken to protect them;
- groundwater extractions should be managed within the sustainable yield of aquifers;
- priority should be given to ensure that sufficient groundwater is available at all time to identified GDEs;
- where scientific knowledge is lacking, the precautionary principle should be applied to protect GDEs; and
- planning, approval and management of developments should aim to minimise adverse effects on groundwater by maintaining natural patterns, not polluting or causing changes to groundwater quality and rehabilitating degraded groundwater systems.

2.2.3 Groundwater Quantity Protection

The objectives of managing groundwater quantity in NSW are to:

- achieve the efficient, equitable and sustainable use of the State's groundwater;
- prevent, halt and reverse degradation of the State's groundwater and/or its dependent ecosystems;
- provide opportunities for development which generate the most cultural, social and economic benefits to the community, region, state and nation, within the context of environmental sustainability; and
- involve the community in the management of groundwater resources.

3. CURRENT AND PROPOSED OPERATIONS

Chain Valley Colliery is an underground coal mine operated by Delta Coal Pty Ltd (Delta Coal).

The Colliery is located in the Newcastle Coalfields at the southern end of Lake Macquarie in NSW, and is approximately 60 kilometres south of Newcastle, within the Swansea-North Entrance Mine Subsidence District.

The project area incorporates the relatively flat pit top area, existing ventilation shaft and fan site on Summerland Point, as well as foreshore areas and Lake Macquarie.

The terrestrial land within the GwMP area is gently undulating and drains to Lake Macquarie.

Chain Valley Colliery commenced operation in the 1960's extracting coal from the Wallarah seam, the Great Northern Seam and the Fassifern Seam, and currently conducts mining within leases ML 1051, CCL 721 and ML 1632.

The current Fassifern Seam Miniwalls are located underneath Lake Macquarie, within and to the north of Chain Valley Bay.

The mine has completed extraction of Miniwalls 1 to 12 (MW1 to MW12) and has an approved Extraction Plan for Miniwalls N1 and S1, S2 and S3 in the Fassifern Seam. At the time of writing, the Chain Valley Colliery has completed MWS1 and N1.

No current or proposed secondary extraction underlies any terrestrial based surface water catchments, with all secondary extraction proposed to be underneath the saline, tidal region of Lake Macquarie.

Chain Valley Colliery currently has Development Consent (SSD-5465 – as modified) for:

- extraction of up to a maximum of 2.1 million tonnes per annum until 31 December 2027 through continued mining via first workings and miniwall methods within the Fassifern Seam;
- continued coal transport for the surface facilities site;
- continued use of the existing surface facilities, and;
- continuation of passive underground activities within the old workings of the Wallarah seam, Great Northern seam and the Fassifern Seam.

The approved mining area is approximately 200m below the sediments of Lake Macquarie, within a boundary set to exclude secondary extraction within the High Water Mark Subsidence Barrier or the Seagrass Protection Barrier**.**

Bord and pillar mining was commenced in the Fassifern Seam in 2006 and secondary extraction in the form of miniwall mining method in the Fassifern Seam commenced in 2011.

The S2 miniwall panel is being mined at 97m wide (rib to rib) with a 40m wide inter-panel pillar, whilst the proposed miniwall panels S3 and S4 will have the same width. These panel widths being significantly less than those previously proposed for Chain Valley and adjacent mines – for example, at Wyee Colliery Longwalls 17 to 21 were up to 150m wide, and were extracted between 150m and 180m below surface.

The Development Consent (SSD-5465 – as modified) was approved on 23 December 2013 which permitted the above activities.

Historically, Chain Valley Colliery has mined within the Wallarah and Great Northern seams to the east with via bord and pillar methods, while to the south west and west Wyee State Mine (now named Mannering Colliery) has mined the Great Northern and Fassifern seams using bord and pillar and longwall extraction.

Mining within the Wallarah and Great Northern Seams will not be undertaken as part of the

Project.

The maximum water depth within the proposed mining areas is greater than 5m, whilst sediment on the bottom of the lake varies from 9 – 23m deep over MWS2, 3 and 4.

Overburden above the Fassifern Seam over Miniwalls S2 and S3, including the lake sediments, ranges from 160 – 171m with a rock cover thickness of 138 – 158m (Strata^2, 2019).

The maximum height of connective fracturing is predicted to be between 94 and 96m for Miniwall S4 (Strata^2, 2019).

3.1 Adjacent Workings

Chain Valley Colliery is entirely surrounded by the existing Mannering, Myuna and Wallarah Collieries as well as by the historic Newvale and Moonee Collieries.

Mannering Colliery (formerly the Wyee State Mine), has conducted longwall mining in the Great Northern and Fassifern seams since the 1960s. Extraction continued until 2002, when mining became uneconomic. The mine was temporarily shut down until 2004 when it was reopened by Centennial Coal. Since 2004, mining progressed in the Fassifern Seam using bord and pillar methods.

The Myuna Colliery commenced operation in 1981 and is currently mining the Fassifern Seam via bord and pillar techniques.

Wallarah Colliery operated from 1979 until 2002, when it was placed under care and maintenance.

Munmorah, Mandalong and Cooranbong Collieries are also nearby, but are not immediately adjacent to the Chain Valley Colliery holding boundary.

3.2 Predicted Subsidence

The maximum subsidence after completion of mining will be located under Lake Macquarie, with the 20mm subsidence line to be contained within the lake high water mark (Strata^2, 2019).

The maximum predicted subsidence, tilts and strains over the proposed workings (assuming a 170m depth of cover) are summarised in **Table 1**.

TABLE 1 Maximum Predicted Subsidence

Parameter	After Extraction of Miniwall S4
Vertical subsidence	296 mm
Tilt	4 mm/m
Strain (Compressive and Tensile)	2 mm/m

To date, the maximum subsidence has been observed as summarised in **Table 2**.

TABLE 2 Maximum Observed Subsidence

Location	Maximum Subsidence (m)
MW1	0.20
MW2	0.40
MW3	0.70
MW4	0.22
MW5	0.46
MW6	0.80
MW7	0.90
MW8	1.00
MW9	1.20
MW10	0.90
MW11	0.60
MW12	0.30
CVB1	0.45
MW S1	<0.1
MW N1	<0.1

It is predicted there will be no observable subsidence at the lake foreshore, lake high water mark, or the sea grass beds (Strata^2, 2019).

3.3 Rainfall and Evaporation

Analysis of climate data from the Bureau of Meteorology (BoM) weather station at Peats Ridge indicates the following rainfall data as shown in **Table 3**.

TABLE 3 Rainfall and Evaporation Summary Data

	Rainfall (mm/year)	Evaporation (mm/year)
Maximum	2186	1420
90th Percentile	1685	1247
75th Percentile	1418	1210
Median	1226	1170
20th Percentile	902	1090
Minimum	567	410

4. LOCAL GROUNDWATER SYSTEM

For management purposes, groundwater within the GwMP area has been divided into the following classes:

- **(Mine water**) groundwater and town water that is pumped into or out of the underground workings;
- (**Groundwater**) water contained within strata overlying the mine workings; and
- (**Seeps and springs**) groundwater that discharges to surface water catchments within the project area.

Groundwater flows from the "terrestrial" recharge areas, outside of Lake Macquarie, as well as from the saline waters of Lake Macquarie into the overburden under a regional hydraulic gradient, with dominantly horizontal confined flow along discrete discontinuities and fractures within bedding planes, and / or above fine grained, relatively impermeable strata within the overburden sequence.

The overburden generally contains low yielding aquifers with low hydraulic conductivities. A schematic of the stratigraphic sequence is shown in **Figure 2.**

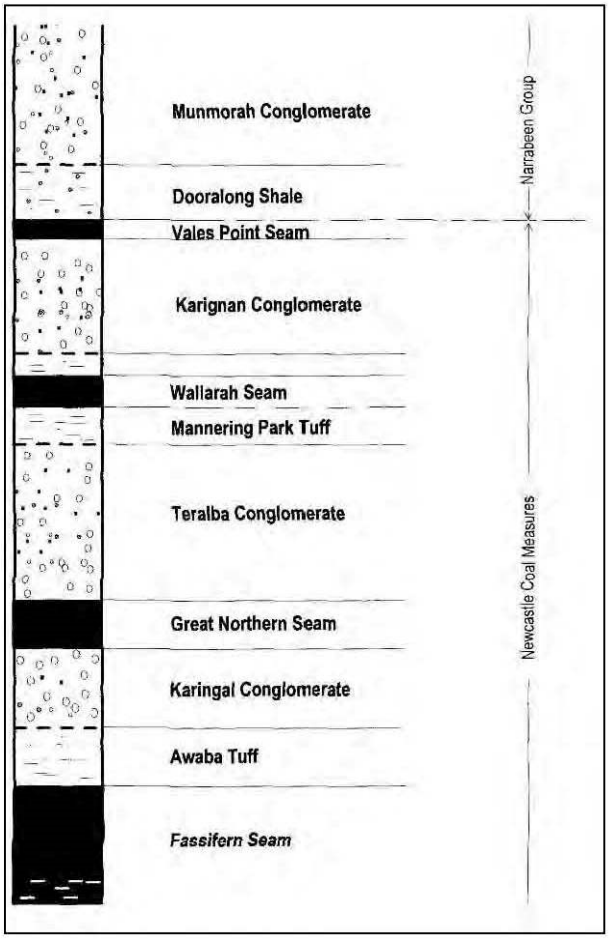

Figure 2 Local Area Stratigraphy

4.1 Alluvial Aquifers

Quaternary to recent alluvial terrestrial sediments comprising sand, gravel, clay and silt are associated with creeks and drainage channels in the local area, to the east, west and south on the shores of Lake Macquarie.

Alluvium in the vicinity of the project area is likely to be present associated with the drainage lines which discharge to Lake Macquarie.

No data is available for the thickness or lithology of alluvium within the project area. However, it is anticipated, if present, to be thin, with limited aerial extent, and no significant water storage or transmitting capacity.

Alluvial sediments within the "terrestrial" areas, outside of the project area, are generally too shallow and limited in extent to be used for groundwater supply.

4.2 Lake Macquarie Sediments

Sediments in the vicinity of MWS2, S3 and S4 within Lake Macquarie consist of unconsolidated sands, clays, silts and gravels from 5 - 23m thick.

4.3 Shallow Bedrock

The shallow bedrock comprises weathered bedrock which potentially contains discontinuous perched aquifers. These have developed at the interface between the soil and bedrock and along zones of locally increased permeabilities caused by weathering of bedrock and faulting.

The depth and permeability of any aquifers is likely to be dependent on the depth of weathering and the extent and frequency of any permeable fracture systems.

Recharge to the shallow bedrock aquifer is primarily through rainfall infiltration, with some infiltration into the underlying basement through fractures, joints and faults.

4.4 Deep Bedrock

The Newcastle Coal Measures are overlain by the Munmorah Conglomerate and the Dooralong Shale of the Triassic Narrabeen Group which comprise the majority of the overburden.

The Munmorah Conglomerate extends to a depth of approximately 120m in the vicinity of the project area and comprises mostly quartz-lithic sandstone interbedded with pebble conglomerate.

The Dooralong Shale is up 20m thick and comprises cross-bedded sandstone intercalated with siltstone and claystone (Forster and Enever, 1992).

Fractured bedrock aquifers would be present within the Narrabeen Group and the Newcastle Coal Measures with discrete water yielding horizons associated with zones of increased permeability i.e. faults and the coal seams.

The overburden and interburden is a low yielding sequence of essentially dry conglomerates and shales.

Joints and fractures associated with fractured bedrock systems tend to be laterally and vertically discontinuous, resulting in poor hydraulic connection and low groundwater yields.

Forster and Enever (1992) state that "*neither the Narrabeen Group nor the Newcastle Coal Measures contain any significant quantities of groundwater and their permeabilities are known to be generally low (<10-7 m/s).*

Any permeable zones which do occur are usually due to jointing, faulting and shearing on bedding planes.

Because of the extremely low permeability of the rock substance, groundwater flow through the overburden strata is almost exclusively by interconnecting defects such as joints and bedding.

For this reason, coal seams with their interconnecting cleat and joint patterns are often found to be 'aquifers' relative to the surrounding strata. Despite this, most underground coal mines on the Central Coast are quite dry, and rarely have any major groundwater problems."

Groundwater in the deep bedrock aquifer is of poor quality with salinity levels ranging from 3000 to 16,000 µS/cm.

Recharge to the deep bedrock aquifer is generally from infiltration of rainfall from overlying aquifers and the flow direction is expected to reflect the local topography.

4.5 Coal Seams

The coal deposits historically or currently mined in the area include the Wallarah, Great Northern and Fassifern seams of the Newcastle Coal Measures which are generally interbedded with tuffaceous claystone.

The coal seams generally have a low primary or inter-granular porosity and permeability, with bedding planes, joints, fractures and cleating imparting an enhanced secondary permeability.

The 4.5 – 5.5m thick Fassifern Seam underlies the Wallarah and Great Northern seams within the project area, and lies between 185m and 220m below surface, with a proposed mining height of up to 3.5m.

4.6 Structure and Intrusions

The overburden dips at approximately two degrees to the south-west.

Superimposed on the regional dip is the Macquarie Syncline, with an axis that runs through the Chain Valley Colliery holding, along with associated faulting and igneous intrusions.

Mapped and inferred geological structures in the project area indicate that MW S4 may be extracted through an approximately 2m wide normal fault dipping at 60° to the north-east over the inbye two-thirds of the panel. The fault plane will almost certainly extend upwards through the Fractured and Constrained Zones. However, given that:

- voussoir beam analysis suggests that such a feature would not appreciably impact on the spanning ability of the Teralba Conglomerate; and
- the favourable experiences from previous extraction panels with much greater exposure to major structures,

this fault is considered to be of no material consequence.

Figure 3 shows the major structural features, based on in-seam drilling, mapping in adjacent areas / seams and exploration drilling results. The MW S2 to S4 panels are orientated at 119°, rather than the 134° of earlier CVC panels which is more favourable with respect to the dominant 131° structural direction.

Overall, the structural environment is considered to have no significant adverse implications for S4 panel subsidence and sub-surface fracturing.

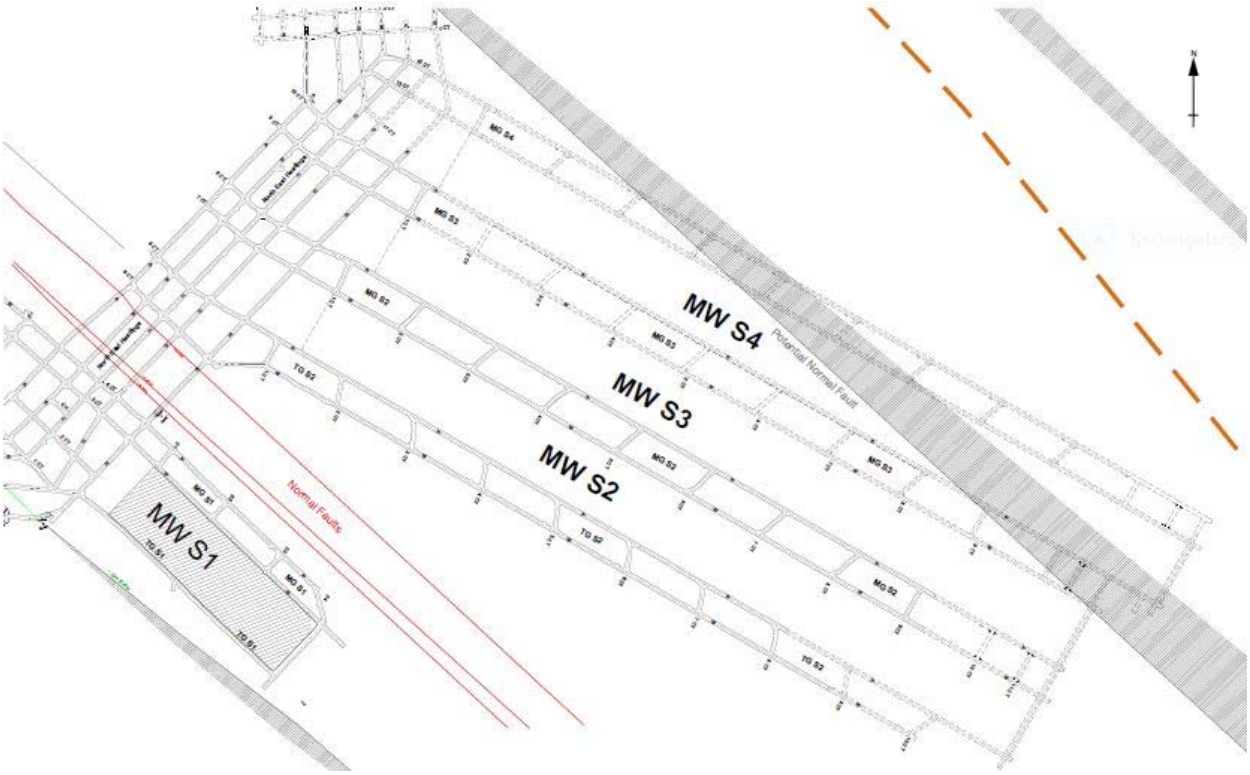

Figure 3 Faulting in the Vicinity of MWS4

4.7 Private Bores Within or Adjacent to the Proposed Mining Area

Twenty three DIW registered bores are (or were) located within or near the GwMP area as shown in **Figure 1** and **Table 4**.

From the available data, the majority of bores are completed in shallow (<18.3) meters below ground level (mbgl) sandy alluvium with one coal exploration bore converted for use as a domestic water supply (GW31646).

Many shallow (<7 mbgl) deep test bores are present in the area, along with some shallow (<7.2 mbgl) monitoring bores.

Most of the deeper remnant private bores in the GwMP area are potentially used for domestic garden or limited irrigation water supply.

Where the data is available from the DIW records, groundwater has been obtained from the shallow sandy alluvial / colluvial aquifers with low to moderate yields ranging from 0.13 L/sec to 1.50 L/sec.

TABLE 4 Registered Local Private Bores

GW	E	N	Drilled	Depth (m)	SWL (m)	Aquifer (mbgl)	YIELD (L/s)	Purpose	Bore Currency
11915	363007	6329604	-	5.4	-	-	-	Poultry	no response
24575	365969	6332788	1965	15.2	-	-	-	Domestic	no response
31646	366742	6329317	1960	277.5	3.0	3.0 – 10.6	0.13	Dom. / Coal Explore	not present
34560	364130	6330883	1970	18.3	5.5	5.5	-	Domestic	not present
34600	367678	6332873	1971	61.0	5.7	18.2	0.06	Waste disposal	-
80489	366441	6329674	2003	-	-	-	-	Domestic	no internal access
80830	363757	6330850	2004	-	-	-	-	Test bore	capped / covered
201149	367104	6329608	2006	4.0	1.0	1.0 – 4.0	1.50	Irrigation spear	no response
201150	366840	6329640	2006	4.0	1.0	1.0 – 4.0	1.50	Irrigation spear	no response
201977	363730	6331388	2008	7.1	6.0	6.0 – 7.0	-	Monitoring	-
201978	363712	6331391	2008	7.1	6.0	6.0 – 7.0	-	Monitoring	-
201979	363704	6331405	2008	7.2	6.0	6.0 – 7.0	-	Monitoring	-
202027	363829	6334141	2007	3.7	-	-	-	Test bore	not present
202028	363872	6334034	2007	5.5	1.6	-	-	Test bore	not present
202098	363829	6334141	2007	4.0	0.8	-	-	Test bore	not present
202246	363834	6334174	2007	3.5	1.2	0.6 – 3.5	-	Test bore	not present
202247	363899	6333964	2007	5.0	3.6	2.0 – 5.1	-	Test bore	not present
202248	363918	6333881	2007	5.0	-	2.0 – 5.0	-	Test bore	not present
202372	363834	6334174	2007	4.0	-	-	-	Test bore	not present
202833	363568	6330876	2013	6.5	2.50	2.5 – 3.5	-	Monitoring bore	-
202834	363563	6330861	2013	6.5	2.50	2.5 – 3.5	-	Monitoring bore	-
202839	363574	6330883	2013	7.2	2.5	2.5 - 3.5	-	Monitoring bore	-
202840	363573	6330859	2013	5	2.0	2.0 – 3.0	-	Monitoring bore	-

Note: - no data available SWL = standing water level

4.8 Regional Groundwater Use

Registered bores in the vicinity of the GwMP area are generally installed into the Munmorah Conglomerate to a maximum depth of 61m, with the majority of bores installed to less than 30m.

Groundwater yields are generally less than 1 L/s, with one bore reporting a yield of 5 L/s.

The authorised uses of the bores include:

- stock watering;
- poultry;
- industrial;
- domestic; and
- waste disposal.

While it is recognised that not all existing bores are likely to be registered, the database gives an indication of groundwater usage in the area.

Overall, it is concluded that the importance and reliance on groundwater by local landowners and residents is limited.

5. GROUNDWATER IMPACTS FROM PREVIOUS MINING

The Chain Valley Mine is surrounded by other collieries which have been extracting coal from as early as the 1940s using both longwall and bord and pillar methods.

Historical and current mining operations have resulted in extensive dewatering and depressurisation within and overlying the extracted coal seams.

Water is pumped out of the mines which results in a lowering of the potentiometric surface within the overlying aquifers.

Due to the extent of mining in the region, the subsidence effects would have partly depressurised the overburden.

5.1 Wyee State Mine

An extensive study by Forster and Enever (1992) at the adjacent Wyee State Mine (now called Mannering Colliery) assessed the impact of 150 m wide longwall mining on the hydrogeological properties of the overburden.

The study assessed that longwall mining of the Great Northern Seam resulted in measurable changes in the hydrogeological properties over a large proportion of the overburden as a result of the redistribution of stresses. The changes reported for the overburden were:

- **Upper Strata** (more than 115 m above the Great Northern Seam) –the hydrogeological properties of the strata after mining were generally similar to those measured prior to mining. Some strata reported a temporary drop in piezometric pressure which recovered soon after the completion of mining in that area.
- **Intermediate Strata** (65 to 115 m above the Great Northern Seam) – experienced significant permanent piezometric pressure increases after mining. The cause of the increase in pressure was uncertain, however it was concluded that *"since the intermediate strata have not lost piezometric pressure, it is certain that significant vertical drainage has not occurred from these strata and they have formed an effective barrier against vertical hydraulic connection between the surface and the mine."*
- **Lower Strata** (less than 65 m above the Great Northern Seam) – showed significant increased permeability and permanent decreases in piezometric pressure which indicated that significant cracking has occurred and allowed partial drainage into the workings.

Although measured changes in the lower strata indicate hydraulic connection was generated and groundwater seepage to the workings had occurred, the changes in the intermediate and upper strata was not significant, and were due to minor strata movements and the formation of fractures that were vertically discontinuous.

It was assessed that the intermediate and upper strata would form a barrier to vertical drainage and that aquifers from 65 – 115 m above the workings should not be hydraulically vertically connected to the workings, and should not be drained as a result of subsidence.

Aquifers greater than 115 m above the mine workings should not be impacted at all.

It should be noted that the subsidence studied over the Wyee State Mine related to 150 m wide longwalls, whilst the maximum width of the proposed Chain Valley miniwalls is 97 m, with 30.6 m wide pillars. As a result, the predicted subsidence and the height of fracturing over the proposed workings will be significantly less than was observed over the Wyee State Mine longwalls.

5.2 Private Bores

No adverse changes to bore yields, pumping flow duration or groundwater quality have been observed or reported in private bores within the GwMP area.

5.3 Potable Mine Water Supply

The mine has a potable water supply connection from the Wyong Council town-water system.

Historically, a range of 132 – 162 ML/year of potable water is supplied to Chain Valley Colliery, of which approximately 15% is used for pit top operations and 85% is used for dust suppression in the underground.

As required by Schedule 3, Condition 18(b) of SSD-5465, practical measures to minimise potable water consumption and maximise recycled water use have been implemented and continue to be investigated by Delta Coal, as discussed in the associated WMP. However, the use of non-potable water in all operational activities is not possible due to its quality, work health and safety and equipment requirements.

5.4 Licensed Mine Water Discharges

The discharge of mine water from the sedimentation and pollution control ponds is licensed under the *Protection of the Environment Operations Act* 1997 by the Environment Protection Authority (EPA).

Under EPL No. 1770 there is a single licensed discharge point for Chain Valley Colliery (LDP1), which has a maximum discharge volume of 12,161 kL/day.

The Colliery obtained a 4,443 ML/year groundwater licence (20BL173107) on the 12th March 2013 under the *Water Act, 1912* to enable water to be pumped from the underground workings to the sedimentation and pollution control ponds at the pit top.

5.5 Mine Water Pumping and Mine Groundwater Inflow

Historic data indicates that 1,914 – 2,536.4 ML/year of mine water has been extracted via two pumps in the Great Northern Seam workings sump, with a reduction in extraction volumes being evident over the last 3 years as shown in **Figure 4**.

The net groundwater seepage into the workings is estimated from the difference between the annual potable water intake and the annual water volume extracted from the underground workings.

The latest annual groundwater make from the mine is estimated at 1,817 ML/yr, or 4.98 ML/day.

Temporary increases in groundwater inflows to the mine have been reported in the vicinity of faults and associated fractures. The increases in inflow are usually short lived as the structures associated with fractured bedrock systems tend to be laterally and vertically discontinuous, resulting in poor hydraulic connection and have low groundwater yields (GeoTerra, 2013).

In general, the Fassifern Seam has to date been the driest seam, whilst mining of the overlying Wallarah Seam has been conducted without major adverse impacts to the overlying aquifers or inflow of water from Lake Macquarie (GeoTerra, 2013).

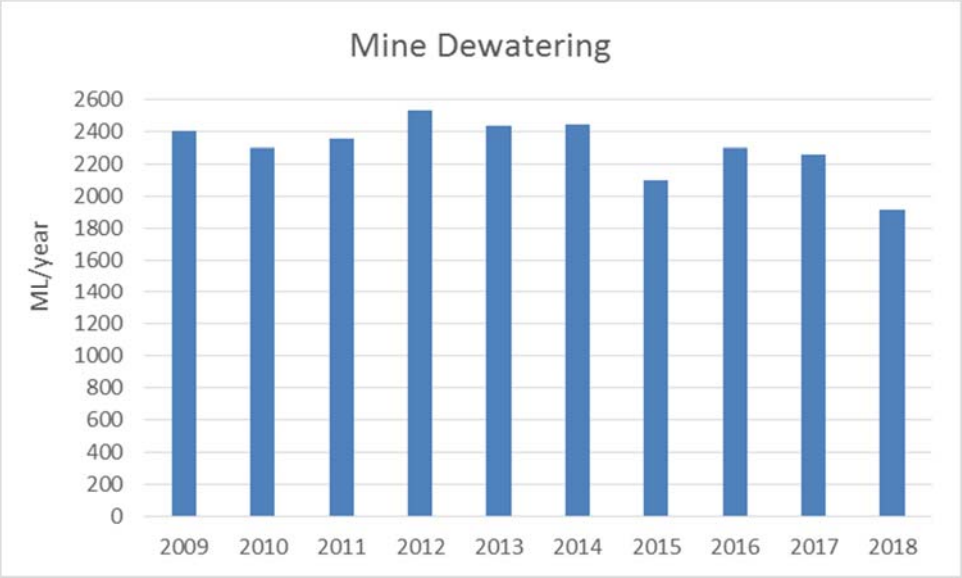

Figure 4 Annual Mine Dewatering Volumes

5.6 Mine Groundwater Quality

Groundwater monitored within the current and historic underground mining areas in the Chain Valley Colliery indicates the inflow water is brackish to relatively saline in subsided areas over the Great Northern Seam workings (11,800 – 28,200 mg/L) with a circum-neutral to mildly alkaline pH (7.30 – 7.76).

Groundwater seepage from a dyke at the northern end of the current Fassifern Seam workings, over the unsubsided main headings, had a brackish salinity of 2,390 mg/L and an alkaline pH of 8.63 as shown in **Tables 5** and **6**.

The data indicates that groundwater within the underground is significantly above the ANZECC (2000) water quality criteria (the default trigger values for physical & chemical stressors in SE Austtralian lowland rivers and 95% protection of freshwater species) for:

- pH (Fassifern dyke);
- electrolytical conductivity (all samples);
- total nitrogen (all samples);
- total phosphorous (Fassifern dyke); as well as,
- filterable copper (Great Northern Seam sump , Fassifern dyke); and
- filterable zinc (all samples except GNS2).

The exceedance in the mine water seepage depends on the guideline applied for the end use of the water.

The groundwater seepage is not generally suitable for potable, livestock or irrigation use, but is suitable for discharge under EPL 1770.

TABLE 5 Water Chemistry - Major Ions

	pH	EC (uS/cm)	TDS	Na	Ca	K	Mg	Cl	F	HCO3	SO4	Total P	Total N	DOC
ANZECC 2000	6.5 -8.0	2,200	-	-	-	-	-	-	-	-	-	0.05	0.5	-
Karignan Ck	6.93	185	100	29	2.2	2.3	3.5	54	0.10	10	6	**0.15**	**0.6**	17
Chain Valley Bay	7.64	47,300	36,100	10500	470	470	1100	19400	1.3	125	2200	**0.06**	0.4	<1
GNS SUMP	7.48	35,600	23,200	7640	590	125	690	13600	0.25	360	1200	0.04	**2.3**	2
GNS1 (roof)	7.30	40,400	28,200	7980	730	80	840	15600	0.47	435	1320	<0.01	**3.4**	<1
GNS2 (pond)	7.76	19,500	11,800	3950	140	38	230	6730	0.57	385	250	0.02	**0.6**	3
Fassifern dyke	**8.63**	3,500	2,390	925	1.9	9.1	2.1	310	5.6	2040	7	**0.65**	**4.1**	3

NOTE: all values in mg/L
samples collected 22/6/2012

TABLE 6 Water Chemistry - Metals

	Fe(T)	Fe	Mn(T)	Mn	Cu	Pb	Zn	Ni	Al	As	Li	Ba	Sr
ANZECC 2000	-	-	1.9	1.9	0.0014	0.0034	0.008	0.011	0.055	0.013 / 0.024	-	-	-
Karignan Ck	1.3	0.82	0.03	0.03	**0.003**	<0.001	**0.014**	<0.01	0.05	<0.01	<0.001	0.026	0.10
Chain Valley Bay	0.10	0.02	0.02	0.01	**0.003**	<0.001	**0.013**	<0.01	0.03	<0.01	0.38	0.041	4.8
GNS SUMP	0.18	0.07	0.06	0.04	**0.004**	<0.001	**0.018**	<0.01	0.04	<0.01	0.98	0.084	31
GNS1 (roof)	0.12	0.07	0.27	0.16	<0.001	<0.001	**0.010**	<0.01	0.03	<0.01	1.3	0.080	44
GNS2 (pond)	0.05	<0.01	<0.01	<0.01	<0.001	<0.001	0.003	<0.01	0.01	<0.01	0.59	0.17	11
Fassifern dyke	2.4	0.08	0.06	0.02	**0.004**	<0.001	**0.019**	<0.01	0.04	<0.01	0.28	0.37	1.0

NOTE: all values in mg/L
metals reported as acidified and 45um filtered samples except where Total (T) values are shown
samples collected 22/6/2012

6. POTENTIAL GROUNDWATER IMPACTS

It is anticipated that subsidence over the 164 – 172 m deep proposed S4 miniwall workings may affect the overlying groundwater system through:

- surface cracking to approximately 20m below surface;
- height of connective fracturing to less than 96 m above the seam (Strata^2, 2019), with partial loss of groundwater if fracturing extends into an overlying aquifer, which can cause minor groundwater inflow from the goaf to the workings;
- an exponential decrease in overburden permeability with height above the workings;
- connectivity between the mine workings and overlying aquifers within the fractured goaf, which can result in depressurisation of the aquifers;
- dewatering and depressurisation of the Great Northern and Fassifern seams as mining progresses;
- increased aquifer permeability, and, potentially;
- reduced groundwater quality in the overlying aquifers.

6.1 Hydraulic Connection to Lake Macquarie

The Forster and Enever (1992) study at Wyee State Mine, with 150 m wide longwalls, indicated there was no hydraulic connection at heights over 115 m above the extracted workings.

It should be noted that the proposed miniwall has a maximum width of 97 m, which means the height of fracturing would be less than that observed over the 150 m wide Wyee State Mine longwalls.

As a result, hydraulic connection between Chain Valley Colliery and Lake Macquarie over the proposed secondary extraction workings associated with Miniwall S4 is not anticipated as the minimum depth of cover is at least 171 m (including lake bed sediments), or from 138 – 158 m of basement (excluding the sediments in Lake Macquarie) .

6.2 Aquifer / Aquitard Interconnection

Mining induced cracking and vertical subsidence of strata over the extraction area may potentially extend up to 20 m below surface, with bedding dilation from below the surface zone down to the upper goaf.

In the upper horizons, subsidence can alter the dominance of the pre-mining horizontal flow along or above aquitards to generate a combination of vertical and horizontal flow regimes as aquitards are breached and water drains to lower elevations in the strata.

Vertical flow continues down the strata until the drainage is restricted by intact aquitards, at which the depth the flow then resumes its horizontal dominance.

Below the surface cracked zone, an increase in horizontal flow component can occur due to dilation and bending of strata, even though the layers are not actually breached by vertical cracking. The increased horizontal permeability extends across the subsided area, gradually diminishing as the subsidence and dilation decreases out to the edge of the subsidence zone.

No adverse interconnection of aquifers and aquitards is anticipated within 20 m of the lake bed as there are no recorded aquifers in this interval.

However, there may be an increased rate of recharge into the upper overburden from the lake waters due to the increased secondary porosity and permeability of the subsided, fractured overburden.

6.3 Regional Groundwater Depressurisation

Extensive mining of the Fassifern, Wallarah and Great Northern seams at Chain Valley and surrounding collieries for more than 60 years has significantly depressurised the overburden within the vicinity of the proposed workings.

Groundwater levels within the Fassifern Seam has already been extensively impacted by mining in the area and therefore continued mining is likely to have little additional impact, if any.

The deeper basement lithologies have increased permeability in areas of partial or full extraction due to subsidence induced caving and fracturing over the workings which results in an increased groundwater storage capacity of the overburden through increased secondary porosity.

Groundwater flow rates within the deeper aquifers are likely to increase within the caved and fractured areas due to greater hydraulic connectivity between horizontal and vertical fractures.

A temporary lowering of the regional piezometric surface over the subsidence area of up to 1.0 m due to horizontal dilation of strata may occur due to the increase in secondary porosity and permeability (GeoTerra, 2013). This effect will be more notable directly over the area of greatest subsidence and dilation, and will dissipate laterally out to the edge of the subsidence zone.

Based on similar observations in NSW with similar mining layouts, surficial and mid depth strata groundwater levels may reduce by up to 15m, and may stay at that reduced level until maximum subsidence develops at a specific location. The duration of the reduction depends on the time required to develop maximum subsidence, the time for subsidence effects to migrate away from a location as mining advances to subsequent panels, and the length of time required to recharge the secondary voids.

The degree of groundwater level decline under the lake due to subsidence is predominantly determined by the proximity to a mined panel, however it can also be significantly affected by the rate of lake water infiltration and terrestrial rainfall recharge to an aquifer, as well as changes in the rate or duration of groundwater extraction in any adjacent groundwater bores.

On the basis that the pre-mining circumstances of lake water and rainfall recharge as well as any local bore pumping remain the same, it is anticipated that groundwater levels will recover over a few months as the secondary void space is recharged by lake water and rainfall infiltration.

There is generally no permanent post mining reduction in groundwater levels under the lake, as no new hydraulically connected outflow paths from within the overburden develop.

6.4 Private Bore Yields and Serviceability

Although registered bore sites are located within the predicted 1.0 m groundwater depressurisation area, no private bore yields or serviceability have historically been reported to be, or are predicted to be affected by subsidence or regional groundwater depressurisation associated with the proposed workings, which are entirely located under Lake Macquarie.

No beneficial users of the deep bedrock/coal measures aquifers have been identified in the vicinity of the GwMP Area.

6.5 Groundwater Dependent Ecosystems

Cumulative impacts from the proposed mining are not anticipated to adversely impact on groundwater dependant ecosystems in the 20 mm subsidence area.

This is primarily because no groundwater dependent ecosystems have been identified in the proposed subsidence area within or under Lake Macquarie.

6.6 Groundwater Quality

Previous observations in NSW Coalfields indicates that groundwater quality within the subsided overburden is not generally adversely affected, however there may be increased iron hydroxide precipitation and a lowering of pH if the groundwater is exposed to “fresh” surfaces in the strata with dissolution of unweathered iron sulfide (marcasite) or iron carbonate (siderite).

The degree of iron hydroxide and pH change due to subsidence is difficult to predict, and can range from no observable effect to a distinct discolouration of water pumped out of bores.

The discolouration does not pose a health hazard, however it can cause clogging of pumping equipment and piping in extreme cases.

It should be noted that many bores in the local area can already have significant iron hydroxide levels, and a pre-mining survey of the active bores is required to assess the baseline water quality prior to undermining.

Acidity (pH) changes of up to 1 order of magnitude can occur, however the change can be reduced if the bore has sufficient bicarbonate levels.

The potential for groundwater contamination also exists from spills of fuels, oils and chemicals from both the surface and underground mine workings. Spills may result in the contamination of soil, while the infiltration of rainfall or direct migration of contaminants to the water table has the potential to contaminate shallow aquifers.

The potential for impacts can be minimised through the appropriate storage of fuels and hazardous chemicals, the implementation of appropriate work procedures and regular inspections and maintenance of equipment and plant.

Leaks and spills should be handled in accordance with the PIRMP prepared for the site, and remediated as required on a case by case basis.

Infiltration of potentially contaminated water from the sedimentation dams also has the potential to impact groundwater quality. As the dams receive all site runoff, amenities water and mine water, as well as workshop and wash down water after treatment by an oil separator, there is potential for the water within the dams to be contaminated by dissolved petroleum hydrocarbons and heavy metals. It is understood the dams are not lined with a low permeability layer, and as such, seepage of potentially contaminated water within the dams may be infiltrating alluvial or shallow aquifers.

6.7 Groundwater Seepage to or From Terrestrial Streams

No known springs or streams are present in the GwMP area that would be affected by subsidence and associated regional groundwater depressurisation with the existing and proposed workings.

Overall, the terrestrial streams within the GwMP area will be subjected to no or very low tensile and compressive strains and are not anticipated to be adversely affected by subsidence related stream bed cracking.

No loss of overall stream flow or regional change in stream water quality within the local streams is anticipated to occur.

6.8 Groundwater Inflow to Mine Workings

Loss of lake water or any significant loss of connate groundwater within the overburden to the underlying workings has not been observed in mines in the local area at similar depths of cover to the proposed workings.

Vertical hydraulic connection to the workings is anticipated to be restricted by the Dooralong Shale and the Mannering Park Tuff aquitards, which are not anticipated to be breached by subsidence over the proposed Fassifern Seam workings and are both below the surficial and above the goaf, vertically connected, dilation zones.

The horizontal permeability above and between the aquitards may be enhanced after subsidence, however there is no additional vertical connectivity through or below them to the underlying workings.

Based on available records, the 2018 annual groundwater seepage into the workings was 1,817 ML/yr, or 4.98 ML/day.

No obvious relationship between expansion of the mine and increased groundwater inflow to the workings is evident in the current data, with a reduction in mine water pumping evident over the last three years.

Based on a groundwater modelling assessment (GeoTerra, 2013) the inflow may increase up to 10.5 ML/day as the Colliery expands.

7. GROUNDWATER MONITORING PLAN

The groundwater monitoring program at available (or currently present) locations shown in **Figure 1** is designed to provide a database that enables:

- comparison of anticipated vs observed impacts on the groundwater system through miniwall as well as bord and pillar extraction of the Fassifern Seam at Chain Valley Colliery and any associated subsidence effects; and
- procedures to assess, manage or rehabilitate any adverse effects that exceed specified trigger levels.

As the proposed workings, and the anticipated associated subsidence impacts, are wholly located underneath or within Lake Macquarie, the monitoring plan specifically deals with the following issues.

7.1 Mine Groundwater Inflow

The active underground mining area should be monitored by the underground supervisors to assess whether observable groundwater inflow is occurring to the active panels and if any changes are noted.

Water flow monitoring appliances have been installed to measure pumped water volumes to and from the mine workings. These appliances will be maintained in good working order, and if required, DC will supply a test certificate to certify the current accuracy of the appliances furnished by the manufacturer or by some duly qualified person or organisation.

Daily total mine water pumping records will be maintained, plotted and interpreted annually and will be supplied to DIW within the Annual Environmental Management Report (AEMR).

7.2 Private Bore Water Levels

Where property access is granted and access inside a producing groundwater bore is possible, water levels within the private bores could be measured at least once before and once after mining is conducted in the GwMP area to assess if any adverse effects due to subsidence have occurred as shown in **Table 7**.

It is suggested that all other shallow monitoring or test bores, or waste disposal bores are not to be included in the monitoring suite.

Where monitoring of groundwater levels is not possible due to installed pump head-works, the mine will assess any reports from landowners in regard to adverse effects on bore water availability that may occur during or after extraction of the proposed workings.

Each property owner may be interviewed before and after the proposed mining to assess the bore's status, pumping rate, and its general duration of pumping as well as the type and set up of the pump.

Where feasible, the bore yield should also be measured, and water levels measured where access inside the bore is possible.

Where private bores are being occasionally or frequently pumped, and could thereby temporarily distort the static regional groundwater levels, the depth to groundwater, where accessible, should be monitored during pump resting periods to assess the regional piezometric surface across the area.

TABLE 7 Suggested Producing Groundwater Bore Water Level Monitoring

GW	Monitoring Frequency	Monitoring Method	Units
11915	Upon access / post mining	Dip meter	mbgl
24575	Upon access / post mining	Dip meter	mbgl
80489	Upon access / post mining	Dip meter	mbgl

Note: mbgl = metres below ground level

7.3 Groundwater Quality

7.3.1 Inactive Private Bores

Where property access is granted and access inside a bore is possible, a pre-mining water sample collection and analysis will be conducted within one month of access being granted and available, and will be repeated at the end of mining in the project area to enable assessment of any subsidence related changes in groundwater quality.

Each bore will be purged prior to sampling until pH and salinity measurements stabilise, which usually involves removal of at least three bore volumes of water.

Samples will be collected, appropriately preserved, kept on ice and transported under chain of custody documentation to arrive at the laboratory within appropriate holding times.

In addition, each piezometer or inactive bore will be monitored in the field for bi-monthly salinity (µS/cm) and pH measurements.

7.3.2 Active Private Bores

Where property access is granted and access to the groundwater bore is possible, an initial water sample collection and analysis will be conducted within one month of access being granted and available, and will be repeated at the end of mining in the project area to enable assessment of any subsidence related changes in groundwater quality.

To date, access to one current bore has been granted (GW80489), however no sample could be obtained as the installed pump was not working.

The use, and any treatment, of the bore water should be ascertained and observations made on the quantum of iron hydroxide precipitating from the pumped water before and after mining.

Each bore will be purged prior to sampling until pH and salinity measurements stabilise, which usually involves removal of at least three bore volumes of water.

Samples will be collected from bores that are current and accessible as shown in **Table 8**, and will be appropriately preserved, kept on ice and transported under chain of custody documentation to arrive at the laboratory within appropriate holding times.

TABLE 8 Suggested Producing groundwater Bore Water Quality Monitoring

GW	Monitoring Frequency	Monitoring Method	Units
11915	Upon access / post mining	In situ pump / bailer	pH EC mg/L (ions, metals, nutrients)
24575	Upon access / post mining	In situ pump / bailer	pH EC mg/L (ions, metals, nutrients)
80489	Upon access / post mining	In situ pump / bailer	pH EC mg/L (ions, metals, nutrients)

During extraction within the GwMP area, the frequency of monitoring and the parameters to be monitored may be varied in consultation with DIW once the baseline groundwater quality and its response to mining (if any) is established.

The frequency of post mining monitoring will be reassessed after mining is complete in the GwMP area as it may be possible, depending on results, to lengthen the intervals.

Table 9 presents the physical groundwater quality parameters to be measured.

TABLE 9 Groundwater Quality Monitoring Parameters

SUITE	ANALYTES
Initial monitoring / after mining is completed	Field EC, Eh, pH, temp TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, Cr, Li, Ba, Cs, Rb, Sr (filtered)

7.4 Groundwater Contamination

In accordance with the sites' EPL and WMP, surface water discharged from the dams is monitored monthly for a range of pollutants.

The range of analysis for surface water also includes oil and grease, which allows the assessment of impact, if any, that these dams may be having on underlying aquifers.

8. GROUNDWATER ASSESSMENT CRITERIA AND TRIGGERS

Management of impacts within predictions follow standard assessment review and response protocols.

Contingent measures are included in this plan to ensure the timely and adequate management of the proposed extraction and subsidence impacts outside of anticipated levels.

Where and if required, specialist hydrogeological / hydrological investigations and reports may include:

- the study scope and objectives;
- consideration of any relevant aspect from this plan;
- analysis of trends;
- assessment of any impacts against prediction;
- assessment of the cause of a change or impact;
- options for management and mitigation;
- assessment for the need for contingency measures;
- any recommended changes to this plan; and
- appropriate consultation with DIW, DRE and EPA.

Site specific mitigation / remediation action plans may include:

- a description of the impact to be managed;
- results of the specialist investigations;
- aims and objections for the plan;
- specific actions required to mitigate/manage;
- timeframes for implementation;
- roles and responsibilities;
- identification of and gaining appropriate approvals from landholders and government agencies; and
- a consultation and communication plan.

Trigger values for further assessment of potential subsidence effects on groundwater systems within the plan area are discussed in the following sections.

The triggers have been developed to reflect the current variability in relevant parameters and to enable the identification of any changes that may be due to either subsidence effects, landowner impacts and/or natural causes.

If trigger values are exceeded, the cause and effect will be investigated and a management plan developed if it is directly related to mining.

The Environment and Community Coordinator shall be responsible for the implementation of agreed actions and shall communicate such actions to the relevant landowners or authorities.

8.1 Mine Water Extraction and Discharge

Chain Valley Colliery holds a DIW license (WAL41508) to extract up to 4,443 ML/year from the workings, and currently holds EPL 1770 which permits volumetric discharge of up to 12,161 kL/day via its licensed discharge point.

Mine water extraction will be measured daily and daily discharge volumes will be reported on a monthly basis via the DC website.

As part of the AEMR the average monthly groundwater extraction rates will be determined by assessing the difference between the potable water pumped into the workings and the total water pumped out of the workings. This assumes no hydraulic conductivity with Lake Macquarie, surface potable water leaks, water theft or measurement error.

A trigger for the groundwater extraction will be where the monthly average extracted underground mine water exceeds **10.5 ML/day** (75th percentile groundwater inflow – refer **Table 3**), and this average continues for at least 2 months.

8.2 Private Bore Groundwater Levels

It should be noted that landowners pumping their own bores, as well as the interference effect from other landholders pumped bores can significantly affect temporary standing water levels in a bore, without any influence from mining or subsidence.

On this basis, if the combined monitoring of the outlined private bores indicates a sustained drawdown of **greater than 2 m over a 2 month period** in a private bore, or, if a landowner reports a lack of groundwater availability in a bore that cannot be accessed internally, then the cause of the exceedance will be investigated to assess whether the >2 m drawdown or lack of supply is due to:

- lack of rainfall recharge, using comparison to the cumulative sum of daily rainfall;
- operation of landowner bores either within or outside an affected bores property;
- subsidence; or
- any or all of the above.

The 2 m drawdown trigger level has been derived through extrapolation of similar mining subsidence related effects in similar mining layouts and geomorphological areas in NSW and to be consistent with the minimal impact considerations of the NSW Aquifer Interference Policy.

8.3 Private Bore Groundwater Quality

If a landowner reports an increase in iron hydroxide precipitation or water salinity, as an initial default, the ANZECC 2000 irrigation and livestock guidelines shown in **Table 10** will be used as trigger levels to assess bore water quality.

As no bores are used for drinking water in the GwMP, drinking water quality criteria and triggers are not specified.

TABLE 10 Groundwater Chemistry Criteria (mg/L)

	pH	**TDS**	**Hardness as CaCO3**	Cu	Pb	Zn	Ni	Fe	Mn	As	Cd
Irrigation	*6 - 8.5*	-	*>60-350*	*5*	*5*	*5*	*2*	*10*	*10*	*2.0*	*0.05*
Livestock	-	*<4000/5000*	-	*1 / 0.4*	*0.1*	*20*	*1*	-	-	*0.5*	*0.01*

NOTE: all metals values are for filtered metals;

irrigation criteria for short term trigger values (< 20 years);

livestock criteria for beef / sheep.

9. POTENTIAL GROUNDWATER AMELIORATIVE ACTIONS

9.1 Private Bore Yield

Although it is not anticipated due to the separation distance from the bores to the proposed subsidence area, should the accessibility, available drawdown or yield of a bore be impacted due to subsidence, Chain Valley Colliery is required to provide an alternative water supply until the bore recovers.

If the level does not sufficiently recover and the effect is due to subsidence rather than regional climatic or anthropogenic factors, repairs or maintenance to a bore can be undertaken after maximum subsidence has developed. At this time the pump intake can be lowered, the bore extended to a greater depth or a new bore can be established.

With these mitigation measures in place it is unlikely that water supply to properties will be significantly impacted by the proposed mining.

In the event of a monitored or reported adverse impacts on the yield or saturated thickness of a private registered bore, the cause will be investigated.

If a groundwater level drop of over 2 m for a period of over 2 months is recorded, and the reduction in bore yield is a consequence of subsidence, the mine will enter into negotiations with the affected landowners and Subsidence Advisory 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, e.g. due to lowering pumps or installation of additional or alternative pumping equipment.

9.2 Private Bore Groundwater Quality

In the event of an adverse change in groundwater quality to a private bore, particularly in regard to salinity and / or iron levels, the mine will implement an investigation to determine if the cause is due to subsidence.

Although it is not anticipated due to the separation distance from the bores to the proposed subsidence area, if subsidence cracking has caused a notable increase in iron hydroxide precipitates or the landowner reports an adverse change in salinity, and that change exceeds the trigger levels, the mine will enter into negotiations with the affected landowner with the intent of formulating an agreement which provides for one, or a combination of:

- re-establishment of the water supply from a new bore to provide water equivalent to the pre mining status of the bore (on the basis that the landholder has allowed for pre-mining status of the bore to be established);
- provide access to an alternative source of water, or;
- compensate the bore owner to reflect the economic costs incurred due to the subsidence effects on the water quality.

10. CONTINGENCIES

In the event that the proposed monitoring indicates that a trigger has been reached or is being approached, DC will commission a hydrogeologist or hydrologist to review the data, with the outcomes of that review, including any recommendations, being subject to consultation with DIW.

A trigger of pH or electrical conductivity would initially lead to an increase in the analytes monitored and/or frequency of sampling to confirm the magnitude and extent of the change in groundwater chemistry and verify the change is a consequence of mining.

Should the standing water level trigger be achieved in any bore, the mine staff shall notify the affected landowner(s) and, if it is the hydrogeologist's opinion that the reduction is a consequence of mining, mitigation measures identified in previous sections will be initiated.

An independent authority may also be used where a dispute arises as to the cause of the change, given that groundwater supply and quality can be affected by non-mining related factors such as bore siltation, aquifer depletion by adjoining mining operations, agricultural users, bacterial infection, fertilizer contamination etc.

11. AUDIT AND REVIEW

This document shall be reviewed, and if necessary revised, within 3 months of the following:

- the submission of an Annual Environmental Management Report (AEMR);
- the submission of an incident report;
- the submission of an independent environmental audit; and
- following any modification to the project approval.

Other factors that may require a review of the GwMP are:

- observation of greater impacts on surface features due to mine subsidence than was previously expected;
- observation of fewer impacts or no impacts on surface features due to mine subsidence than was previously expected; and/or
- observation of significant variation between observed and predicted subsidence.

Internal and external audits of this document will be carried out as described below. If possible, audits shall be objective and be conducted by a person or organisation independent of the document being audited.

Audits shall be carried out by personnel who have the necessary qualifications and experience to make an objective assessment of the issues. The extent of the audit, although pre-determined may be extended if a potentially serious deviation from this document is detected.

Any audit non-conformances and/or improvement opportunities will have corrective and preventative actions implemented to avoid recurrence, these actions will be loaded into the site Incident Database to ensure the actions are assigned to the relevant people and completed.

11.1 Internal Audits

Internal audits of this document and all other Environmental Management System documents are to be undertaken every three years. Improvements from the audit are to be incorporated in the site action database to ensure the actions are assigned to the relevant people and completed.

11.2 External Audits

External audits will be conducted utilising external specialists and will consider the document and related documents. External auditors shall be determined based on skills and experience and upon what is to be accomplished. External audits will be periodically at a frequency determined by the site General Manager, or in response to significant environmental incidents for which a systems failure has been determined as a contributor to the incident.

An Independent Environmental Audit (IEA) will be undertaken every three years, or as otherwise required by the Department of Planning, Industry and Environment (DPIE).) the audit will be conducted by an audit team whose appointment has been endorsed by the Secretary of DPIE.

Any actions arising from external audits will be loaded into the site actions database to ensure the actions are assigned to the relevant people and completed.

12. RECORDS

Generally, the site Environment and Community Coordinator will maintain all EMS records, which are not of a confidential nature. Records that are maintained include:

- monitoring data and equipment calibration;
- environmental inspections and auditing results;
- environmental incident reports;
- complaint register; and
- licenses and permits.

All records are stored so that they are legible, readily retrievable and protected against damage, deterioration and loss. Records are maintained for a minimum of 4 years.

13. RESPONSIBILITIES AND ACCOUNTABILITIES

13.1 General Manager

- Ensure that the requisite personnel and equipment are provided to enable this plan to be implemented effectively;

13.2 Environment and Community Coordinator

- authorise the Plan and any amendments thereto;
- ensure this plan is reviewed should any changes to the mine plan or if levels of subsidence are greater than predicted. Notify the relevant authorities of any triggers being exceeded;
- reporting in the AEMR;
- ensure that inspections are undertaken in accordance with the schedule;
- ensure that persons conducting the inspection are appropriately trained, understand their obligations and the specific requirements of this plan;
- review and assess monitoring results and inspection checklists;
- promptly notify the General Manager of any identified environmental issue.

13.3 Hydrogeologist / Hydrologist

- assist in compiling and/or reviewing the monitoring to the standard and frequency as outlined in this plan; and
- promptly notify the Environment and Community Coordinator of any identified environmental issue.

14. TRAINING

All personnel who conduct inspections will be trained in the requirements of the plan.

Training will be conducted on maintaining and downloading monitoring equipment, operation of the field testing equipment and sampling procedure for laboratory analysis identification of the various subsidence impacts detailed in this plan.

15. REPORTING

15.1 Annual Environmental Management Report

An Annual Environmental Management Report (AEMR) will be submitted to DIW each year. As part of the AEMR the groundwater section will include;

- groundwater related activities, and the level of compliance with the GwMP;
- all groundwater monitoring volumes and rates taken by the works;
- the volume groundwater extracted from the works that was discharged via the Licensed Discharge Point;
- all groundwater extraction data;
- the extent of groundwater depressurisation and any groundwater salinity impacts compared with predictions in the Environment Assessment;
- interpretation of the data, discussion of trends and their implications;
- an overall comparison of groundwater performance with predictions for the life of the mine provided in the Environmental Assessment; and
- an outline of proposed adaptive or remediation actions if required.

Notification of the groundwater monitoring results and interpretations will be reported within the required annual period to outline the natural trends and any impacts from mining on the groundwater system.

16. REFERENCES

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Strata^2, 2018 Geotechnical Aspects of S2 and S3 Panel Design

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DISCLAIMER

This report was prepared in accordance with the scope of services set out in the contract between GeoTerra Pty Ltd (GeoTerra) and the client, or where no contract has been finalised, the proposal agreed to by the client. To the best of our knowledge the report presented herein accurately reflects the client's intentions when it was printed. However, the application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document.

The findings contained in this report are the result of discrete / specific methodologies used in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site / sites in question. Under no circumstances, however, can it be considered that these findings represent the actual state of the site / sites at all points. Should information become available regarding conditions at the site, GeoTerra reserve the right to review the report in the context of the additional information.

In preparing this report, GeoTerra has relied upon certain verbal information and documentation provided by the client and / or third parties. GeoTerra did not attempt to independently verify the accuracy or completeness of that information. To the extent that the conclusions and recommendations in this report are based in whole or in part on such information, they are contingent on its validity. GeoTerra assume no responsibility for any consequences arising from any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to GeoTerra.

Interpretations and recommendations provided in this report are opinions provided for our Client's sole use in accordance with the specified brief. As such they do not necessarily address all aspects of water, soil or rock conditions on the subject site. The responsibility of GeoTerra is solely to its client and it is not intended that this report be relied upon by any third party, who should make their own enquiries.

The advice herein relates only to this project and all results, conclusions and recommendations made should be reviewed by a competent and experienced person with experience in environmental and / or hydrological investigations before being used for any other purpose. The client should rely on its own knowledge and experience of local conditions in applying the interpretations contained herein.

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Appendix 5: Standard Erosion and Sediment Controls

Land Clearing Procedures (Clearing and Topsoil Stripping)

Minimise land disturbance to avoid exposing unnecessary land to the processes related to erosion and sedimentation. This is achieved by:

- All operations are planned to ensure that only the areas which are under active excavation are cleared and that there is no damage to any trees and pasture areas outside the limits to be cleared.
- Limiting the cleared width to that required to accommodate excavation plus areas required for topsoil stockpiling.
- General vegetation clearing will not be undertaken until earthwork operations are ready to commence.
- All proposed erosion and sediment control measures are implemented in advance of, or in conjunction with, vegetation clearing and soil stripping operations.
- Prior to vegetation clearing or soil stripping operations, the stripping panel is delineated on a plan and in the field will be marked by survey pegs placed at intervals on each side of the disturbed area. Topsoil limits and the topsoil stripping depths are shown on the pegs.
- Where possible, topsoil is stripped in moist but not wet condition to reduce deterioration in topsoil quality and dust generation and only be stockpiled when no areas of reshaped overburden are available for direct placement and spreading.

Topsoil Stockpiles

Where suitable areas are unavailable for the immediate respreading, topsoil is stockpiled to a maximum depth of three metres and subsequently applied when the areas become available. The period of the stockpiling is minimised in order to reduce the detrimental effects of the storage of any native seed in the soil and damage to the soil structure.

All stockpiles are shaped, trimmed (max batter slope 3H:1V) then ripped and immediately sown with a sterile cover crop and permanent pasture species to provide stockpile stabilisation. Sediment fence is constructed around the downslope perimeter of the stockpiles where required to provide temporary sediment control until vegetation becomes established. Surface drainage in the vicinity of the stockpiles is configured as to direct any runoff around the area so not to cause any potential erosion of the loose material.

Where topsoil is used as the growing medium, it is re-spread in the reverse sequence to its removal, so that the organic layer, containing any seed or vegetation, is returned to the surface. Re-spreading on the contour aids runoff control and increased moisture retention for subsequent plant growth. Re-spread topsoil should be levelled to achieve an even surface, avoiding a compacted or an over-smooth finish.

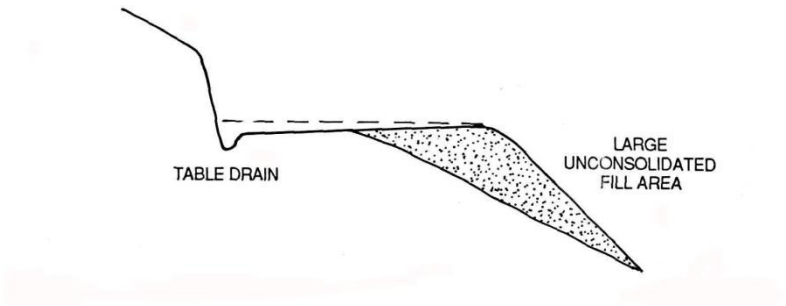
Access Tracks

Access tracks are constructed in accordance with appropriate standards such as those described in *Managing Urban Stormwater: Soils and Construction Vol. C - Unsealed Roads*. Surface drainage is optimised and stabilised, thereby reducing roadside erosion and sedimentation. Appropriate control measures are constructed on all access roads with cross fall drainage at 3% either side of the road crown to be largely responsible for immediate water shed from the road surface. Techniques that could be used to provide crossfall on the track include crowing, infall and outfall

- Crowning

Crowning allows water to be shed on both sides

- Infall



- Outfall

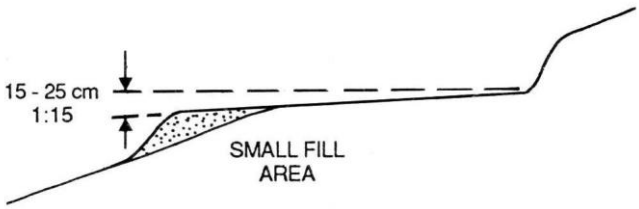


Table Drains, Mitre Drains, Culverts and Cross Drains are used where required to safely convey the water from the track surface so to prevent runoff from eroding them or adjacent land. Mitre Drain spacing should not exceed 50m even on soils with low erodibility. Cross Drains are placed every 20m to 90m depending on

the road grade and soil erodibility as required. Refer to Table 5.2 of Vol2C – Unsealed Roads of the 'Blue Book' for more detail.

Cut and fill batters associated with service tracks are formed to a safe slope and stabilised by vegetation. Where cut batters are greater than 1.5m, stabilisation methods are applied to these areas such as laying back, revegetation and drainage. Stabilisation is assisted by spreading topsoil and/or by applying chemical or organic mulch over the exposed batter surface. Where fill batters are greater than 2:1, re-grading may be required.

Planning and construction of new tracks is undertaken in accordance with the guidelines presented Vol. 2C - Unsealed Roads of the 'Blue Book'.

Haul Roads

Run off from haul roads to be constructed within Chain Valley Colliery is to be contained within the mine water management system. The ultimate goal for the site is that water is not allowed to discharge from the site unless through a LDP. If the runoff from future haul road constructions are not contained within the existing mine water system, dams will be constructed to contain this water and allow it to be pumped back into the mine water management system for release through the LDPs.

During any construction of haul roads, temporary erosion and sediment controls (see **Section 1.1.8**) will be implemented. Sediment fencing will be strategically located around fill termination points as the road alignment approaches clean water drainage lines. The silt fencing will not be removed until construction of the appropriate drainage and culverts are completed. Temporary sediment trapping devices may be required during construction to treat sediment-laden runoff from small areas (0.5 ha or less). Where haul roads are required to cross any watercourses, they will generally be constructed so that they cross perpendicular to the watercourse, subject to other constraints. Once constructed, long term sediment controls such as mine water sediment dams will be constructed at the outlet points of the storm water drains to contain water within the mine water management system. However haul roads at Chain Valley are currently sealed bitumen surfaces and erosion of the permanent structures may be effectively controlled by regular cleaning to prevent the accumulation of coal fines.

Diversion Structures (Clean Water)

In order to minimise the volume of dirty and mine water to be treated, all clean run-on water is diverted where possible into clean water drainage lines to be directed off-site. This not only reduces the potential for erosion to occur on disturbed areas, but also reduces the pressure on the dirty and mine water management controls which are required to treat sediment-laden runoff to an acceptable standard for discharge. Suitably designed and constructed diversion drains are implemented where practical around the Chain Valley Colliery in accordance with 'Blue Book' standards relating to channel design. In general, the drains should be trapezoidal in shape with maximum side slopes of 1V:2H. Where peak design water velocities exceed 1.5m/s, the drains should be protected from scour using either erosion channel liners and/or geofabric with rock rip-rap armouring.

Diversion Structures (Mine and Dirty Water)

Catch drains are utilised throughout the site to minimise erosion and re-direct potentially contaminated runoff into dirty water sediment dams and mine water dams. Runoff from disturbed areas, such as stockpile areas, is conveyed to these dams by catch drains and bunds.

Bunds shall be constructed similar to top soil emplacement areas, bunds shall be shaped, trimmed (max batter slope 3H:1V) then ripped and immediately sown with a cover crop and permanent pasture species to provide bund stabilization.

For runoff from rehabilitation areas, the water management structures should be appropriately designed before layout and construction. Typically the water management structures include contour banks, which are constructed at intervals down the slope of rehabilitation areas to control surface flow and minimize erosion. The effect of these is to divide long slopes into a series of short slopes with the catchment area commencing at each bank. This prevents runoff from reaching a depth of flow or velocity which would cause erosion. As the slope angle of the landform increases, the banks are spaced closer together. Bank spacing is determined based on the surrounding catchment layout and the bench spacing guide contained in Table 4.1 of *Vol2E – Mines and Quarries* of the 'Blue Book'. The banks should have a longitudinal grade of 1.2%. Where peak design water velocities exceed 1.5m/s, the drains should be protected from scour using either erosion channel liners and/or geofabric with rock rip-rap armouring.

Control Devices

Mine water dams and mine water sediment dams (generally smaller structures) are used at Chain Valley Colliery to contain potentially contaminated 'mine' water. This water has the potential to contain elevated salinity concentrations and/or potential hydrocarbon contamination as a result of runoff from haul roads, workshop areas and areas exposed to carbonaceous material. They also function as sediment dams for sediment control but are not allowed to spill into neighbouring watercourses unless released through a LDP.

Dirty Water sediment dams are intended to catch runoff from disturbed areas that are not exposed to potential contamination of hydrocarbons or carbonaceous material. These include general construction areas and rehabilitation areas. In general dirty water sediment dams should be constructed on all disturbed areas not draining to mine water dams. The dams are constructed for the purpose of capturing sediment-laden runoff prior to off-site release. Dirty water sediment dams assist in improving water quality throughout the mine site.

The number and capacity of dams will be related to the total area of catchment, the duration of disturbance and the anticipated soil loss. The capacity of each dam is derived from the benchmark design reference for sediment control, *Managing Urban Stormwater: Soils and Construction Vol. 1* and *Vol. 2E Mines and Quarries* (the Blue Book) (Landcom, 2004 and DECC, 2008). The dams are constructed to at least the recommended minimum design criteria as presented in Table 6.1 of Vol 2E Mines and Quarries of the Blue Book. For most areas, this is the 90th percentile, 5 day rainfall event for a Type F/D basin (soils that are fine textured and possibly dispersive).

The following points will be considered when selecting future sites for sediment dams:

- Each dam will be located so that runoff may easily be directed to it, without the need for extensive channel excavation or for excessive channel gradient. Channels will discharge into the dam without risk of erosion. Similarly, spillways will be designed and located so as to safely convey the maximum anticipated discharge.

- The material from which the dam is constructed will be stable and be imported from elsewhere on the mine, if necessary. Highly dispersible clays will require treatment with gypsum and/or bentonite to prevent failure.

Temporary Erosion and Sediment Controls

Prior to any construction activity (including soil stripping, road construction, bulk earthworks), temporary erosion and sediment control measures are installed. The following sub-sections include temporary erosion and sediment control features that may be utilized at the site.

Sediment Filter Fences

There may, on occasion, be a disturbance area which is either not protected by existing structures or requires additional temporary protection against erosion and sedimentation. In these cases it may be suitable to install sediment filter fencing. Sediment filter fences filter run-off leaving the site, trapping sediment and allowing filtered water to pass. Sediment filter fences are constructed around the base of any areas of exposed land that are not subject to concentrated overland flow, that are not adequately protected by existing structures and that are not within the mine water management system. Sediment filter fencing is installed around the extent of the disturbance areas where sediment-laden water could potentially enter clean downstream receiving waters.

Sediment filter fences are normally placed on the contour or slightly convex to the contour. The contour on each end of the fence should be turned to create a stilling dam up slope of the fence. Where possible, a silt fence system should consist of a series of overlapping fences. Each fence should be NO longer than about 40 metres. They should not intercept large concentrated or channelised flows. The fences are constructed in accordance with the Sediment Fence Standard Drawing (SD6-8) of the 'Blue Book'. Silt fences require regular maintenance. Trapped sediments should be removed, pickets straightened, filter cloth re-secured and tightened.

Sandbag Weirs

Sandbag weirs are sometimes installed within existing swale drains or existing drainage channels, which are not able to be regularly graded. The use of these devices is limited to temporary erosion and sediment control in channels during construction or high disturbance phase mining.

The weirs are typically installed at a minimum of 40 metre intervals. As with sediment filter fences, sandbag weirs may be installed prior to any works commencing on the site in existing channels and immediately after the construction of new channels. Inspections of the sandbag weirs after rain should take place with removal of the collected sediment as required. Damaged/shifted bags should be repaired or replaced.

Temporary Drains

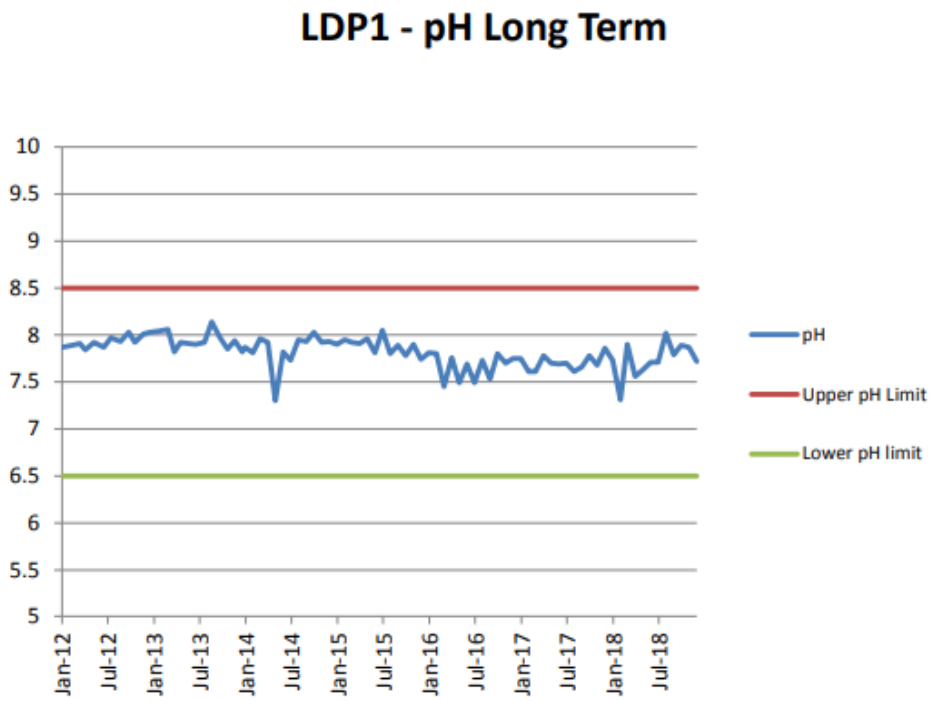
Runoff from areas exposed during the works is to be controlled by construction of temporary contour and diversion drains. These drains generally take the form of channels constructed across a slope, with a ridge of the lower side. They should be implemented immediately after a construction site is cleared to intercept and divert runoff from the site to nearby stable areas at non-erosive velocities. The drains should be formed with a gentle grade of approximately 1.2%

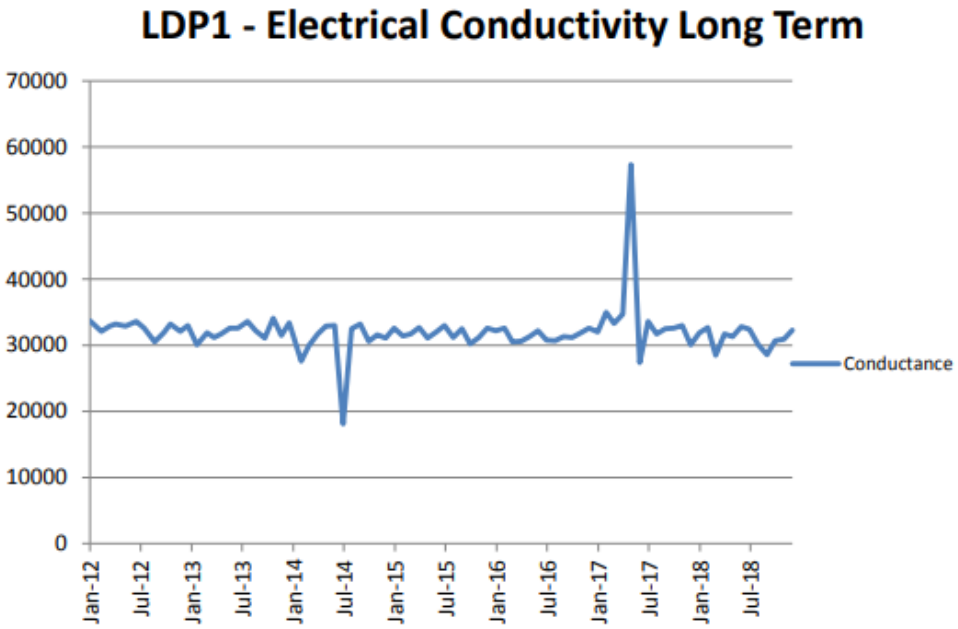
Temporary Silt Traps

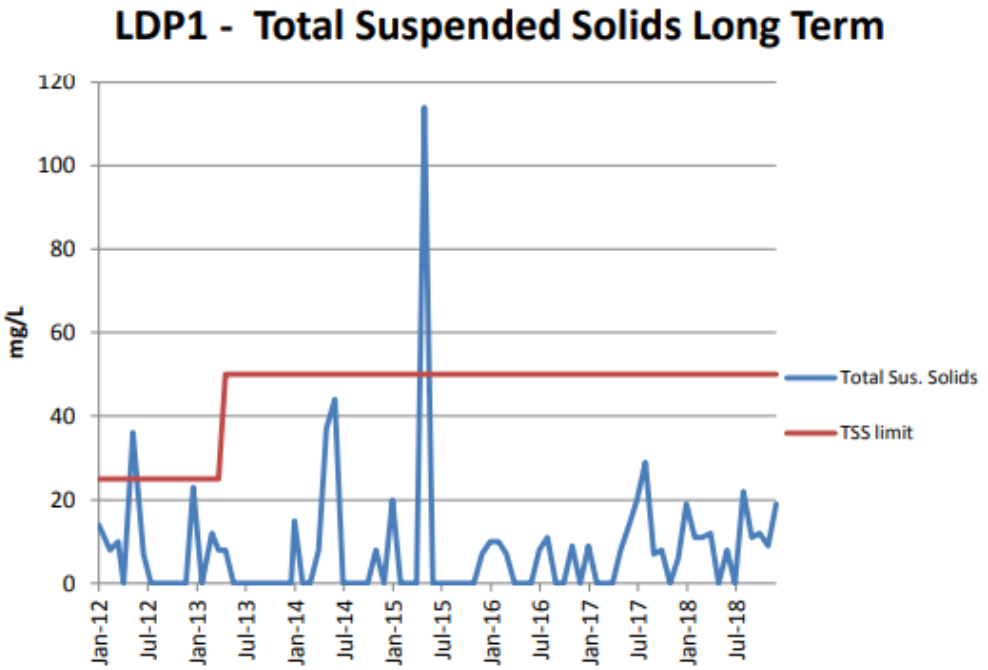
Temporary sediment trapping devices may be required during construction to trap and filter sediment-laden runoff from small areas (0.5 ha or less) prior to discharge. They are used to trap small amounts of run-off water and filter sediment from runoff before entering the natural watercourses or to protect adjacent lands. These would typically be used at the discharge point of mitre drains and other similar devices.

Appendix 4: EPL 1770 Water Quality Monitoring Results

Long term monitoring results from AEMR detailed below.






LDP1 - Total Suspended Solids Long Term
mg/L
120
100
80
60
40
20
0
Jan-12
Jul-12
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
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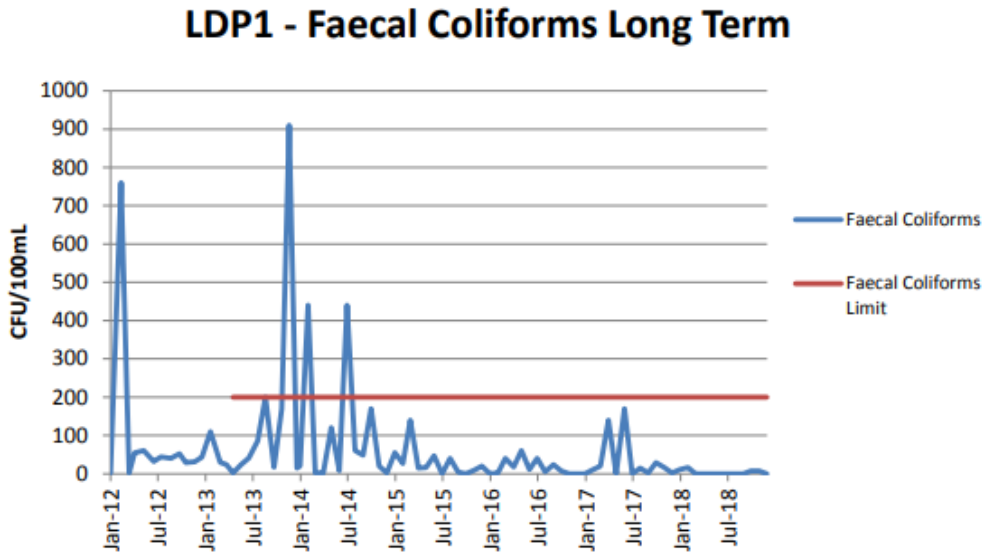
Jan-17
Jul-17
Jan-18
Jul-18
Total Sus. Solids
TSS limit


LDP1 - Faecal Coliforms Long Term
CFU/100mL
1000
900
800
700
600
500
400
300
200
100
0
Jan-12
Jul-12
Jan-13
Jul-13
Jan-14
Jul-14
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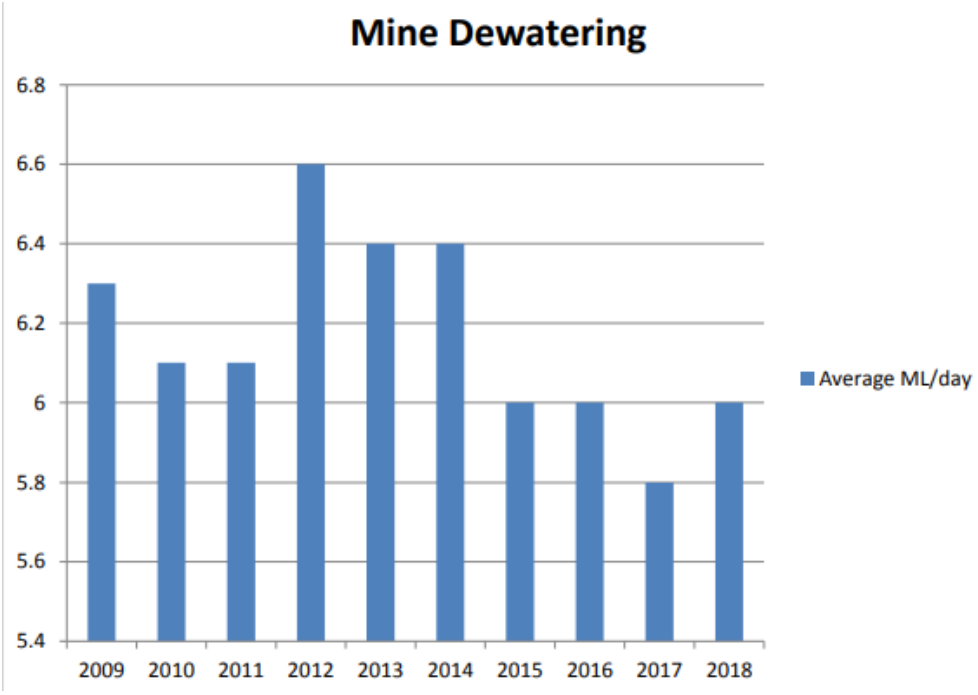
Jul-18
Faecal Coliforms
Faecal Coliforms Limit


Mine Dewatering
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Average ML/day

Appendix 6 Biodiversity Management Plan

Delta coal	Doc Owner: Environment and Community Coordinator Doc No:

CHAIN VALLEY COLLIERY

Biodiversity Management Plan

ENVIRONMENTAL MANAGEMENT PLAN

Reviewer	Katie Weekes – EMM Consulting
	Eugene Dodd – EMM Consulting
	Chris Armit – EMM Consulting
Authorised by:	Chris Armit
	Environment and Community Coordinator
Date:	1 December 2019

Table of Contents

1 Introduction

1.1 Purpose

This management plan addresses the requirements for Development Consent SSD-5465, Schedule 3, Condition 20 which specifies that a Biodiversity Management Plan (BMP) be prepared.

The BMP applies to the surface operations at Chain Valley Colliery (CVC), including pit top facilities and lands where additional infrastructure may be constructed.

The purpose of this management plan is to:

- provide an overall framework for consultation related to biodiversity;
- set out the rehabilitation objectives for CVC;
- meet the requirements of the development consent in respect of the BMP;
- detail monitoring requirements (if required);
- minimise and appropriately control potential impacts to biodiversity from operations;
- minimise potential impacts on biodiversity surrounding the operational areas;
- define specific responsibilities of all stakeholders and function as a management tool for all relevant operational personnel; and
- identify the requirements for review of the document and a procedure for continual improvement.

The BMP includes a Biodiversity Enhancement Strategy, which will implement measures to enhance and restore the endangered ecological communities (EECs) in the Biodiversity Enhancement Area, including:

- weed and rubbish removal;
- return of the natural hydrological regime; and
- regeneration with native endemic species.

The overall aim of this management plan is to promote a high level of environmental performance through the minimisation of impacts.

1.2 Background

CVC is an underground coal mine located on the southern side of Lake Macquarie approximately 60 km south of Newcastle and 80 km north of Sydney (see **Figure 1**). The pit-top is located approximately 1 km south-east of the township of Mannering Park at the southern extent of Lake Macquarie.

In August 1960, J&A Brown and Abermain Seaham Collieries Ltd commenced clearing the present site with drift and shaft sinking starting a few months later. Production of coal from the Wallarah Seam, commenced with the first delivery to the adjacent Delta Electricity's Vales Point Power Station (VPPS) in April 1963.

LakeCoal was formed in 2001 to acquire BHP Billiton's 80% share in the Wallarah Coal Joint Venture (WCJV), the remaining 20% share was owned by Sojitz. In October 2006, Peabody Energy, a US listed company acquired LakeCoal Pty Limited.

In November 2009 LDO Coal Pty Limited purchased LakeCoal Pty Limited. LDO Coal is a consortium consisting of LD Operations, AMCI and private investors. In March 2011 the 20% share in the WCJV which Sojitz held was acquired by LDO Coal shareholders through the entity Fassi Coal Pty Ltd. The WCJV had operated the Wallarah, Moonee and Chain Valley underground coal mines and the Catherine Hill Bay Coal

Preparation Plant, all located at the southern end of Lake Macquarie. At the time of LakeCoal's acquisition by LDO Coal, both the Wallarah and Moonee mines were closed.

In 2013 the owners of Mannering Colliery (MC) and CVC entered into an agreement which enabled LakeCoal to operate the MC until 2022. LakeCoal became the operator of MC effective 17 October 2013, with the underground link between CVC and MC completed in October 2017.

LakeCoal was placed into Voluntary Administration on 3 October 2018. The receivers continued operation of the mines in the period 3 October 2018 to 1 April 2019. As of 1 April 2019, Great Southern Energy Pty Ltd (trading as Delta Coal, DC) own and operate the two underground coal mines, CVC and MC. Mining is currently undertaken at CVC, with the coal being transported underground to MC where the coal is crushed and screened and sent directly to VPPS.

1.3 Operation

With changes to the *Mining Act 1992* and amendments to the Environmental Planning and Assessment Regulation 2000, LakeCoal was required to obtain approval under the *Environmental Planning and Assessment Act 1979* (EP&A Act) to permit continued operation. Approval of the mine was granted on 23 January 2012 (MP10_0161) following submission of an environmental assessment (EA) (AECOM, 2011). Development consent (SSD-5465) was subsequently approved on 23 December 2013, granting approval for underground mining over an additional area of Lake Macquarie and a consolidation of approved activities granted by virtue of MP10_0161. Mining operations are approved to occur until 31 December 2027.

1.4 Construction

No above-ground construction works are planned that would result in significant vegetation changes or removal. As a result of construction, the following biodiversity issues have been identified:

- clearing of vegetation and fauna habitat for water management and maintenance (dams and embankments) works;
- clearing of vegetation and fauna habitat for bushfire management and maintenance (asset protection zone) works; and
- potential for invasion and spread of weeds and soil pathogens into areas of remnant vegetation.

Commitments related to the clearing of fauna habitat and weed management during the ventilation fan augmentation project which was approved under MP10_0161 have already been undertaken during construction under a specific management plan and are therefore not included within this BMP. However, follow-up measures to monitor the effectiveness of these measures and potential impacts post-construction activities have been included within this plan.

1.5 Consultation

The BMP was originally developed in 2012 and, following some minor changes to the original document as a result of comments from the then Department of Planning and Infrastructure (DPI), the final plan was subsequently approved on 6 November 2012.

This BMP has been subsequently updated to be consistent with the requirements of the most recent development consent (SSD-5465 dated 16 December 2015) and the commitments made within Chain Valley Colliery's Mod 2 Statement of Environmental Effects (SEE). Extensive consultation was undertaken with the then Office of Environment and Heritage (OEH) by LakeCoal during the approvals process.

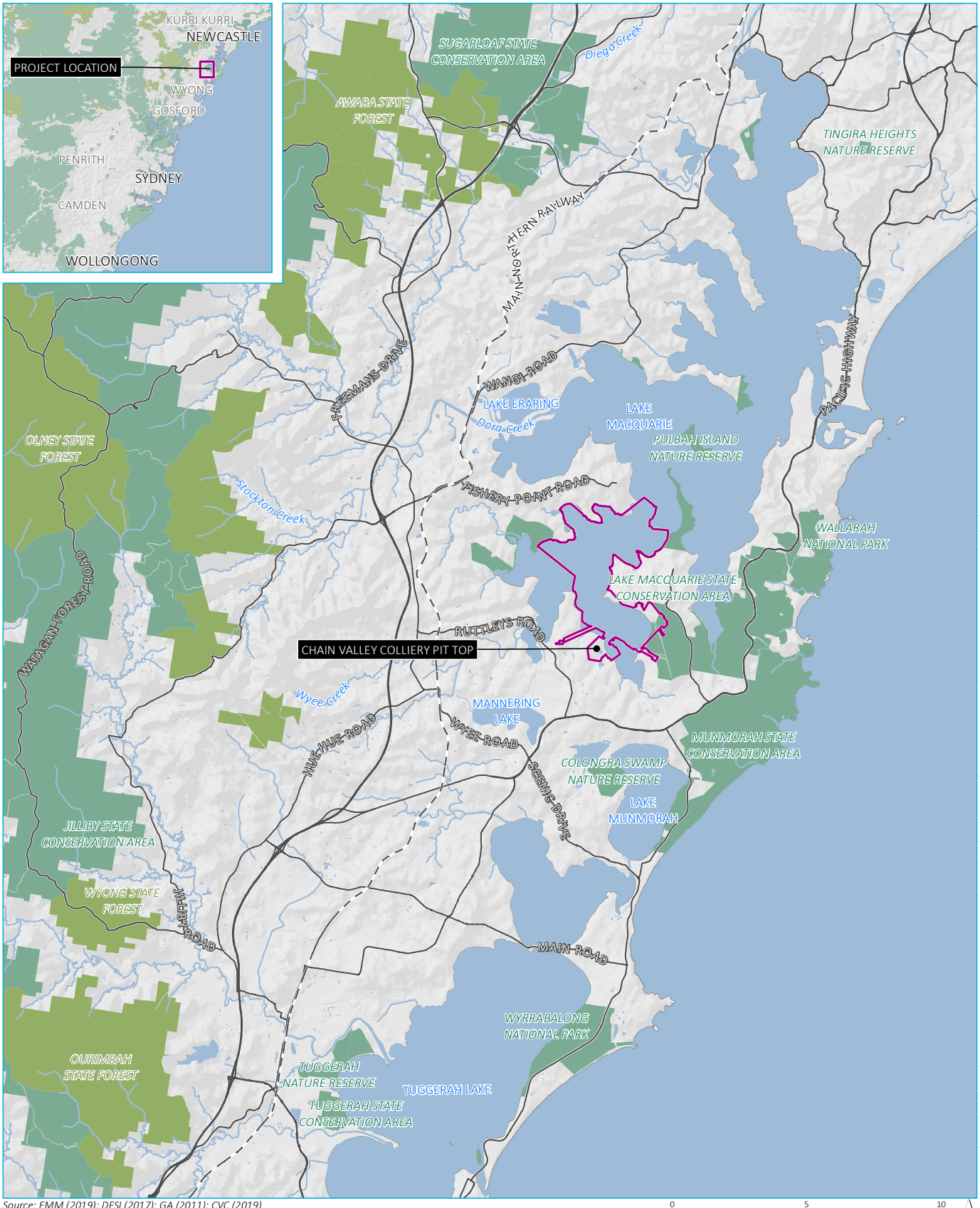
This BMP, while based substantially on the previously approved LakeCoal BMP (V3), has been updated to reflect the recommendations of the Independent Environmental Audit (IEA) conducted by SLR in June 2019. These updates are administrative only and there are no changes to activities, impacts, the mine footprint or development consent requirements associated with CVC.

Endorsement of individuals undertaking the review of this management plan was received from DPIE on the14 August 2019.

This BMP was provided to the Environment Protection Authority (EPA), Biodiversity Conservation Division (BCD) and Department of Planning, Industry and Environment (DPIE) on 1 December 2019 for their review and comment. A summary of the comments received, and amendments subsequently made to the document prior to finalisation are detailed in **Table 1**. Evidence of consultation is provided in **Appendix 1**.

Table 1: Consultation Summary

Stakeholder	Comments	Response/Action
NSW EPA	•	•
NSW DPIE	•	•
NSW BCD	•	•



Source: EMM (2019); DFSI (2017); GA (2011); CVC (2019)

0 5 10 km

GDA 1994 MGA Zone 56

N

\\emmsvr1\EMMJobs\2019\H190358 - Mannering Colliery Mgt Plan Updates\GIS\02_Maps\MCMP001_RegionalLocation_20191021_02.mxd 21/10/2019

KEY

- Chain Valley Colliery development consent boundary
- Rail line
- Main road
- Watercourse/drainage line
- Waterbody
- NPWS reserve
- State forest

CVC regional context

Chain Valley Colliery
Figure 1

EMM
creating opportunities

2 Statutory Requirements

2.1 Key Legislation, Policy and Guidelines

Both State and Commonwealth environmental legislation applies to DC's operation and activities. Compliance with State regulations requires the implementation of activities ranging from the control of priority weeds (*Biosecurity Act 2015*), monitoring for threatened species (*Biodiversity Conservation Act 2016)* and management of forest fuels to prevent fire spread (*Rural Fire Services Act 1997).*

A number of legislative requirements, government policies and guidelines relating to biodiversity are applicable, key items relevant to this BMP are:

- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- *Protection of the Environment Operations Act 1997* (POEO Act);
- *Environmental Planning and Assessment Act 1979* (EP&A Act);
- *Mining Act 1992*;
- *Biosecurity Act 2015* and Biosecurity Regulation 2017;
- *Local Land Services Act 2013*,
- *National Parks and Wildlife Act 1974*;
- *Biodiversity Conservation Act 2016*;
- *Rural Fires Act 1997;*
- Central Coast Council Tree Works Permit (former Wyong Local Government Area); and
- Auld, B. (2009). Guidelines for monitoring weed control and recovery of native vegetation, NSW Department of Primary Industries (DPI).

Delta lands are within the Lake Macquarie City Council (LMCC) and Central Coast Council (CCC) local government areas (LGAs).

2.2 Development Consent (SSD-5465) Requirements

Biodiversity related requirements of the development consent (SSD-5465) include specific conditions that are to be addressed. **Appendix 1** details where in the BMP they are addressed.

DC will also carry out works generally in accordance with the Environmental Assessment (EA), EA (Mod 1), EA (Mod 2), Project Layout Plans, and Statement of Commitments.

3 Existing Environment

3.1 Previous Assessments

Several biodiversity assessments have been undertaken in the Wyong Local Government Area (LGA), for the nearby VPPS, and for CVC. This section provides a summary of previous assessments in relation to management of biodiversity values within and surrounding the CVC.

Ecotone Ecological Consultants undertook detailed biodiversity surveys within and surrounding the study area in June 1997 and April 2010. Their study area included the CVC pit top area with the following biodiversity values identified:

- Narrow-leaved Scribbly Gum Open Forest in vegetated areas;
- potential habitat for threatened flora listed under the *Threatened Species Conservation Act 1995* (TSC Act): Black-eyed Susan (*Tetratheca juncea*); Leafless Tongue Orchid (*Cryptostylis hunteriana*) and *Angophora inopina*; and
- a record of the threatened Grey-headed Flying-fox (*Pteropus poliocephalus*), listed under the TSC Act and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The CVC EA for continued operations (MP10_0161) identified the following biodiversity values at the pit top and ventilation shaft site at Summerland Point.

- pit top area:
  - Contains remnant and regenerating vegetation including Coastal Plains Smooth-barked Apple Woodland, Riparian Melaleuca Swamp Woodland, and Swamp Mahogany Paperbark Forest. The latter two communities are part of the Swamp sclerophyll forest which is listed as an EEC under the TSC Act.
- ventilation shaft site at Summerland Point:
  - Contains remnant vegetation including Coastal Plains Smooth-barked Apple Woodland, Coastal Wet Sand Cyperoid Heath and some areas of Riparian Melaleuca Swamp Woodland, and Swamp Mahogany Paperbark Forest, which are part of the Swamp Sclerophyll Forest EEC.
- Both sites:
  - contain potential habitat for threatened species: Regent Honeyeater (*Anthochaera phrygia*), Swift Parrot (*Lathamus discolor*), Osprey (*Pandion haliaeetus*), Squirrel Glider (*Petaurus norfolcensis*) and Grey-headed Flying-fox (*Pteropus poliocephalus*). An additional ten threatened fauna species may utilise the habitats in the pit top area on occasion.

Under the Wyong Local Environmental Plan 2013 the pit top area and sediment dams are zoned as SP2 Infrastructure, with the vegetation east of the sediment dams zoned as E2 Environmental Conservation.

The infrastructure area and surrounds of the ventilation shaft site at Summerland Point are zoned E1 National Parks and Nature Reserves under the Wyong Local Environmental Plan 2013.

3.2 Baseline Monitoring

3.2.1 Native Vegetation

Baseline data on vegetation condition in the area of Swamp oak forest enhancement areas was collected in 2013 in accordance with the monitoring program outlined in this BMP (see **Table 2**).

Table 2 provides baseline data for site attributes for Swamp Oak Forest in the Biodiversity Enhancement Area. It provides the site attribute score (plot score) and calculates the weighted score of each site attribute to give an overall weighted score.

Table 2: Baseline (2013) Swamp Oak Forest Data

Site attribute	Benchmark	Plot 1 score	Plot 2 score	Average	Weighting %	Calculation	Weighted score %
Native plant species richness	>6	4	3	3.5	25	21.875	21.9
Native over-storey cover	5 to 18	3	3	3	10	7.5	7.5
Native mid-storey cover	36 to 48	3	3	3	10	7.5	7.5
Native ground-cover (grasses)	3 to 21	4	4	4	2.5	2.5	2.5
Native groundcover (shrubs)	0 to 0	4	4	4	2.5	2.5	2.5
Native groundcover (other)	1 to 13	4	4	4	2.5	2.5	2.5
Exotic plant cover (all strata)	>66%	3	4	3.5	5	4.375	4.4
Number of trees with hollows	> 0	4	4	4	20	20	20.0
Proportion of over-storey species occurring as regeneration	0	1	2	1.5	12.5	4.6875	4.7
Total length of fallen logs	> 20	3	4	3.5	10	8.75	8.8
Total		34	37	35.5	100		**82.2**

Native vegetation in this area is in good to moderate condition, with an overall weighted score of 82.2%. The trigger value for remedial works is when the weighted score is less than 60%. Subsequent monitoring events will be compared against these baseline results for Swamp oak forest in the biodiversity enhancement area to monitor the overall weighted score against this trigger value.

3.2.2 Terrestrial Ecology

Vegetation mapping undertaken during 2012 in areas surrounding the CVC pit top identified the nearby vegetation communities as Coastal Open Woodland, Swamp Oak Forest and Swamp Sclerophyll Forest. Mapping was also undertaken at the ventilation shaft site and identified Coastal Open Woodland, Grassy Open Woodland and Swamp Sclerophyll Forest.

From the above, both the Swamp Oak Forest and Swamp Sclerophyll Forest are listed as Endangered Ecological Communities (EEC s) under the *Biodiversity Conservation Act 2016*.

These vegetation communities are also known to provide habitat for threatened fauna species such as the Squirrel Glider (*Petaurus norfolcensis*), Regent Honeyeater (*Anthochaera phrygia*), Swift Parrot (*Lathamus discolor*), Grey-headed Flying-fox (*Pteropus poliocephalus*) and microbats.

In addition to the natural habitat within the site, built structures are also known to provide potential habitat for a number of fauna species. It is known that threatened microbat populations have inhabited mine portals elsewhere in NSW (Olsen Consulting Group, 2009). In addition, the CVC sediment dams have become used by a number of native fauna species.

3.2.3 Wallum Froglet

A baseline monitoring event was completed to identify the presence of the Wallum Froglet in the pit top area. The survey was completed in accordance with guidelines for the species, described in *Threatened species survey and assessment guidelines: field survey methods for fauna (Amphibians)* (DECCW 2009). The survey was conducted on two separate nights in April 2014, during the breeding and calling season when the species is readily detectable. The surveys were also completed during rain. The survey guidelines note that wet weather conditions are more important for detection of the species than the time of year the survey is completed (DECCW 2009).

The survey was completed by a qualified and experienced ecologist during 2014. Wallum Froglet calls were broadcast at the start of the survey with a five-minute listening period to check for responses. Active searches were then completed with a spotlight and head torch in potential habitat including the Swamp Oak Forest, Swamp Sclerophyll Forest and around the edges of dams.

No Wallum Froglet individuals were identified despite the survey being completed at the correct time of year and in suitable weather conditions. Additionally, the site is not considered to contain optimal habitat for the species which is usually found in acid paperbark swamps. It is not associated with Swamp Oak Forest and only occasionally found in Swamp Sclerophyll Forests (DECCW 2009; OEH 2014). Based on failure to detect the species and sub-optimal nature of the habitat identified, no further monitoring has been conducted.

4 Remnant Native Vegetation

Remnant native vegetation is located within both the CVC pit top area and ventilation shaft site (see **Figure** 2 and **Figure 3**). Vegetation in these areas has been subject to a number of influences from the surrounding areas and uses, including clearing for powerline easements, mine activities and associated infrastructure, and encroachment from adjacent residential areas. However, in general, the native vegetation within the study area is in reasonable condition and is known to contain EECs and threatened fauna species including Squirrel Gliders and microbats. A description of these vegetation communities is provided in the following sections.

4.1 Coastal Open Forests

Coastal open forests (Coastal Open Woodland and Grassy Open Woodland) occur in both the pit top and ventilation shaft areas. These areas contain a mixture of vegetation types dominated by either Narrow-leaved Scribbly Gum (*Eucalyptus haemastoma*), Red Bloodwood (*Corymbia gumifera*) or Smooth-barked Apple (*Angophora costata*). These communities generally occur above 5 metres AHD in the study area, i.e. above the high-water mark, and are not influenced by tidal movements or inundation by floodwaters.

The vegetation within the coastal open forest areas is not considered to meet the description of any EECs, although it provides important habitat for threatened fauna and contains important habitat features such as large hollow-bearing trees.

4.2 Coastal Swamp Forests

Swamp forests occur generally below 5 m AHD within the study area. Several types occur within the study area, including:

- Mangroves;
- Swamp Sclerophyll Forest; and
- Swamp Oak Forest.

4.2.1 Mangroves

Patches of mangroves occur along Swindles Creek, an unnamed creek and Lake Macquarie foreshore. The creek is subject to tidal flows from the lake, which has influenced the occurrence of the mangroves in this area. Mangrove areas are within the intertidal zone, inundated more frequently than other communities such as saltmarsh and Swamp Oak Forest.

4.2.2 Swamp Sclerophyll Forest

Swamp Sclerophyll Forest occurs on the deeper alluvial soils where drainage is impeded and standing water occurs after rain. These areas are not influenced by saline tidal waters or discharge waters associated with the sediment dams. The community is dominated by Swamp Mahogany (*Eucalyptus robusta*), Broad-leaved Paperbarks (*Melaleuca quinquenervia*), *Melaleuca sieberi*, and Forest Red Gum (*Eucalyptus teriticornis*).

This community is listed as an EEC in NSW under the TSC Act. In the study area, it surrounds some of the ventilation fan site (**Figure 3**). Microclimatic changes to this vegetation could occur from the outputs of the shaft, which could influence the health of the community. Therefore, the health of vegetation in this area will be monitored during operations.

4.2.3 Swamp Oak Forest

Swamp Oak Forest typically occurs in estuaries where tidal influence has created saline groundwater. These areas are not always inundated by saline or freshwater, with the understory within the community determined by the amount of tidal influence and salinity within floodwaters. Within the Lake Macquarie area, this community typically fringes the lake foreshore.

The area to the east of the sediment dams has been mapped as containing Swamp Sclerophyll Forest, a listed EEC. The vegetation in this area is considered to more accurately represent a Swamp Oak Forest community as it is dominated by Swamp Oak (*Casuarina glauca*). Some dead trees do occur in this area and it is likely that it previously contained species such as Swamp Mahogany (*Eucalyptus robusta*) and Broad-leaved Paperbark. These species, when dominant are indicative of Swamp Sclerophyll Forest, though have the potential to also occur in Swamp Oak forest in low quantities or in transitional areas. Regardless, the decline of these species and the lack of subsequent recruitment is a potential indicator that the area has become too saline and/or too waterlogged to provide suitable habitat.

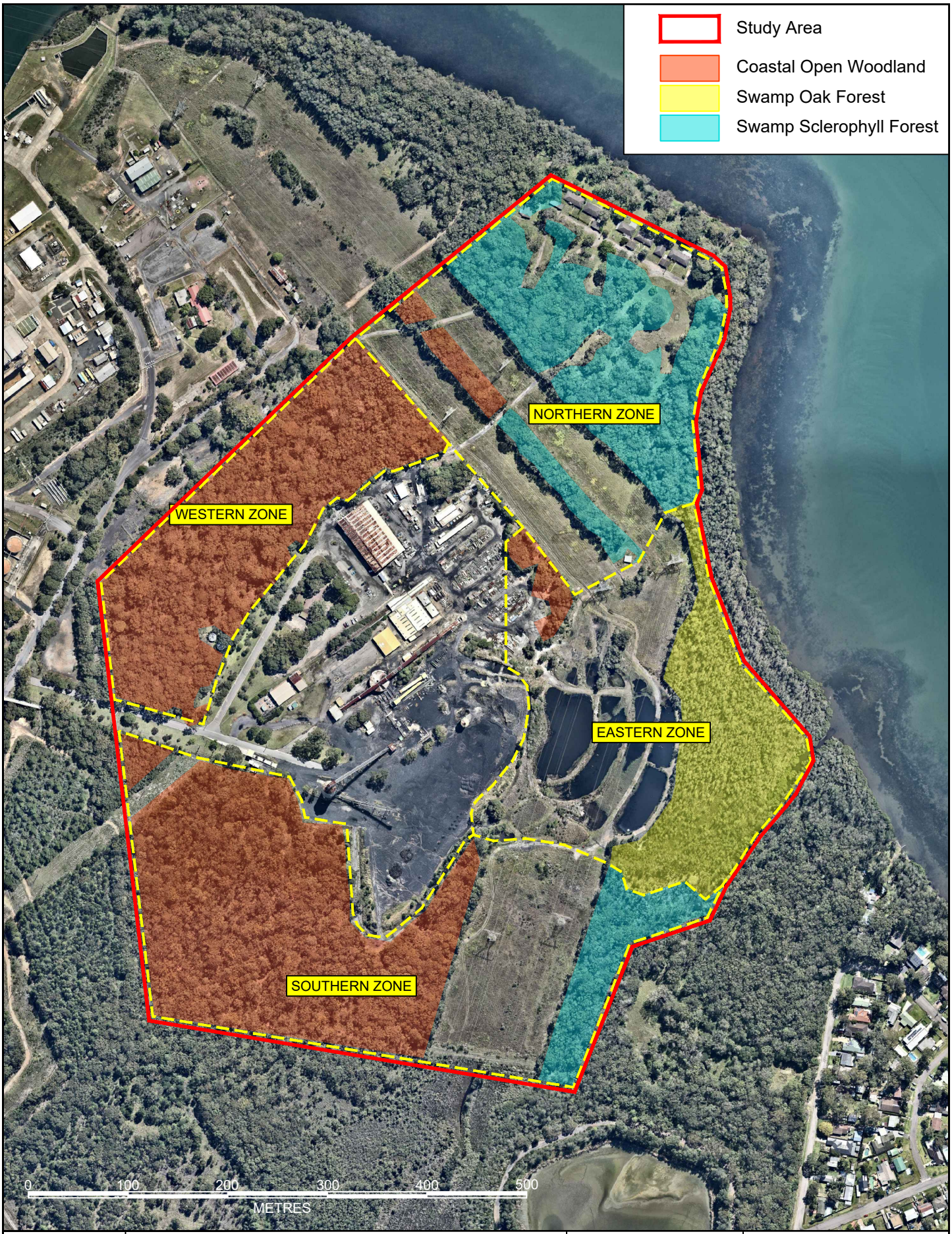
The Swamp Oak Forest is listed as a EEC under the TSC Act and is differentiated from the Swamp Sclerophyll Forest by Swamp Oak being dominant canopy species, the low abundance of eucalypt species and the position of the landscape (where flooding is periodic and soils show some influence of saline groundwater).

The area to the east of the sediment dams is unlikely to be subject to tidal influence. However, saline groundwater from the underground workings is continually discharged (via the sediment dams). This in conjunction with consequential ponding due to the relatively flat nature of the area, is likely to have influenced the vegetation present, increasing the presence of species which are adapted to higher levels of saline inundation (halophytes). Several Saltmarsh species, which tolerate inundation with saline water, occur throughout the Swamp Oak area, including *Selliera radicans*, *Suaeda australis* and *Samolus repens.* Other understory species include sedges and rushes such as *Juncus spp., Schoenus brevifolius*, *Chorizandra cymbaria* and Water Couch (*Paspalum distichum*).

Without the sediment dam discharge water, this area is likely to only be inundated after large flood events, by freshwater from Swindles Creek and runoff from other areas associated with the mine. The community present in 2014 therefore appears to be in transition and generally in poor health as is evident from the presence of weed species, dominance of sedges and rushes, and the density and health of Swamp Oaks.

Any changes to the current hydrological cycle (even though it is not natural), may impact on this community. Too much or not enough water could have effects on future species composition in this area. Changes in the quality and quantity of water discharges from the sediment dams and through seepage from the dam walls could also affect the health of the vegetation in this area.

While Swamp Oak can tolerate saline groundwater, too much saline water may lead to dieback, as is evident from the baseline monitoring in 2013, where the sediment dams have permanently inundated areas of the community. Conversely, too little inundation may cause changes to the composition of the community allowing further invasion of weeds. Changes in the condition and composition of the community present will be monitored during operations to ensure that the vegetation in this area is not negatively impacted by the operation of CVC.



N
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DELTA COAL
CHAIN VALLEY COLLIERY

SURFACE FACILITIES
BROAD VEGETATION TYPES

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CHECKED:	K Weekes	REV NO:	1
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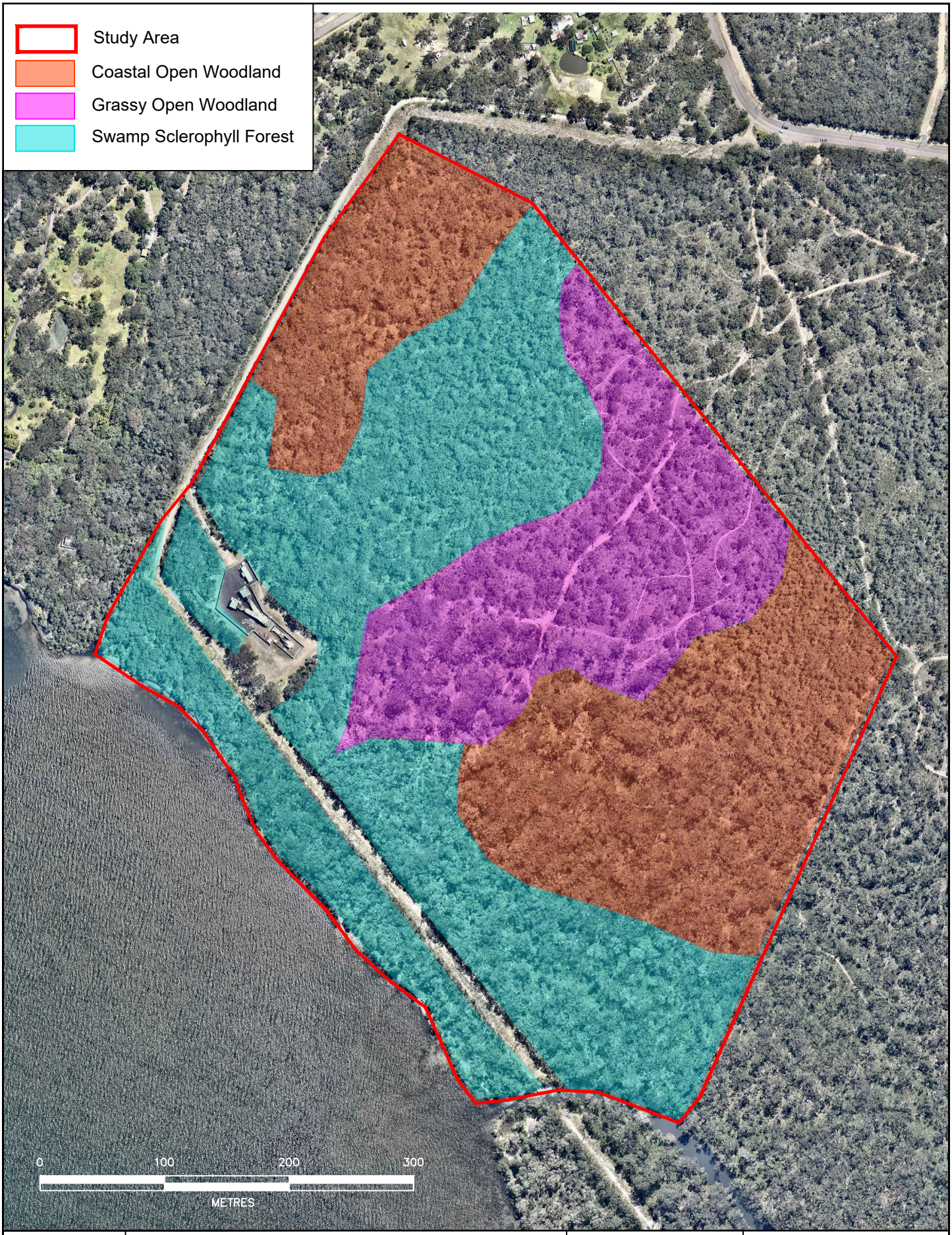
Delta coal



N
W E
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DELTA COAL
CHAIN VALLEY COLLIERY

VENTILATION FAN COMPOUND
BROAD VEGETATION TYPES

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DRAWN:	R Tubridy	DRG NO:	C1S0271
CHECKED:	K Weekes	REV NO:	1
SIGNED:	-	SIZE:	A4

Delta coal

5 Design and Construction Environmental Management

5.1 Ecological Inputs to Design

CVC designed the dam embankment and spillway in consultation with an ecologist to minimise potential impacts on the Swamp Oak Forest.

5.2 Pre-clearance Ecological Surveys

Pre-clearance ecological surveys will be undertaken by a qualified ecologist prior to any future construction works. They will clearly identify sensitive fauna habitats and significant vegetation and be undertaken during the appropriate flowering time for the particular flora species. Identification of sensitive features will potential impacts during construction to be minimised.

The following activities will be completed during the pre-clearance ecological survey:

- clear delineation of the clearing footprint;
- classification of the surrounding vegetation as a 'no go zone' during construction activities;
- installation of protective fencing/markers; and
- designating sites in previously cleared areas for material stockpiles and machinery parking.

5.3 Environmental Management Prior to and Following Construction Activities

The following measures will be implemented prior to and during any construction activities, particularly the maintenance of Asset Protection Zones (APZs) to minimise impacts to native vegetation and fauna habitats:

- installing erosion and sediment controls around any proposed earthworks;
- installation of delineation fencing around threatened flora populations (if found) to ensure their protection during development and maintenance of APZs;
- condition monitoring for threatened flora populations (if found) in APZ areas;
- 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) under the supervision of a suitably qualified ecologist or wildlife carer to replace hollows where hollow-bearing trees cannot be retained;
- 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;
- felled trees to augment nearby habitat, i.e. woody debris to be placed on the ground to create additional habitat;
- avoiding disturbance to dead standing timber and fallen timber during clearing works, or if required to be removed, timber will be relocated into suitable habitat areas nearby; and
- clearing all earthworks equipment of excess soil, potentially containing pathogens and weed seeds, prior to entering the site.

6 Native Vegetation Enhancement Strategy

The development consent and commitments for the CVC related to the enhancement of native vegetation comprise:

- the improvement and enhancement of the Swamp Oak Forest and Swamp Sclerophyll Forest to compensate for potential impacts on EECs;
- development of rehabilitation methods in accordance with the Saltwater Wetlands Rehabilitation Manual (DECC 2008), with the methods potentially including:
    - restoration of natural flow regimes;
    - rubbish and litter removal;
    - control and removal of competitive introduced species to allow for regeneration of native species;
    - revegetation where natural regeneration processes are interrupted; and
    - condition monitoring.

The native vegetation enhancement strategy aims to compensate for the potential impacts on the Swamp Oak Forest and Swamp Sclerophyll Forest and covers all the areas identified as these EECs within the pit top area, including those adjacent to the sediment dams and in areas to their north and south.

The strategy builds on existing actions and monitoring programs identified in the previous versions of the BMP to ensure that the Swamp Oak Forest and Swamp Sclerophyll Forest are enhanced and improved. The extent of the Enhancement Area is shown on **Figure 4**.

The main issues in the area adjacent to the sediment dams are:

- continuous presence of standing saline mine discharge water;
- limited canopy regeneration and canopy senescence;
- lack of understory diversity; and
- presence of weeds and rubbish.

In accordance with the SSD-5465 Statement of Commitments for Terrestrial Ecology, upgrade works to the sediment dam (D10) wall, which is located adjacent to the Swamp Oak Forest area, was completed in February 2015 in order to prevent future leakage through the wall. At the same time a new discharge monitoring system and spillway were installed.

Any changes to the hydrological cycle (even though it is not natural), also has the potential to impact on this community.

Table 5 outlines the goals, objectives and actions for native vegetation enhancement.

Figure 4 Native Vegetation Enhancement Area

Table 3: Native Vegetation Enhancement Strategy

Issue	Goal	Objective	Action
EASTERN ZONE			
Continuous presence of standing saline water from mine discharge	Restoration of natural flow regimes to the EEC areas	Water quality values in the EEC areas are within or better than the trigger values identified in Table 10 of this BMP.	1. Spillway and improvements to dam wall embankment to direct saline water away from EECs completed; 2. Water quality monitoring undertaken in accordance with the CVC Water Management Plan.
Weed invasion	Weeds are controlled in EEC area	Weeds of national environmental significance are controlled in EEC areas to a level where low maintenance is required.	1. Weed management is completed in line with **Section 7** of this BMP; 2. Weed monitoring is undertaken in accordance with **Section 11** of this BMP.
Presence of rubbish and litter	EEC area is rubbish and litter free	EEC areas are rubbish and litter free and continues to be litter free for the life of the mine.	1. Collection and disposal of rubbish and litter; 2. Type and location of rubbish/litter recorded during compliance monitoring.
Limited canopy regeneration and canopy senescence	Native species regeneration is evident in the EEC areas	Native species regeneration is at least 20% in plots by 2022	1. Annual monitoring of EEC areas downstream of D10 in accordance with **Section 11**, with regeneration values investigated and rehabilitation actions undertaken as required to ensure that the objectives are achieved; 2. Native vegetation monitoring in accordance with **Table 6** to determine if active rehabilitation is required; 3. Weed management is completed in line with **Section 7** of this BMP; 4. Weed monitoring is undertaken in accordance with **Section 11** of this BMP.
Lack of understorey diversity	Ecologically functional and diverse EECs	Final weighted condition criteria from plots in the swamp oak forest are above the trigger value (60%). Condition criteria should increase over time and meet benchmark conditions for the EECs present.	1. Monitoring EEC areas downstream of D10 in accordance with **Section 11**, to assess condition values against the trigger value and to ensure that the condition of the EEC areas is improving over time; 2. Native vegetation monitoring in accordance with **Table 6** to determine if active rehabilitation is required; 3. Weed management is completed in line with **Section 7** of this BMP; 4. Weed monitoring is undertaken in accordance with **Section 11** of this BMP.

Issue	Goal	Objective	Action
SOUTHERN ZONE			
Weed invasion	Weeds are controlled in EEC area	Weeds of national environmental significance are controlled in EEC areas to a level where low maintenance is required.	1. Weed management is completed in line with **Section 7** of this BMP; 2. Weed monitoring is undertaken in accordance with **Section 11** of this BMP.
Presence of rubbish and litter	EEC area is rubbish and litter free	EEC areas are rubbish and litter free and continues to be litter free for the life of the mine.	1. Collection and disposal of rubbish and litter; 2. Type and location of rubbish/litter recorded during compliance monitoring.
NORTHERN ZONE			
Weed invasion	Weeds are controlled in EEC area	Weeds of national environmental significance are controlled in EEC areas to a level where low maintenance is required.	1. Weed management is completed in line with **Section 7** of this BMP; 2. Weed monitoring is undertaken in accordance with **Section 11** of this BMP.
Presence of rubbish and litter	EEC area is rubbish and litter free	EEC areas are rubbish and litter free and continues to be litter free for the life of the mine.	1. Collection and disposal of rubbish and litter; 2. Type and location of rubbish/litter recorded during compliance monitoring.
WESTERN ZONE			
Weed invasion	Weeds are controlled in native vegetation area	Noxious weeds and weeds of national environmental significance are controlled in native vegetation to a level where low maintenance is required.	1. Weed management is completed in line with **Section 7** of this BMP; 2. Weed monitoring is undertaken in accordance with **Section 11** of this BMP.

Active rehabilitation will be undertaken in the EEC areas if condition criteria fall below the trigger values, or if natural regeneration is not occurring sufficiently to meet the objectives nominated in Table 5, as determined by the monitoring program. Supplementary planting with suitable species for each of the communities present, where required, would assist to meet the rehabilitation objectives. Suitable species would include:

- Swamp Oak Forest:
    - canopy species: Swamp Oak (*Casuarina glauca*); and
    - understorey and groundcover species: Water Couch (*Paspalum distichum*), *Baumea juncea* and *Selliera radicans*,
- Swamp Sclerophyll Forest:
    - canopy species: Swamp Mahogany (*Eucalyptus robusta*), paperbarks (*Melaleuca sieberi*, *Melaleuca quinquenervia*) and Forest Red Gum (*Eucalyptus tereticornis*); and
    - understory and groundcover species: *Gahnia clarkei*, Bracken (*Pteridium esculentum*), Large-leaf Hopbush (*Dodonaea triquetra*) and Whiteroot (*Pratia purpurascens*).

7 Weed Management

7.1 Background

Weed invasion impacts on species biodiversity and may alter habitats through processes such as competition and erosion. They also have the potential to impact on DC's commercial operations and reputation as a responsible land manager. Biosecurity at the land management level is the protection of environmental, economic and community values from the impacts of invasive weed species.

Some of the most common disturbance triggers are land clearing, soil disturbance, fires or change in fire regimes, and drought.

The greatest threat to the ecological integrity of the threatened ecological communities at CVC is the invasion by weeds, particularly associated with disturbance/construction activities.

This had the potential to occur with the planned embankment and spillway works on dam D10 and, subsequently, when inundation and salinity regimes are changed as a result of those works In order to facilitate weed management.

7.2 Weed Species

Total Earth Care undertook a weed survey in October 2019 which identified 36 weed species listed under the *Biosecurity Act 2015* and Biosecurity Regulation 2017 (Total Earth Care Weed Action Plan, 2019). Of these, there are various weed species which have been identified as priority species on site. The weeds detailed fall under some of the following categories:

- a declared weed under the *Biosecurity Act 2015* / Biosecurity Regulation 2017;
- listed as a Weed of National Significance (WoNS);
- listed in the Greater Sydney Regional Strategic Weed Management Plan; and
- considered a significant environmental weed which has the ability to spread rapidly and substantially reduce biodiversity.

Table 4 details the priority weed species. The ranking of 1 indicates the highest priority of control required for a weed that is recognised on a national level (WoNS) and is regionally declared weed. A ranking of 2 indicates that significant management would be required before the next monitoring survey to reduce presence, abundance and spread. Controls should be undertaken with ongoing monitoring to ensure significant reduction in distribution.

Table 4: Priority Weed species

Priority Ranking Category	Weed common name (*scientific name*)	WoNS	State Priority	Regional Priority	Duties for Priority Weeds of Greater Sydney
1	Bitou Bush (*Chrysanthemoides monilifera* subspecies *rotundata*)	Yes	Containment		Prohibition on dealings, 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.

Priority Ranking Category	Weed common name (*scientific name*)	WoNS	State Priority	Regional Priority	Duties for Priority Weeds of Greater Sydney
1	Blackberry (*Rubus fruticosis* aggregate species)	Yes			Prohibition on dealings.
2	Crofton Weed (*Ageratina adenophora*)	-			Potential risk to environment and agriculture.
2	Asparagus Fern (*Asparagus aethiopicus*)	Yes			Prohibition on dealings.
2	Lantana (*Lantana camara)*	Yes	Asset protection		Prohibition on dealings.
1	Pampas Grass (*Cortaderia jubata*)			Asset protection	Regional recommended measure. Land managers mitigate the risk of the plant being introduced to their land or spread from their land where feasible. It should not be bought, sold, grown, carried or released.
1	Fireweed (*Senecio madagascariensis)*	Yes	Asset protection		Prohibition on dealings.
1	Giant Reed (*Arundo donax)*			Asset protection	Regional recommended measure. Land managers mitigate the risk of the plant being introduced to their land. It should not be bought, sold, grown, carried or released.

7.3 Weed Management

For ease of management, monitoring and reporting, areas infested with weeds have been divided into the following zones shown on Figure 5 and Figure 6:

- Northern zone;
- Southern zone;
- Eastern zone;
- Western zone; and
- Ventilation shaft.

Several parties have management interests within the study area. Delta Electricity owns the land while DC manages CVC. TransGrid also has rights over the land in the transmission line easements. Though ultimate legal responsibility for weeds rests with Delta Electricity, as land managers, DC will undertake weed management as part of its operations on Delta Electricity owned land.

The principal objectives of weed management are guided by national, state and local legislation. The guidelines and the legislation used to determine the prioritisation of weed species for targeted control are:

- preventing the introduction of weeds into new and highly desirable areas such as rehabilitation areas, APZs and high biodiversity value areas;
- eradicating high risk infestations that are new and/or have the potential to spread quickly or significantly impact biodiversity is left unmanaged;
- containment and management of WoNs that are widespread; and
- containment and control of environmental weeds that pose a high risk to biodiversity in riparian, bushland and grassland habitats. This includes areas where control measures have already been undertaken.

For areas such as exploration sites and rehabilitation areas, the revegetation programs limit initial weed infestations, however the early control of naturally introduced weeds will minimise competition and maximise early growth and survival of desired species. This can and will be achieved by physical removal, mulching and/or chemical control as required.

When any activity results in vegetation disturbance, DC has committed to undertaking:

- seasonal monitoring and weed control as necessary to minimise the spread of weeds into nearby remnant vegetation;
- delineate the clearance footprint for works and to cordon off all surrounding vegetation as a 'no go' zone; and
- minimising disturbance areas where possible; and
- stockpiling materials, parking machinery etc. in previously cleared areas.

7.4 Weed Control

Table 5 provides recommendations for the control of the priority weed species within the site, i.e. the weeds identified within the study area during site visits, those listed in the Greater Sydney Regional Strategic Weed Management Plan and listed WoNS.

Weed control should minimise the requirements for herbicide usage, particularly given the sensitive location of the infestations and the potential for the spread of herbicides into surrounding water bodies and wetland communities.

Other environmental weeds recorded in the study area include Whisky Grass (*Andropogon virginicus*), Scotch Thistle (*Onopordum acanthium*), Large-leaved Privet (*Ligustrum lucidum*), Cassia (*Senna pendula*), Asparagus Fern (*Asparagus virgatus*), Fishbone Fern (*Nephrolepis cordifolia*), Coral Tree (*Erythrina x sykesii*) and Radiata Pine (*Pinus radiata*).

There is no legal obligation to control these weeds, but in most cases it is good practice to remove them as well as any other weeds of significance to protect the health of native vegetation communities. These infestations will be visually inspected during the weed monitoring program. If infestations increase significantly, appropriate control methods will be implemented in consultation with an approved ecologist and/or Central Coast Council.

Table 5: Recommended Weed Control

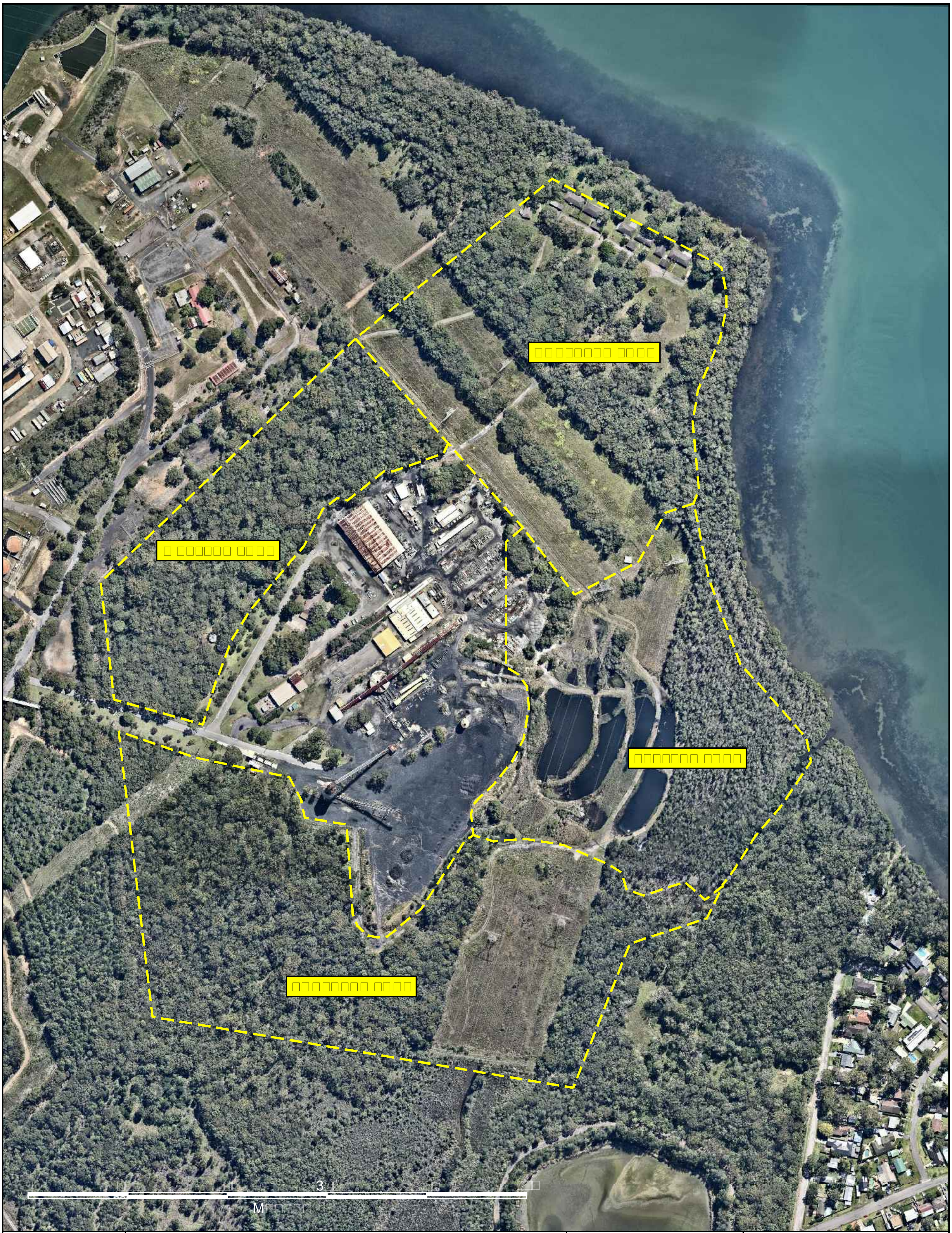
Weed	Photo	Control technique	Control priority
Bitou Bush		Hand-weeding and/or cut and paint with Glyphosate in winter. Do not undertake weeding when plants are seeding or bear fruit due to the risk of spread.	High – WoNS
Blackberry		Brush cut. Scrape and paint stem with Glyphosate in spring/summer. N.B. Gloves should be worn during application due to thorns.	High – WoNS
Croton Weed		Hand-weed individual plants.	Moderate – Weed of concern.
Ground Asparagus		Cut underground tubers with secateurs out of ground around root base and remove from site. This is most easily done by cutting a small square of ground around the above ground stems.	Moderate – WoNS which occurs in sensitive EEC areas
Lantana		Cut and paint stem with Glyphosate.	Moderate – WoNS which occurs in sensitive EEC areas

Weed	Photo	Control technique	Control priority
Pampas Grass		Remove seed heads, place in plastic bags and remove from site. Slash/brush cut plant down to bottom of stem and remove from site. Dig out roots with a mattock and remove from site. N.B. Eye protection should be worn during all stages of removal as Pampas Grass contains fine hairs that can irritate the eye.	Moderate
Fireweed		Foliar spraying with Glyphosate, hand pulled and brush cut.	High – WoNS
Giant reed		Cut and paint with neat Glyphosate.	Moderate

Sources: NSW, Australian and QLD Government 2009; DLWBC 2006; NSW Primary Industries Weed Management Unit 2009; Primary Industries (Agriculture) 2012; NSW; Sydney Weeds Committee 2012; Winkler, Cherry and Downey (eds) 2008; Total Earth Care Weed Management Plan 2019.

Weed control is undertaken by a suitably qualified contractor who will undertake mechanical removal, spraying of weeds or other treatment measures in the correct periods to maintain effective control. The contractor will use approved herbicides at the required volumes according to manufacturer's instructions.

Areas that are targeted include predominantly disturbed grassland, fragmented forested and woodland zones in the vicinity of the pit top prior to rehabilitation. These areas exhibit signs of previous agricultural use and mining-related activities. All other areas remain largely undisturbed by DC mining activities.



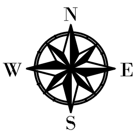

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Figure 6: Ventilation Shaft Weed Management Zone and Distribution

8 Feral Animal Management

Although there are no specific conditional requirements in SSD-5465 relating to feral animal management, the Statement of Commitments requires the abundance and distribution of feral animals to be identified.

Feral animals and/or evidence of their presence (i.e. tracks and scats) have been observed within the Pit Top and Ventilation Shaft areas at CVC. Feral animals recorded within the area include:

- European Red Fox (*Vulpes vulpes*);
- Feral Rabbit (*Oryctolagus cuniculus*);
- Feral Pig (*Sus scrofa*);
- Feral Cat (*Felis catus);*
- Dog (*Canis lupus familiaris); and*
- Feral Pigeons (*Columba livia*).

The species listed above are of concern through the potential environmental impacts they generate and their capacity to establish quickly from neighbouring areas. The European fox, dogs and feral cats have been identified as the most ecologically damaging species present due to their predation of native species. The most likely prey onsite is frogs, small mammals, birds and small reptiles. A proportion of cats and dogs preying on native species are likely to be domestic pets from adjoining properties.

Feral animals currently (and historically) do not appear to be abundant or causing adverse impacts at CVC. Monitoring is undertaken during monthly inspections and biodiversity monitoring. Only in the event that these species become an issue, or a clear trend if increasing observations become apparent, would control measures be implemented by an appropriated licenced contractor.

Other common pests identified and controlled on site include spiders, rodents (rats and mice), cockroaches, and other invertebrates.

9 Fire Management

9.1 Background

As CVC is not a residential development and there are no strict requirements for fire management, with the exception of preventing fires within the project area and their spread to surrounding land. However, Condition 24 within Schedule 3 of SSD-5465 identifies a requirement that DC be sufficiently equipped to respond to fires on site and to assist the NSW Rural Fire Service (RFS) in the event of a fire in the vicinity of the surface facilities.

There is also a statutory responsibility under the *Rural Fires Act 1997* that requires the owners of land to prevent the ignition and spread of bushfires on their land. This act provides for the prevention, mitigation and suppression of bush and other fires in NSW. Section 63(2).

9.1.1 Existing Environment

Topography can have a great impact on bushfire behaviour. For every increase in slope gradient, there is a similar increase in fire intensity and rate of fire spread. The topography of CVC is relatively flat. According to classifications in the PBP guideline, the vegetation surrounding CVC comprises forests and forested wetlands. Forests are particularly vulnerable to bushfire.

9.1.2 Key Stakeholder and Emergency Response Details

The key stakeholder and emergency response details and contacts are contained within the Pollution Incident Response Management Plan (PIRMP) which is retained in the CVC operations room, Control Room and on the DC website.

9.1.3 Bushfire Risk

Bushfire risks have been assessed in accordance with the NSW Rural Fire Service's (RFS) Planning for Bush Fire Protection Guideline (the PBP guideline). The majority of CVC is on land mapped as being in the Vegetation Category 1 on the Wyong Bushfire Prone Land Map, which is considered high risk. Category 1 vegetation comprises areas of forest, woodlands, heaths (tall and short), forested wetlands and timber plantations and requires a 100 m buffer.

As with all rural settings where vegetation is present, there is a risk that bushfires could occur in or near CVC. There is therefore a risk that a bushfire could damage buildings and present a hazard to human life. This was demonstrated in October 2013 when CVC's pit top area was threatened by a bushfire.

9.2 Land Management Zones

Fire management is addressed in this BMP as fire can present a threat to biodiversity at both the pit top and ventilation facility as these areas contain vegetation which is considered to be bushfire prone land (Category 1).

Bushfire prone land surrounding the CVC pit top and ventilation facility are shown in **Figure 7** and **Figure 8** respectively.

Figure 7: Bushfire Prone Land Map for the Pit Top Area (Source: Central Coast Council, 2015)

Figure 8: Bushfire Prone Land Map for the Ventilation Shaft Area (Source: Central Coast Council, 2015).

9.3 Defendable Space

Fire protection zones or defendable space around assets which assist in fire prevention comprise three zones:

1st Zone -APZ (Asset Protection Zone);

2nd Zone -SFAZ (Strategic Fire Advantage Zone); and

3rd Zone - LMZ (Land Management Zone).

The fire protection zones are positioned between a bush fire hazard and the asset and minimise fuel loads via hazard reduction; inhibit a fire path, and reduce the effects of heat, flame, ember and smoke attack.

Following the bushfires which occurred in 2013, DC undertook a risk assessment of bushfire controls across the operation. This review concluded that improvements to the sites APZ's around the pit top area and ventilation fan site were required. The proposed improvements to the existing APZ's were approved as part of the most recent approval modification to SSD-5465 in December 2015. The APZ's as they were approved in December 2015 are shown in **Figure 9**.

9.3.1 Asset Protection Zones

APZs provide fire vehicle access, reduce radiant heat, reduce convection winds, reduce ember attack and allow smoke to disperse. APZs are divided into an inner protection area (IPA) and an outer protection area (OPA) for forest vegetation.

APZs were determined using the PBP guideline which compares the bushfire hazard vegetation classification, bushfire weather and slope classes on bushfire prone land to derive their minimum extent. The vegetation communities and slope classes were characterised in accordance with Appendix 4 of the PBP. CVC is located in the Greater Hunter Fire Weather Area (Fire Danger Index 100).

As the topography around the CVC pit top area is relatively flat, with the primary slope class identified in the PBP guideline as class (ii) (any vegetation greater than 0° and up to 5° downslope vegetation).

The APZs for the pit top infrastructure are 25 m, comprising a 15 m inner protection area (IPA) and a 10 m outer protection areas (OPA), while the APZ for the ventilation fan site is 20 m with no requirement for an OPA. Where unimpeded access is not already available, the IPAs will also include the establishment of a 4 m wide fire trail around certain assets (ie structures, buildings and the ventilation fan site) to enable access for fire fighting vehicles.

A buffer or Asset Protection Zone (APZ) is provided between areas of vegetation and the main offices, workshops and infrastructure at the pit top and, currently, in limited areas around the perimeter of ventilation facility. Within the pit top, the APZ is landscaped to minimise fuel loads and reduce potential radiant heat levels, flame, ember and smoke attack to the buildings.

Figure 9: Asset Protection Zones

An example of the pit top APZ can be seen in **Figure 10**.

Figure 10: Firebreak between CVC Pit Top Area and Surrounding Bush

9.4 Access and Egress

Fire trails and access roads provide an important line of defence for fighting bushfires. An extensive array of fire trails and tracks are located around the pit top area to provide access for emergency services in case of a bush fire. These also provide access to easements throughout the study area which are maintained by TransGrid to provide vertical clearance and buffers for high-voltage transmission lines.

Though there is an existing road access to the ventilation facility and some fire trails, the November 2013 risk assessment and review of the October fires incident identified a risk due to access and an inadequate turnaround for fire tankers at the facility. APZs were approved and established to account for this risk and a clear area maintained around the Ventilation shaft site.

Fire trails will be inspected annually prior to the start of the Bushfire Danger Period.

9.5 Water Supply

Existing fire management infrastructure surrounds the pit top area, with water tanks and a distribution system (100 millimetre diameter water reticulation line). Fire hydrants, fire reels and depots are also placed in strategic positions to enable rapid response to fires on site. Though no reticulated water is available at the ventilation facility, its proximity to Lake Macquarie provides an emergency source of water if required.

CVC has 10 dams which can also be used if required.

Following the cessation of mining and surface operations, DC will consider maintenance of applicable controls during rehabilitation establishment (e.g. maintain APZs or other controls until rehabilitation vegetation is adequately established).

9.6 Prohibition on Hot Work Activities During Extreme and Catastrophic Fire Periods

Welding, cutting, grinding and other within vegetated area activities should not be undertaken on Extreme and Catastrophic fire danger rating days. All site vehicles should carry portable fire extinguishers and be able to communicate with the CVC Control Room in case of an emergency.

9.7 Water Access Points and Fire Fighting Equipment Locations

Existing fire management infrastructure surrounds the MC surface infrastructure areas, with water tanks and a distribution system (100-millimetre diameter water reticulation line). Fire hydrants, fire reels and depots are also placed in strategic positions to enable rapid response to fires on site. An example is shown in **Figure 11**. CVC also has 13 dams, however, due to their saline nature, they would not be an ideal source of water.

Following the cessation of mining and surface operations, DC will consider maintenance of applicable controls during rehabilitation establishment (e.g. maintain APZs or other controls until rehabilitation vegetation is adequately established).

9.8 Controls

The APZs will be managed in accordance with the PBP guideline. Maintenance will be undertaken in a manner that prevents accumulation of fine flammable debris on the ground so that fuel quantities are reduced, thus lessening flame heights and potential crowning. General maintenance guidelines are described in Appendix 2 of the PBP guideline.

The PBP guideline nominates that APZs should be maintained as follows:

- Inner protection areas (IPAs):
  - canopy cover kept at less than 15% of total surface area and at least 2 m from the roof line of a building;
  - garden beds and shrubs not to be located under trees and sited at least 10 m from any exposed windows or doors; and
  - lower limbs of trees up to 2 m above the ground are removed.
- Outer protection areas (OPAs):
  - canopy cover kept at less than 30% of total surface area; and
  - understorey mowed annually before the fire season (usually September) to remove shrubs and long grasses.

Figure 11: CVC Water Access Points

DC has, and will continue to, implement appropriate controls to assist in the management of bushfires that may impact the mining operations, including:

- Defendable Space - A buffer or APZ is provided between areas of vegetation and the main offices, workshops and infrastructure at the pit top and, currently, in areas around the perimeter of ventilation facility. Within the pit top, the APZ is landscaped to minimise fuel loads and reduce potential radiant heat levels, flame, ember and smoke attack to the buildings. The size of the protection zones will take into consideration matters such as the type of vegetation, slope of the land, fuel load source and criticality of the asset to the operation. The APZ areas will be maintained and inspected prior to the start of the fire season (1st October to 31st March unless advised otherwise). In the event additional bush fire hazard reductions works are proposed, they will be undertaken only after obtaining the requisite Bushfire Hazard Reduction Certificate from the NSW Rural Fire Service. Regular training of mine firefighting crews is also undertaken.

The APZ areas will be inspected prior to the start of the fire season (1st October to 31st March). In the event additional bush fire hazard reductions works are proposed, they will be undertaken only after obtaining the requisite Bushfire Hazard Reduction Certificate from the NSW Rural Fire Service. Regular training of mine firefighting crews is also undertaken.

10 Public Access Management

10.1 Background

While public access management is not specified in SSD-5465 as a matter to be addressed within the BMP, it has been identified as an issue within the larger surrounding Delta Electricity land (Connell Wagner 2008). Though primarily a concern from a safety management perspective, uncontrolled access to bush land areas, particularly by motor-bikes, has the potential to introduce and/or spread weeds and be a cause of erosion, both of which have the potential to affect biodiversity in remnant areas, rehabilitation or biodiversity enhancement activities.

Uncontrolled public access does not appear to be an issue within the pit top area even though some small access tracks occur throughout the areas of remnant vegetation and function as fire trails and access routes to the power line easements. These do not however appear to be commonly used and rubbish dumping does not appear to be a significant problem in this area. Motorbike tracks have been observed on the fire trails of the Ventilation Facility area and, given its location relative to local rural residential properties, it is possible that it is accessed by locals on occasion.

10.2 Management and Control

A security firm is engaged to undertake scheduled site security checks and remote alarm monitoring and reporting with these security checks e generally undertaken at times of higher unauthorised access risk such as nights and weekends.

As uncontrolled public access or potential associated problems does not appear to be a major issue at either the pit top area or the ventilation facility, it is not considered that any further management actions are required to control public access. Public access will be monitored and managed during operation of the mine through the standard incident reporting process which would include reporting of unauthorised access. Similarly, the monitoring programs such as for weeds and erosion, are considered appropriate for the management of any potential uncontrolled access issues.

Any reported incidents concerning public safety or access will be detailed in the Annual Review.

11 Biodiversity Monitoring

11.1 Overview

Table 6 provides an overview of the biodiversity monitoring programs which are identified in this BMP. Further details are provided for each of the monitoring program methodologies within the following sections. As required by the project approval conditions, this includes ecological monitoring of the:

- weed occurrence and control effectiveness;
- feral animals;
- fire risk (including asset protection zones);
- uncontrolled public access; and
- Ecological aspects including:
    - receiving waters;
    - the EEC downstream of the discharge point;
    - remnant vegetation around ventilation facilities at Summerland Point; and
    - habitat within the Biodiversity Enhancement Area as detailed in **Figure 4**.

Table 6: Biodiversity Monitoring Details

Monitoring Regime	Site	Monitoring Frequency	Methodology
Weeds	Pit Top area Ventilation Shaft	Bi-annual (seasonal)	Target existing locations and significant new occurrences of weed species (**Figure 5** and **Figure 6**) in each management zone. Record: - the number of individuals, the estimated size of infestation (i.e. m² for large infestations); - the estimated distance to native vegetation; and - recommended control measures.
Feral animals	Pit Top area and Ventilation Shaft	Annually	Monitor activity of feral species by searching for tracks, diggings, scats, burrows and sightings of individuals. Monitoring to be undertaken in conjunction with weed monitoring.
Bushfire risk /uncontrolled public access	Pit Top area Ventilation shaft	Annually prior to the fire season	APZ and fire trails (access to ventilation shaft area, access to houses to the north of the pit top area and tracks south of the pit top area to the transmission lines) to be visually inspected annually prior to the fire season (1st October – 31st March). Security firm to continue site security patrols and remote monitoring of security systems/alarms. Public access issues to be reported via standard incident form or in conjunction with weed/feral animal monitoring programs.
Receiving waters	Pit Top area	n/a	Monitoring requirements related to receiving waters are documented in the Water Management Plan.Results will be considered in conjunction with the outcomes of biodiversity

Monitoring Regime	Site	Monitoring Frequency	Methodology
			monitoring.
EEC areas downstream of the D10 discharge	Pit Top area	Annually	Continuation of surveys in the identified swamp oak forest areas. Two BioBanking plots have been established within the Swamp Oak forest which will be monitored annually. Refer to **Section 11.1** for further information.
Native vegetation	Ventilation Shaft	Annually	Monitoring of the health and condition of vegetation surrounding the ventilation shaft area. Two large Rough-barked Apple (*Angophora floribunda*) occurring directly adjacent to the Ventilation Shaft will be monitored for condition and health.

11.2 Monitoring of the Biodiversity Enhancement Area

The Biobanking methodology provides a means of determining the baseline condition, structure and composition of vegetation communities. Repeating this method over time allows changes in these variables to be identified.

A baseline event was completed in 2013 where vegetation data was collected from two plots and transects across the swamp oak forest at the site, in accordance with the Biobanking methodology (**Table 7**). The baseline monitoring identified that the generic benchmark values for the swamp oak forest (HU635) were much higher than the condition identified onsite, and would not provide a useful value to compare changes over time. Accordingly, local benchmarks (

Table 8) were assigned for Swamp Oak Forest using the baseline surveys results. These local benchmarks will provide an accurate point of comparison with site attribute scores collected in the future to determine any changes in condition resulting from management and the proposed discharge works.

Using the local benchmarks, the weighted site attribute score for these plots has varied between 65.0 – 80.3% during monitoring conducted 2016 and 2018. A value of 60% has been assigned which will trigger management in addition to the proposed enhancement strategy, if the weighted site attribute score drops below this value. A high degree of flexibility has been applied in assigning this trigger value.As this trigger is based on local benchmark data of a system already in low condition, any significant changes are likely to result in a noticeable decrease in scores. Trigger values will be reviewed and updated to reflect these changes if they occur as part of the review of the BMP.

Coupled with the water quality data, the monitoring will be able to detect changes in the composition and health of the community. **Table 7** describes the attributes to be measured during the ecological monitoring of the EEC area.

Trigger values will be determined using the final weighted site score out of 100, based on the benchmark conditions.

Table 7: Condition Criteria for Monitoring as per the Biobanking Methodology

Site attribute		Site attribute score				Weighting for site score attribute
		1	2	3	4	
A	Native plant species richness	0	0-<50% of benchmark	50-<100% of benchmark	≥ benchmark	25%
B	Native over-storey cover	0-10% or >200% of benchmark	0-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark	10%
C	Native mid-storey cover	0-10% or >200% of benchmark	0-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark	10%
D	Native ground-cover (grasses)	0-10% or >200% of benchmark	0-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark	2.5%
E	Native groundcover (shrubs)	0-10% or >200% of benchmark	0-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark	2.5%
F	Native groundcover (other)	0-10% or >200% of benchmark	0-<50% or >150-200% of benchmark	50-<100% or >100-150% of benchmark	Within benchmark	2.5%
G	Exotic plant cover (all strata)	>66%	>33-66%	>5-33%	0-5%	5%
H	Number of trees with hollows	0 (unless benchmark includes 0)	0-<50% of benchmark	50-<100% of benchmark	≥ benchmark	20%
I	Proportion of over-storey species occurring as regeneration	0	>0-<50%	50-<100%	100%	12.5%
J	Total length of fallen logs	0-10% of benchmark	>10-<50% of benchmark	50-<100% of benchmark	≥ benchmark	10%
Total weighted score						100%

Table 8 provides the local benchmarks that have been developed as a baseline for the Swamp Oak Forest. This information will form the basis against which changes will be assessed using the above criteria (**Table** 7).

Table 8: Benchmarks to measure changes within the Swamp Oak Forest Community

Criteria	Benchmarks	
	Biobanking Benchmark (HU635)	Local Benchmark
Native plant species	15	≥ 6
Native overstorey cover	15 to 65	5 to 18
Native midstorey cover	0 to 50	36 to 48
Native ground cover (grasses)	0 to 90	3 to 21
Native ground cover (shrubs)	1 to 15	0 to 0

Criteria	Benchmarks	
	Biobanking Benchmark (HU635)	**Local Benchmark**
Native ground cover (other)	2 to 90	1 to 13
Number of trees with hollows	0.8	≥ 0
Total length of fallen logs (m)	10	≥ 20

11.3 Weed Control

Monitoring is vital to assessing the effectiveness of the treatment methods carried out. Assessing the site response to any treatments is also essential in providing any follow-up actions. This will be conducted by collecting information about the site and the treatment methods used in the following ways:

- using photographic monitoring points;
- mapping of weed species, their location and densities;
- noting if the weeds have been previously treated; and
- recording significant native species and their density within the treatment area.

Information on the best practice for weed monitoring and detail on the monitoring techniques to be applied will be utilised from guidelines for monitoring weed control and recovery of native vegetation.

The results and recommendations from any monitoring will be detailed in a report or Weed Action Plan and supplied to the Environment and Community Coordinator.

Baseline information and data should be collected and assessed when measuring the effectiveness of presence and/or densities of weed species over time. The weed contractors must maintain daily activity reports detailing the following information:

- number of contractors and total number of person/people hours worked;
- weed control methods used;
- herbicide application (if any) and the type of chemical and quantity/volume used;
- weather conditions, morning, midday and afternoon, including Delta T measurements;
- location of work performed;
- the approximate area (m^2) or % of weeds treated within each management area;
- consider establishing photo points at significant infestation areas;
- other information or observations that may be relevant;
- provide this information in a report to DC, summarising weed management activities undertaken; and

record threatened or endangered flora or fauna identified within the study area.

12 Compliance Management

12.1 Introduction

The biodiversity monitoring results will be reviewed on an annual basis to confirm compliance with the conditions specified in SSD-5465.

The results will also be presented in the Annual Review and include a summary of monitoring results during the past year; a comparison against the impact assessment criteria; a summary of previous years' monitoring results; a comparison of the impacts with those predicted in the EIS and present an analysis of the potential cause(s) of significant discrepancies, if any. The Annual Review will also identify any relevant trends and any non-conformance over the year as well as describing any actions currently implemented or planned to ensure compliance with the impact assessment criteria. The Annual Review will be forwarded to the relevant authorities including the DPIE and the EPA. The Annual Review will also be forwarded to members of the Community Consultative Committee and local Councils (Central Coast and Lake Macquarie) and will also be placed on the company's website along with a summary of environmental monitoring results.

12.2 Compliance Monitoring

Trigger values have been identified for each of the biodiversity monitoring regimes implemented within this BMP based on the compliance criteria specified in Section 1. These are outlined in **Table 9** with recommended actions if trigger values are exceeded.

Table 9: Biodiversity Monitoring Triggers and Actions

Management Issue	Compliance Criteria	Triggers	Action
Weeds	Control and suppress the spread of weeds into remnant vegetation around the ventilation facility and pit top areas.	Spread of weed infestations into remnant vegetation as determined by monitoring.	Include findings in the Annual Review and undertake targeted weed control as per **Table 5** in identified areas.
Feral animals	Control feral animals.	Feral animal monitoring will identify if the number of individuals and activity levels increase. As current levels are low, the trigger value is an increase in activity levels of 2 points from the previous monitoring period for any given species.	Include findings in Annual Review and employ a suitably qualified person to undertake feral animal control for the identified species in accordance with local control programs.
Bushfire risk	Asset Protection Zones (APZs) are well maintained.	Growth of vegetation in asset protection areas surrounding the pit top and ventilation shaft areas.	Include findings in the Annual Review and undertake firetrail and APZ maintenance.
Uncontrolled public access	Control public access	Public accesses prohibited areas.	Restrict public access as required.
Receiving waters	Ecological monitoring of the receiving waters of the mine water discharge.	Use results of the Water Management Plan (EMP-D-16368) monitoring to compare to the trigger values in **Table 10**.	Monitoring requirements related to receiving waters are documented in the Water Management Plan. Results will be considered with the outcomes of biodiversity monitoring and will be included in the Annual Review. If ecological triggers are exceeded (based on annual averages), amelioration measures to improve water quality will be determined in accordance with the Water Management Plan.
EEC areas downstream of the discharge from D10 (Pit top area)	Any harm to EEC vegetation due to mine water discharge would be offset in accordance with the Office of Environment and Heritage (OEH) policy.	A decrease in the total weighted score to less than 60% for any Biobanking plots (decrease in condition and health of the EECs) within the swamp oak forest and below trigger values identified by baseline monitoring for the Swamp Sclerophyll Forest.	If the trigger is exceeded, amelioration and compensatory measures will be adopted. See Section 12.4 for details.
Native vegetation (Ventilation shaft)	Condition of remnant native vegetation around the ventilation shaft to be monitored.	Observable decrease in health of the two Rough-barked Apple in close proximity to the ventilation shaft. Observable dieback in vegetation surrounding the ventilation shaft from monitoring photos.	Amelioration measures to be discussed with the Project Ecologist to minimise impacts. This could include additions to fencing, restrictions for access and rehabilitation of disturbed vegetation.

12.3 Water Quality Triggers

The water quality triggers detailed in **Table 10** have been devised to maintain the ecological health of the receiving waters and EEC area downstream of dam D10. Trigger values will be determined by averaging the annual water quality parameters over the sampling events to ensure that stochastic environmental events are not influencing the results.

Table 10: Water Quality Triggers for Compliance Monitoring

Water quality parameter (units)	Estuary health (DECC, 2010)			Trigger (averaged annual results)
	Healthy	Fair	Poor	
pH	7 - 9	-	<7 or >9	Poor health
Suspended Solids (mg/L)	<10	10 - 20	>20 (may be influenced by tides)	Poor health
EC (µS/cm)	No trigger value. Area affected by tides			No trigger value – Area affected by tides. Monitoring in association with vegetation condition
Total Phosphorus (mg/L)	<0.02	0.02 - 0.3	>0.3	Poor health

Notes:

- *Suspended solids measurements are used instead of turbidity (as per DECC, 2010) but utilises the same health criteria. Turbidity data will also be collected in the event that the suspended solids trigger is reached.*
- *Total phosphorus used instead of Phosphates (PO_4), with the same estuary health guidelines applied from DECC, 2010.*

Water quality triggers will be investigated when EEC condition appears to be declining, that is when it has a total weighted score of less than 60%. If the threshold is exceeded, annual average water quality values will be investigated to determine if trigger values are being exceeded, to establish whether or not water quality is negatively influencing EEC condition. Results will be included within the annual monitoring report with appropriate recommendations in line with the water quality management plan reporting.

Water quantity (volumetric) triggers have not been proposed as flows may vary significantly on any day as a result of mine dewatering changes and the daily discharge volume is restricted to a maximum of 12,161 kL under EPL 1770. The need for a volumetric trigger will be reassessed in the future if EPL 1770 is varied to include a higher daily discharge volume.

12.4 Swamp Oak Forest Actions

The significance of any degradation in condition of the Swamp Oak Forest community will be determined based on the final weighting of the data from two Biobanking plots undertaken annually. Plot data will be compared to the local benchmark (baseline) data (Table 10) to calculate a final weighting.

A trigger value has been developed for the project of 60% for the total weighted score. If the weighted score for a plot falls below this threshold as a result of impacts from the Colliery, ameliorative measures and compensation will be required. Using the baseline data as a 'before impact condition', the Biobanking calculator (under the Biobanking Assessment Methodology) will be used to determine the compensatory measures required for the decrease in vegetation condition identified. The calculator will generate ecosystem credits required to be retired.

Potential offset sites will then be identified, with a preference for CVC land within the locality, using existing vegetation mapping and ground-truthing by the Project Ecologist. Offset requirements will be determined in consultation with the BCD and in the manner approved at the time.

13 Reporting

13.1 Annual Review

The results of any monitoring will be summarised in the relevant Annual Review. The Annual Review will also include a description of any actions being implemented or planned with respect to biodiversity.

Annual Review will be forwarded to members of the Community Consultative Committee, local Councils (Central Coast and Lake Macquarie), DPIE and other relevant authorities and be placed on the company's website.

13.2 Incident or Non-compliance Reporting

If monitoring reveals that actions by CVC have resulted in an environmental issue or that there has been non-compliance in relation to rehabilitation, then DC will conduct an investigation into the cause of the non-compliance.

The report will:

- describe the date, time and nature of the observation;
- identify the cause (or likely cause) of the damage/incident;
- describe what action has been taken to date; and
- describe the proposed measures to address the incident and prevent further such occurrences.

14 Stakeholder Management and Response

14.1 Complaints Handling

DC has a 24-hour telephone hotline (1800 115 277) through which members of the public can lodge complaints, concerns, or to raise issues associated with the operation. This service aims to promptly and effectively address community concerns and environmental matters.

All complaints are recorded and responded to and if, for some reason, no action is taken then the reason why is recorded. The information recorded in the complaint register includes:

- date and time the complaint was lodged;
- personal details provided by the complainant;
- nature of the complaint;
- action taken or, if no action was taken, the reason why; and
- follow up contact with the complainant.

14.2 Independent Review

As detailed in Condition 2, Schedule 5 of SSD-5465, an Independent Review can be requested by a landowner who "*considers the development to be exceeding the relevant criteria in Schedule 3".*

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

(a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the 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 Secretary and landowner a copy of the independent review

14.3 Dispute Resolution

If any disputes are not adequately addressed by the complaints handling process then they will be handled by the Environment and Community Coordinator. If the response of CVC is not considered to satisfactorily address the concern of the complainant, a meeting may be convened with the complainant, Mine Manager together with the Environment and Community Coordinator to determine any further options to reduce potential impacts.

Any actions agreed from the meeting will be implemented by CVC. After implementation of the proposed actions the complainant will be contacted and advice sought as to the satisfaction or otherwise with the measures taken.

If no agreed outcome is determined or the complainant is still not satisfied by the action taken, then an Independent Review may be requested by the complainant. If determined to be warranted by the Secretary, an independent review will be undertaken in accordance with the process identified in Schedule 5 of SSD-5465.

15 Audit and Review

The BMP will be kept up to date through DC's standard audit and review process, however it is noted that significant planning for the detailed mine closure plan is not expected until around 2026. Current site audit and review arrangements are set out below.

15.1 Review

This document will be reviewed, and if necessary revised, within three months of the following;

- The submission of an Annual Review;
- The submission of an incident report;
- The submission of an independent environmental audit; and
- Following any modification to the project approval.

Internal and external audits of this document will be carried out as described below. If possible, internal and external audits will be objective and be conducted by a person or organisation independent of the document being audited.

Audits will be carried out by personnel who have the necessary qualifications and experience to make an objective assessment of the issues. The extent of the audit, although pre-determined, may be extended if a potentially serious deviation from this document is detected.

Any audit non-conformances and/or improvement opportunities will have corrective and preventative actions implemented to avoid recurrence, these actions will be loaded into the Colliery Incident Database to ensure the actions are assigned to the relevant people and completed.

15.2 Auditing

The objectives of an audit are to maintain compliance with the BMP. Audits shall be carried out by personnel who have the necessary qualifications and experience to make an objective assessment of the issues. The extent of the audit, although pre-determined, may be extended if a potentially serious deviation from this document is detected.

Any audit non-conformances and/or improvement opportunities will have corrective and preventative actions implemented to avoid recurrence, these actions will be loaded into the site Incident Database to ensure the actions are assigned to the relevant people and completed.

External audits will be conducted utilising external specialists and will consider this document and related documents. External auditors shall be determined based on skills and experience and upon what is to be accomplished.

An Independent Environmental Audit (IEA) was undertaken during June 2019. In accordance with SSD-5465 Schedule 6, Condition 9, IEA's will be scheduled for every three years thereafter (unless the Secretary directs otherwise) by an audit team whose appointment has been endorsed by the Secretary.

16 Records and Document Control

16.1 Records

Generally, the Environment and Community Coordinator will maintain all Environmental Management System records which are not of a confidential nature. Records that will be maintained include:

- monitoring data;
- environmental inspections and auditing results;
- environmental incident reports;
- the complaints register; and
- licences and permits.

All records will be stored so that they are legible, readily retrievable and protected against damage, deterioration and loss. Records will be maintained for a minimum of 4 years or as otherwise required under any legislation, licence, lease, permit or approval.

16.2 Document Control

This document and all others associated with the Environmental Management System shall be maintained in a document control system which is in compliance with the site Document Control Standard which is available to all site personnel. Any proposed change to this document will be via the Environment and Community Coordinator.

A copy of this document is available on the DC website. Details on document revisions are provided in **Table 11**.

Table 11: Document Revision Details

Version	Date	Details of Revision	Company	Reviewed by/ Authorised by
1	06/03/2013	Original BMP	LakeCoal	P. Stewart C. Ellis B. Johnston
2	07/01/2014	Review	LakeCoal	C. Ellis
3	05/12/2014	Review	LakeCoal	C. Ellis
4	01/03/2019	Review	LakeCoal	C. Armit W. Covey
5	1/12/2019	Updated to Delta Coal format	Delta Coal	K. Weekes E. Dodd C. Armit

17 Roles and Responsibilities

Roles and responsibilities specific to completing the requirements of the BMP are identified in **Table 12**.

Table 12: Roles and Responsibilities for Biodiversity Management

Role	Responsibilities
General Manager	• Ensure that adequate financial and personnel resources are made available for the implementation of the BMP, including rehabilitation activities.
Environment and Community Coordinator	• Document owner managing the implementation of the plan. • Coordinate the biodiversity monitoring. • Engage contractors to undertake weed management and feral animal management activities and review plan updates. • Coordinate the required native vegetation enhancement strategy. • Provide results of other environmental monitoring for the project to the Project Ecologist to assist in determining any change and cause of changes to monitored vegetation. • Inspect and report on bushfire risk and management and uncontrolled public access management. • Inspect APZs prior to the start of the fire season. • Arrange for access to site for all personnel involved in implementing this BMP. • Compile data for the Annual Review. • Follow up complaints or disputes. • Respond to any potential or actual non-compliances and report these as required to regulatory bodies and other stakeholders. • Undertake reviews of this document. • Undertake or coordinate the required audits of this document. • Complete notification process for any noncompliance or incident.
Project Ecologist	• Undertake ecological monitoring specified within this BMP. • Determine compliance with approval conditions based on monitoring results and in accordance with the criteria. • Incorporate results of other environmental monitoring into the biodiversity monitoring program. • Provide feedback to the Environment and Community Coordinator for updates to the plan based on monitoring results.
All employees and contractors	• Comply with the requirements of this BMP.

18 References

Documents used in the preparation of this management plan are detailed in Error! Reference source not found..

Table 13: References

Reference	Title
Standards	AS/NZS ISO 14001:2004 Environmental management systems – Requirements with guidance for use AS/NZS ISO 14004:2004 Environmental management systems – General guidelines on principles, systems and support techniques AS2601-2001: The demolition of structures
Legislation and Regulations	*Biodiversity Conservation Act 2016* *Biosecurity Act 2015* Biosecurity Regulation 2017 Environment Protection Licence (EPL) 1770 *Environmental Planning and Assessment Act 1979 (EP&A Act)* *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* *Fisheries Management Act 1994* *Game and Feral Animal Control Act 2002* *Game and Feral Animal Control Regulation 2012* *Local Land Services Act 2013* *Mining Act 1992* *National Parks and Wildlife Act 1974* *Pesticides Act 1999* Development consent SSD-5465 (as modified) *Protection of the Environment Operations Act 1997 (POEO Act)* *Rural Fires Act 1997*
Delta Coal documents	EMS 001 Environmental Management Strategy. Chain Valley Colliery Benthic Communities Management Plan, May 2018. Chain Valley Colliery Biodiversity Management Plan, July 2014. Chain Valley Colliery Heritage Management Plan, June 2014. Chain Valley Colliery Seagrass Management Plan, June 2019. Chain Valley Colliery Water Management Plan, July 2012. LakeCoal 2018, MC and CVC Mine Operations Plan 2018 - 2020. Delta Coal Permit to Clear or Disturb land.
External	AECOM, 2011, Environmental Assessment Chain Valley Colliery Domains 1 &2 Continuation Project, prepared for LakeCoal.

Reference	Title
	Australian Government Weeds of National Significance, www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html, viewed 5 August 2019. Bureau of Meteorology (BOM) 2019, Map of Climate Zones of Australia. Cardno Ecology Lab, 2011, Mannering Colliery Extension of Mining – Aquatic Ecology Assessment, prepared for Centennial Coal. Commonwealth of Australia, September 2016, Mine Closure: Leading Practice Sustainable Development Program for the Mining Industry. Department of Environment, Climate Change and Water (DECCW) 2009, Threatened species survey and assessment guidelines: field survey methods for fauna (Amphibians), NSW Government. Department of Environment, Climate Change and Water (DECCW) 2010, Waterwatch estuary field manual and guide. Ecotone Ecological Consultants 1997, Flora and Fauna Survey and Assessment Vales Point Power Station Perimeter lands Biodiversity. Waratah, NSW. Ecotone Ecological Consultants 2010, Flora and Fauna Investigations Vales Point Power Station Perimeter lands Biodiversity Update. Waratah, NSW. EMGA Mitchell McLennan, 2015 – Statement of Environmental Effects, Chain Valley Colliery – Modification 2, Prepared for LakeCoal Pty Ltd EMGA Mitchell McLennan, 2013 – Environmental Impact Statement, Chain Valley Colliery Mining Extension 1 Project, Prepared for LakeCoal Pty Ltd. Greater Sydney Regional Strategic Weed Management Plan 2017 - 2022 Developed in partnership with the Greater Sydney Regional Weed Committee - Revised September 2019. Kelly, G.L., 2006, Recycled Organics in Mine Site Rehabilitation - A review of scientific literature, prepared for the Department of Environment and Conservation NSW. Kleinfelder 2016, Weed Action Plan - Mannering Colliery and Chain Valley Colliery. NSW Government Department of Land, Water and Biodiversity Conservation (DLWBC) 2006, Asparagus Weeds Best Practice Management Manual, Department of Water, Land and Biodiversity Conservation, South Australia. NSW Government, Australian Government and QLD Government 2009, Lantana Best Practice Manual and Decision Support Tool, Department of Employment, Economic Development and Innovation, Queensland. NSW Minerals Council Improving Mine Rehabilitation Discussion Paper, February 2018. NSW Office of Environment & Heritage (OEH) 2014, BioBanking Assessment Methodology 2014. Office of Environment and Heritage for the NSW Government, Sydney. NSW Primary Industries Weed Management Unit 2009, Blackberry control manual: Management and control options for Blackberry (Rubus spp.) in Australia, Department of primary Industries, Victoria. NSW Rural Fire Service (RFS) 2006, Planning for bush fire protection: a guide for councils, planners, fire authorities and developers. NSW

Reference	Title
	Government. Office of Environment and Heritage (OEH) 2014, *Wallum Froglet – profile,* www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10183, viewed 29 November 2019. Sydney Weeds Committee 2012, Groundcovers: Nasturtium (Tropaeolum majus), www.sydneyweeds.org.au/nasturtium, viewed 29 November 2019. Total Earth Care 2019, Weed Action Plan - Mannering Colliery and Chain Valley Colliery. Watterson, E.K., Burston, J.M., Stevens, H. and Messiter, D.J., 2011, The hydraulic and morphological response of a large coastal lake to rising sea levels. Worley Parsons. pp 1-14. Winkler MA, Cherry H and Downey PO (eds) 2008, *Bitou bush management manual. Current management and control options for bitou bush Chrysanthemoides monilifera* ssp. *rotundata) in Australia,* Department of Environment and Climate Change (NSW), Sydney.

19 Definitions

BMP Biodiversity Management Plan

CCC Central Coast Council

DC Delta Coal

DP&E Department of Planning & Environment

DPIE Department of Planning, Industry and Environment

DPI Department of Primary Industries

EA Environmental Assessment

EMS Environmental Management System

EPA NSW Environment Protection Authority

EPL Environmental Protection License

EP&A Act *Environmental Planning and Assessment Act 1979*

LMCC Lake Macquarie City Council

MC Mannering Colliery

MOP Mine Operations Plan

MP 10_161 Project Approval for CVC Domains 1 & 2 Continuation Project, referred to in Schedule 3, Condition 25 of SSD-5465

MSDS Material Safety Data Sheet

NSW New South Wales

OEH NSW Office of Environment and Heritage

POEO Act *Protection of the Environment Operations Act 1997*

RFS NSW Rural Fire Service

ROM Run of mine

Secretary Secretary of the Department, or nominee

VPPS Vales Point Power Station

WoNS Weed of National Significance

Appendix 1: Consultation

Appendix 2: Development Consent Summary

Chain Valley Colliery Development Consent SSD-5465 Summary

Relevant sections of Development Consent SSD-5465 detail the requirements of the BMP and are reproduced in Table A1 below along with identification of where the requirements are addressed in this document.

Table A1: Requirements from Chain Valley Colliery Development Consent (SSD-5465)

Condition No.	Requirements	Relevant section of this document
	Schedule 2 Administrative Conditions	
18	***Updating and Staging Strategies, Plans or Programs*** *The Applicant must regularly review the strategies, plans and programs required under this consent and ensure that these documents are updated to incorporate measures to improve the environmental performance of the development and reflect current best practice in the mining industry. To facilitate these updates, the Applicant may at any time submit revised strategies, plans or programs for the approval of the Secretary. With the agreement of the Secretary, the Applicant may also submit any strategy, plan or program required by this consent on a staged basis.* *With the agreement of the Secretary, the Applicant must prepare a revision or stage of any strategy, plan or program required under this consent without undertaking consultation with all parties nominated under the applicable condition in this approval.* *Notes:* • *While any strategy, plan or program may be submitted on a staged basis, the Applicant must ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times.* • *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program.*	**Section 10.1**
	Schedule 3 Specific Environmental Conditions	
	BIODIVERSITY ***Rehabilitation Objectives***	

<table>
<tr><th>Condition No.</th><th>Requirements</th><th>Relevant section of this document</th></tr>
<tr><td>19</td><td>The Applicant shall implement a Biodiversity Enhancement Strategy as described in the EIS and summarised in Table 6, in consultation with OEH, and to the satisfaction of the Secretary.
Table 6: Summary of the Biodiversity Enhancement Strategy
<table>
<tr><th>Area</th><th>Offset Type</th><th>Minimum Size/Amount</th></tr>
<tr><td>Biodiversity Enhancement Area</td><td>Enhancement and restoration measures, including weed and rubbish removal, return of natural hydrological regime and regeneration with native endemic species.</td><td>3 ha (in total) of Swamp Sclerophyll Floodplain Forest and Swamp Oak Floodplain Forest endangered ecological communities within the surface facilities sites</td></tr>
</table>
Note: To identify the Biodiversity Enhancement Area referred to in Table 6 see the applicable figures in Appendix 7.</td><td>Section 6</td></tr>
<tr><td></td><td>The Applicant shall 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 OEH and to the satisfaction of the Secretary.</td><td>See below</td></tr>
<tr><td></td><td>Biodiversity Management Plan</td><td></td></tr>
<tr><td>20</td><td>The Applicant shall 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 Secretary. This plan must:</td><td></td></tr>
<tr><td></td><td>(a) be prepared by a suitably qualified person approved by the Secretary; in consultation with OEH, and submitted to the Secretary within 6 months of the date of this consent;</td><td>Section 1.5</td></tr>
<tr><td></td><td>(b) establish baseline data for the existing habitat in the Biodiversity Enhancement Area and elsewhere on the site;</td><td>Section 6</td></tr>
<tr><td></td><td>(c) describe the short, medium, and long term measures that would be implemented to:</td><td></td></tr>
<tr><td></td><td>• manage the impacts of clearing vegetation;</td><td>Section 5</td></tr>
<tr><td></td><td>• manage the remnant vegetation and habitat in the Biodiversity Enhancement Area and elsewhere on the site; and</td><td>Section 6, 10</td></tr>
<tr><td></td><td>• implement the Biodiversity Enhancement Strategy, including detailed performance and completion criteria;</td><td>Section 6</td></tr>
<tr><td></td><td>(d) include a program to monitor and report on the effectiveness of these measures, and progress against the detailed performance and completion criteria;</td><td>Section 11</td></tr>
<tr><td></td><td>(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</td><td>Section 6</td></tr>
<tr><td></td><td>(f) include details of who would be responsible for monitoring, reviewing, and implementing the plan.</td><td>Section 17</td></tr>
<tr><td></td><td>The Applicant shall implement the approved management plan as approved from time to time by the Secretary.</td><td>Noted</td></tr>
<tr><td>20A</td><td>Within 3 months of the approval of MOD 2, the Applicant shall 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 Secretary for approval.</td><td>This document</td></tr>
<tr><td></td><td>BUSHFIRE MANAGEMENT</td><td></td></tr>
<tr><td>24</td><td>The Applicant shall:</td><td></td></tr>
</table>

Condition No.	Requirements	Relevant section of this document
	(a) ensure that the development is suitably equipped to respond to any fires on site; and	**Section 9**
	(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.	**Section 9**
	STATEMENT OF COMMITMENTS	
	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. LakeCoal will:	
	• *investigate one of the following options in consultation with OEH 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 OEH to identify a suitable conservation program and provide $10,000 of funding; or* ○ *purchase and retire 5 credits on the Biobanking register.*	**Financial contribution by LakeCoal in 2016**
	• *update* the BMP to include the following: ○ *the completion of predisturbance surveys in the survey area for Blackeyed 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;* ○ *condition monitoring for threatened flora populations (if found);* ○ *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;* ○ *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;*	**Section 5, 7 and 9**
	• *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;*	**Dam works completed 2017**
	• *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;*	**As above and Section 5**

Condition No.	Requirements	Relevant section of this document
	• *clearly delineate the clearing footprint and cordon off surrounding vegetation as a 'no go' zone during works to the dam embankment and spillway;*	**As above and Section 5**
	• *minimise disturbance areas where possible by ensuring all stockpiling of materials, parking of machinery etc, is undertaken in previously cleared areas;*	**As above and Section 5**
	• *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;*	**As above and Section 5**
	• *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;*	**As above and Section 5**
	• *install sediment fencing surrounding the proposed earthwork areas, in accordance with a site- specific erosion and sediment control plan for the works;*	**As above and Section 5**
	• *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;*	**As above and Section 5**
	• *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.*	**Section 7, 8, 11**
	• *noxious weeds will be removed and continually controlled from the pit top area, allowing for natural regeneration of vegetation;*	**Section 7**
	• *weed invasion will be monitored as part of the Colliery's BMP; and*	**Section 11**
	• *the condition of the EEC areas will be monitored through the Colliery's BMP.*	**Section 11**

Appendix 7 Benthic Communities Management Plan

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CHAIN VALLEY COLLIERY

Benthic Communities Management Plan

ENVIRONMENTAL MANAGEMENT PLAN

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Contents

1 Introduction

1.1 Purpose and Scope

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1.2 Background

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LakeCoal was formed in 2001 to acquire BHP Billiton's 80% share in the Wallarah Coal Joint Venture □□ □□□□□□□e re□ □i□g □□□□ □□□re □□□ □□□□d □□ □□i□□□□□ □ □□□□er □□□□□□e□□□d □□erg□□ □□ i□□ed □□□□ □□□□□ □□□uired □□□e□ □□□□□□□□i□ied□

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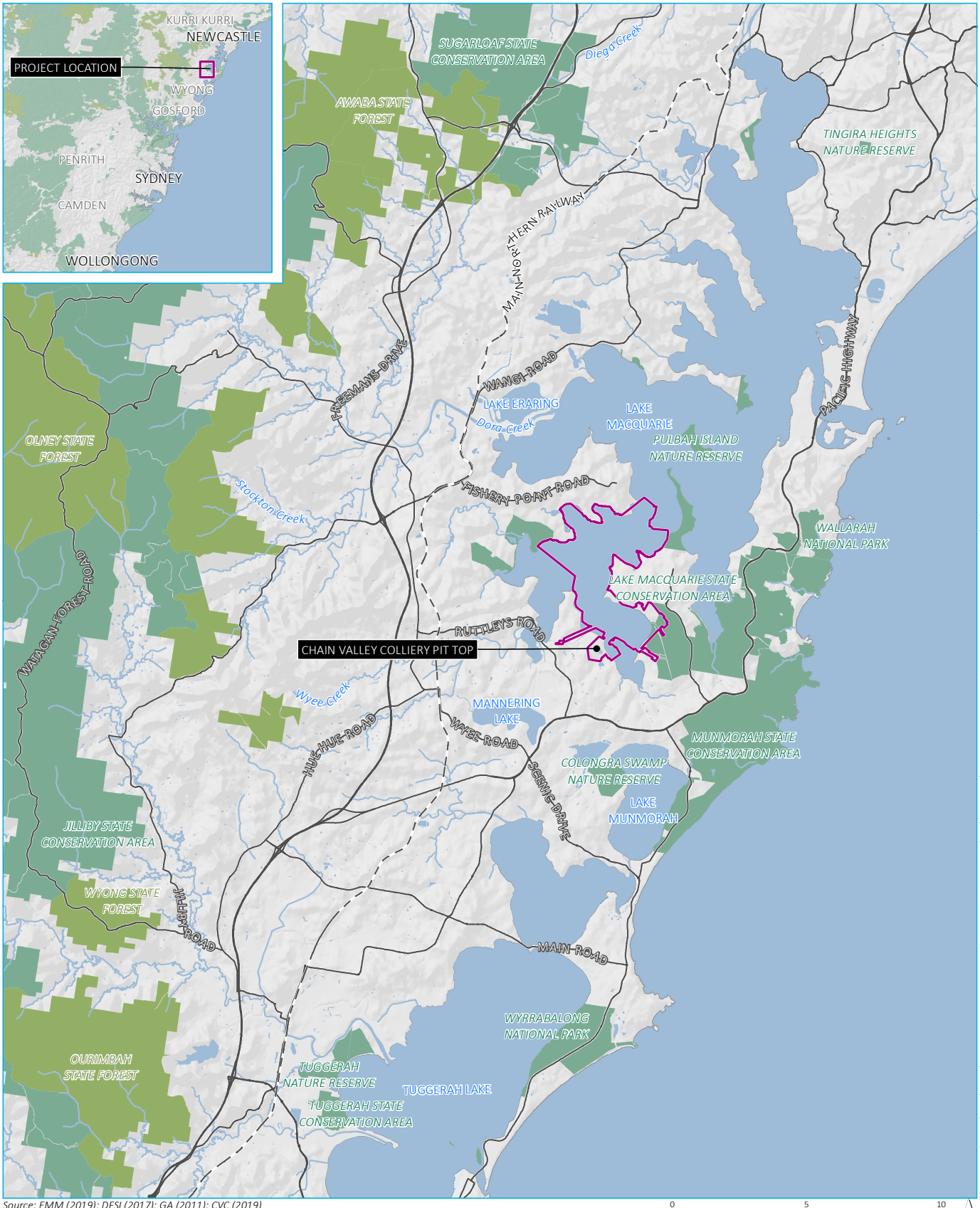

Source: EMM (2019); DFSI (2017); GA (2011); CVC (2019)

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KEY

- Chain Valley Colliery development consent boundary
- Rail line
- Main road
- Watercourse/drainage line
- Waterbody
- NPWS reserve
- State forest

CVC regional context

Chain Valley Colliery
Figure 1

EMM
creating opportunities

1.3 Consultation

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Table 1: Consultation Summary

Stakeholder	Comments	Response/Action
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2 Statutory Requirements

2.1 Key Legislation, Policy and Guidelines

[illegible]'s operation and activities. A number [illegible] guide[illegible] [illegible]

- *Environment Protection and Biodiversity Conservation Act 1999* [illegible]
- *Protection of the Environment Operations Act 1997* [illegible]
- *Environmental Planning and Assessment Act 1979* [illegible]
- *Mining Act 1992*[illegible]
- *National Parks and Wildlife Act 1974*[illegible]
- *Biodiversity Conservation Act 2016*[illegible]
- [illegible] 3 [illegible] *Policy and guidelines for fish habitat conservation and management* [illegible]
- [illegible] *and New Zealand Guidelines for Fresh and Marine Water Quality*[illegible]

[illegible]

2.2 Development Consent SSD-5465 Requirements

[illegible]

"The [illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible] species number and benthic communities' composition, incorporating the monitoring and survey data [illegible]
- [illegible]

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Table 2: Subsidence Impact Performance Measures

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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 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.*

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3 Benthic Communities Management

3.1 Baseline Data

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3.2 Bathymetric Surveys

[illegible]

[illegible]

[illegible] CVC's [illegible] **Figure 2** [illegible]

[illegible]

3.3 Subsidence Predictions and Modelling

[illegible]

4 Benthic Communities Monitoring Program

[illegible]

4.1 Sampling Locations

[illegible]

- [illegible] prefix "IM"): Sites which are currently, or were historically impacted upon by [illegible]
- Reference (site prefix "R"): Sites which are not currently impacted by subsidence but fall within [illegible]
- Control (site prefix "C"): Sites which will not be impacted upon by subsidence.

[illegible] **Table 3** [illegible] **Figure 3** [illegible]

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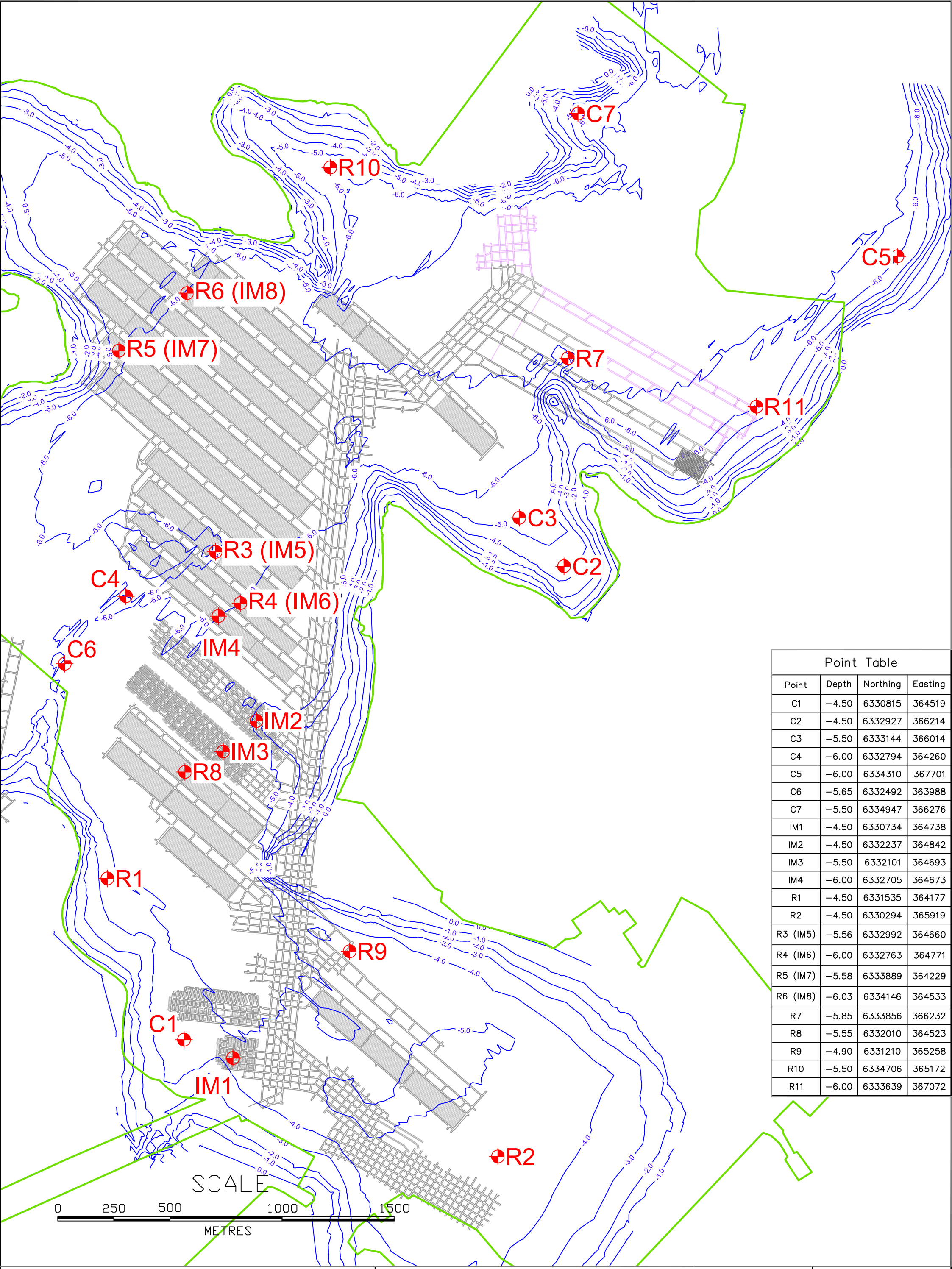
Delta coal



Point Table

Point	Depth	Northing	Easting
C1	−4.50	6330815	364519
C2	−4.50	6332927	366214
C3	−5.50	6333144	366014
C4	−6.00	6332794	364260
C5	−6.00	6334310	367701
C6	−5.65	6332492	363988
C7	−5.50	6334947	366276
IM1	−4.50	6330734	364738
IM2	−4.50	6332237	364842
IM3	−5.50	6332101	364693
IM4	−6.00	6332705	364673
R1	−4.50	6331535	364177
R2	−4.50	6330294	365919
R3 (IM5)	−5.56	6332992	364660
R4 (IM6)	−6.00	6332763	364771
R5 (IM7)	−5.58	6333889	364229
R6 (IM8)	−6.03	6334146	364533
R7	−5.85	6333856	366232
R8	−5.55	6332010	364523
R9	−4.90	6331210	365258
R10	−5.50	6334706	365172
R11	−6.00	6333639	367072

Legend

- Fassifern Seam CVC Workings (December 2015)
- Proposed Fassifern Seam Workings
- Other Existing Workings (Fassifern Seam)
- Project Boundary - Chain Valley Mining Extension 1

DELTA COAL
CHAIN VALLEY COLLIERY

BENTHIC MONITORING POINTS
LAKE MACQUARIE

Figure 3

SCALE:	1:15000	DATE:	21 October 2019
DRAWN:	T Chisholm	DRG NO:	C1S0120_1
CHECKED:	C Armit	REV NO:	14
		SIZE:	A3

Delta coal

Table 3: Benthic Community Sampling Locations

Site Name	Sample Depth (m)	Easting	Northing
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4.2 Sampling Methods

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4.2.1 Water Quality

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4.2.2 Benthic Sediment

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4.2.3 Benthic Invertebrates

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4.3 Laboratory Analysis

4.3.1 Benthic Sediment

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4.3.2 Benthic Invertebrate Identification

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4.4 Data Analysis

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Table 4: Data Analysis

Variable Type	Analysis	Description
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	[illegible]	[illegible]
	[illegible]	[illegible]

4.5 Monitoring Frequency

[illegible] **Section 3** [illegible] to light reduction and sediment disturbance, on benthic species number and benthic communities' [illegible]

[illegible]

4.6 Program Refinements

[illegible]

5 Modelling to Monitor Potential Impacts

5.1 Model Background

[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]

5.2 Analysis

[illegible]

- [illegible]
- [illegible]

[illegible]

Figure 2 [illegible]

[illegible]

did □□□r□ide □de□u□e □e□ur□□e re□u□□□□ □□e □□ □ig□i□□□□e □i□□e □□□ied □□ □e□□□□□□d□□□ □□d re□i□ied reg□rdi□g □ui□□i□□ □□□ed □□ d□□□ □u□□□□e□□

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6 Reporting

6.1 Regular Reporting

In accordance with Schedule [illegible] Condition [illegible] the [illegible] provide regular reporting on the environmental performance of the development on its website in accordance with the reporting arrangements in any plans or programs approved under the conditions of the development consent.

The benthic community monitoring results will be reviewed [illegible] as survey reports are received to confirm compliance with the conditions specified in the *Subsidence Impact Performance Measures*.

6.2 Annual Review

In accordance with Schedule [illegible] Condition [illegible] the [illegible] review the environmental performance of the development to the satisfaction of the Secretary by the end of March each year, or other timing as may be agreed by the Secretary.

The Annual Review will include a summary of monitoring results during the [illegible] with reference to the [illegible] criteria and [illegible] identified [illegible] between [illegible] results and predictions in the environmental [illegible] Non-compliances [illegible] recorded [illegible] relevant authorities including [illegible] non-compliances [illegible] be [illegible] recorded [illegible] community consultative committee and [illegible] Lake Macquarie [illegible] be placed on the company's website along with a summary of environmental monitoring results.

6.3 Incident or Non-Compliance Reporting

[illegible] monitoring reveals [illegible] result [illegible] exceeding [illegible] greater than [illegible] incurred [illegible] investigate the cause [illegible] Schedule [illegible] Condition [illegible] relevant agencies will be notified [illegible] incident [illegible] cause [illegible] criterion [illegible] the environment. For other incidents relevant agencies will be notified [illegible]

The investigation into the incident will consider [illegible] activities [illegible] or other [illegible] caused or contributed [illegible] the [illegible] provided [illegible] and [illegible] existing [illegible] including [illegible] and [illegible] other relevant [illegible] incident or being [illegible] incident [illegible] receiving [illegible] monitoring data [illegible] investigation [illegible] consider [illegible] activities or other [illegible] generated the [illegible] provided [illegible]

The report [illegible]

- describe the date [illegible] and nature [illegible]
- identify the cause (or likely cause) [illegible] damage
- describe [illegible] and [illegible]
- describe the proposed measures to address the damage and prevent further such occurrences

[illegible] incident [illegible] in order to prevent future occurrences [illegible] incident [illegible] recorded and [illegible] investigated to find root causes and corrective actions implemented where [illegible]

7 Stakeholder Management, Response and Training

7.1 Complaint Protocol

[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

1.1 Independent Review

[illegible] landowner who "*considers the development to be exceeding the relevant criteria in Schedule 3".*

If the Secretary is satisfied that an independent review is warranted, then within 2 months of the Secretary's [illegible]

(a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the 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 Secretary and landowner a copy of the independent review.

1.2 Dispute Resolution

[illegible]

[illegible]

[illegible]

7.2 Training, Awareness and Competence

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8 Audit and Review

8.1 Review and Improvement

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8.2 Auditing

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9 Records and Document Control

9.1 Records

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9.2 Document Control

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Table 5: Document Revision Details

Version	Date	Details of Revision	Company	Reviewed by/ Authorised by
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Version	Date	Details of Revision	Company	Reviewed by/ Authorised by
		[illegible]		

10 Roles and Responsibilities

[illegible]

[illegible] **Table 6**.

Table 6: Benthic Communities Management Plan Roles and Responsibilities

Role	Responsibilities
[illegible]	• [illegible] • [illegible] • [illegible]
[illegible]	• [illegible] • [illegible] • [illegible] • [illegible] • [illegible] • [illegible] • [illegible] • [illegible] • [illegible]
[illegible]	• [illegible] • [illegible]

11 References

[illegible] referenced in the preparation of the [illegible] are detailed in **Table 7**.

Table 7: References

Reference	Title
[illegible]	[illegible] *Environmental management systems – Requirements with guidance for use* [illegible] *Environmental management systems – General guidelines on principles, systems and support techniques* [illegible] *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*
[illegible]	[illegible] Industries [illegible]3 *Policy and guidelines for fish habitat conservation and management* [illegible] [illegible]
[illegible]	[illegible] Management [illegible]
[illegible]	[illegible]3 *Chain Valley Colliery Mining Extension 1 Project Marine Ecology Assessment,* [illegible] [illegible], *Chain Valley Colliery Modification 2 Marine Ecology Assessment,* [illegible] [illegible], *Chain Valley Colliery Benthos Statistical Analysis,* [illegible] [illegible] [illegible]3 *Lake Macquarie Benthos Survey Results of Sampling No. 4.* [illegible]3 [illegible] *Benthic Communities Survey of Chain Valley Bay, Summerland Point and Crangan Bay, Lake Macquarie* [illegible] [illegible], *Lake Macquarie Benthos Survey Results No.10 September 2016.* [illegible] O'Connor S et al [illegible]

12 Definitions

CVC □e□□□ □□□□□□ □□i□ □□□e□ □□□ier□

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EPA □□□ □□□ir□□□ e□□□r□□e□i□□ □u□□□ri□□

EPL □□□ir□□□ e□□□□□r□□e□i□□ □i□e□□e

EP&A Act *Environmental Planning and Assessment Act 1979*

LMCC □□□e M□□□u□rie □i□□ □□u□□i□

POEO Act *Protection of the Environment Operations Act 1997*

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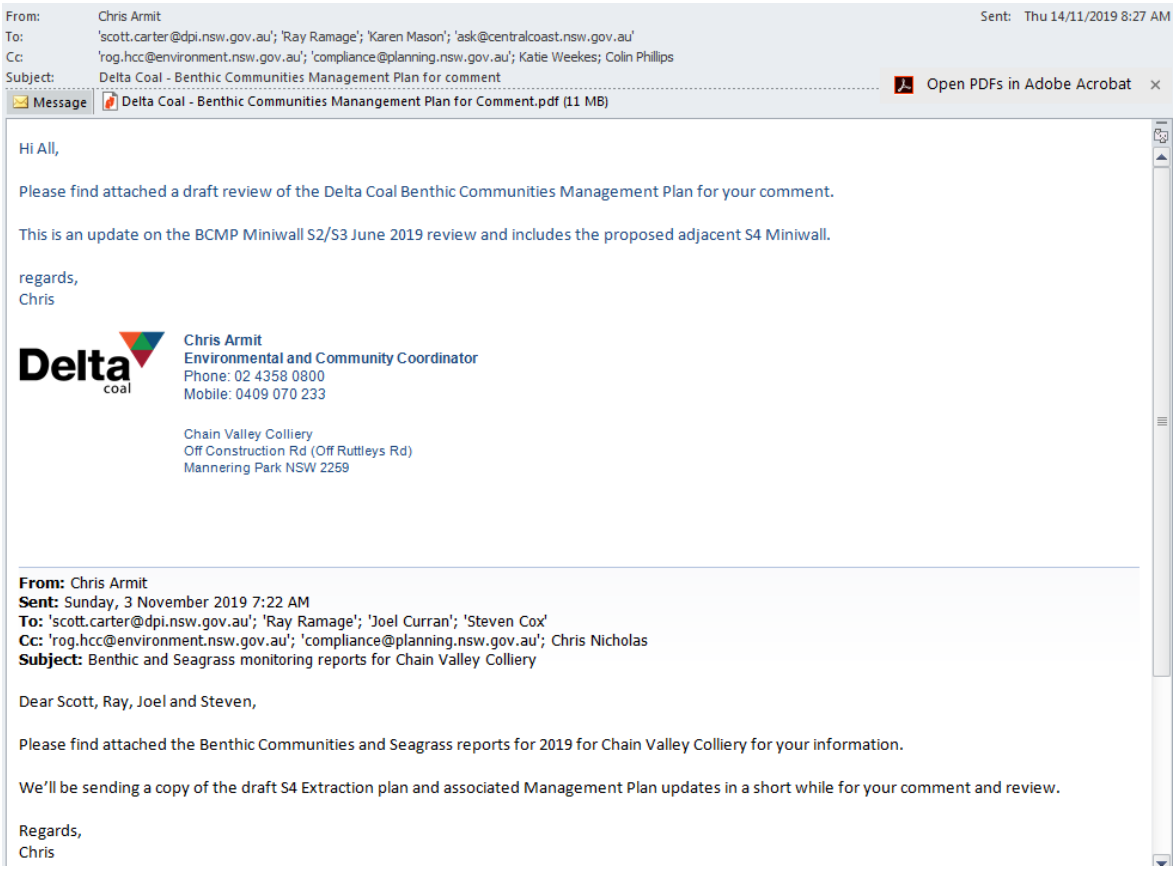
Appendix 1: Consultation



From: Chris Armit
To: 'scott.carter@dpi.nsw.gov.au'; 'Ray Ramage'; 'Karen Mason'; 'ask@centralcoast.nsw.gov.au'
Cc: 'rog.hcc@environment.nsw.gov.au'; 'compliance@planning.nsw.gov.au'; Katie Weekes; Colin Phillips
Subject: Delta Coal - Benthic Communities Management Plan for comment
Sent: Thu 14/11/2019 8:27 AM

Message | Delta Coal - Benthic Communities Manangement Plan for Comment.pdf (11 MB)

Open PDFs in Adobe Acrobat

Hi All,

Please find attached a draft review of the Delta Coal Benthic Communities Management Plan for your comment.

This is an update on the BCMP Miniwall S2/S3 June 2019 review and includes the proposed adjacent S4 Miniwall.

regards,
Chris

Chris Armit
Environmental and Community Coordinator
Phone: 02 4358 0800
Mobile: 0409 070 233

Chain Valley Colliery
Off Construction Rd (Off Ruttleys Rd)
Mannering Park NSW 2259

From: Chris Armit
Sent: Sunday, 3 November 2019 7:22 AM
To: 'scott.carter@dpi.nsw.gov.au'; 'Ray Ramage'; 'Joel Curran'; 'Steven Cox'
Cc: 'rog.hcc@environment.nsw.gov.au'; 'compliance@planning.nsw.gov.au'; Chris Nicholas
Subject: Benthic and Seagrass monitoring reports for Chain Valley Colliery

Dear Scott, Ray, Joel and Steven,

Please find attached the Benthic Communities and Seagrass reports for 2019 for Chain Valley Colliery for your information.

We'll be sending a copy of the draft S4 Extraction plan and associated Management Plan updates in a short while for your comment and review.

Regards,
Chris

From: Chris Armit
To: 'rog.hcc@environment.nsw.gov.au'; 'Resources Regulator'; 'Margaret MacDonald-Hill'; 'scott.carter@dpi.nsw.gov.au'; 'Geoffrey Keech'; Melissa Sawatske; 'dpi.cabinet@dpi.nsw.gov.au'; 'cassandra.mcnamara@dpi.nsw.gov.au'; 'Matthew.Montgomery@finance.nsw.gov.au'; 'Ray Ramage'; 'dan.adams@planning.nsw.gov.au'; 'Robert Gibson'; 'Joanna Pajkowska'; 'landuse.enquiries@industry.nsw.gov.au'; 'water.referrals@dpi.nsw.gov.au'; 'Mitchell Isaacs'; 'Danielle.Allen@centralcoast.nsw.gov.au'; 'EPA RSD Hunter Region Mailbox'; 'Steve Clair'
Cc: Tim Chisholm; 'David Richards'; Chris Nicholas; 'David Hill'; Dave McLean; 'Flood, Justin'; Everett, Greg; Colin Phillips; 'Gurney, Steve'; 'Joel Curran'; Katie Weekes
Subject: Miniwall S4 Extraction Plan draft for comment and associated MP status
Sent: Fri 20/12/2019 4:57 AM

Dear All,

The draft Miniwall S4 Extraction Plan document has been uploaded onto the Delta Coal website (https://www.deltacoal.com.au/environment/chain-valley-colliery/ch) for your comment.
After 28 days and the inclusion/consideration of your comments the S4 Extraction Plan document will be uploaded onto the DPIE planning portal.

The associated management plans were submitted on the below dates to the relevant stakeholders and comments have been received, thank you for your comments on these.
The management plan review for comment process nominally ends December 31 and the management plans will being updated with comments and added to the planning portal for assessment/approval.

Associated Management Plan	Date submitted to stakeholders
CVC Public Safety MP	25/11/19
CVC Built Features MP	20/11/19
CVC Water MP	1/12/19
CVC Rehabilitation MP	19/11/19
CVC Benthic Communities MP	17/11/19
CVC Seagrass MP	14/11/19
CVC Heritage MP	1/12/19
CVC EMS	1/12/19
CVC Biodiversity MP	1/12/19

As always, happy to go through any comments you have in person or over the phone.

Thanks for your collective assistance over 2019 and look forward to working with you all again in 2020. Happy Holidays !

Regards,
Chris

From: Robert Gibson <Robert.Gibson@environment.nsw.gov.au> Sent: Fri 10/01/2020 4:40 PM
To: Chris Armit
Cc: Nicole Davis
Subject: RE: Miniwall S4 Extraction Plan draft for comment and associated MP status

Dear Chris,
Thank you for your e-mail of 20 December 2019 with a copy of the draft Miniwall S4 Extraction Plan for the Chain Valley Colliery for comment. Biodiversity and Conservation Division (BCD) notes that this document has been prepared to meet the requirements of Condition 7, Schedule 4 of the consent for SSD-5465, and is to be prepared in consultation with several Government agencies, including BCD. BCD has reviewed the draft Extraction Plan and has no comment to make on it.

If you have any questions about this advice then please call me on 4927 3154 to discuss.

Kind regards,

Robert

Robert Gibson
Regional Biodiversity Conservation Officer, Hunter Central Coast Branch

Biodiversity and Conservation Division | Department of Planning, Industry and Environment
T 02 4927 3154 | **E** robert.gibson@environment.nsw.gov.au
Level 4, 26 Honeysuckle Drive, Newcastle, NSW 2300
www.dpie.nsw.gov.au

From: Geoffrey Keech [mailto:gkeech@lakemac.nsw.gov.au]
Sent: Thursday, 12 December 2019 3:41 PM
To: Chris Armit
Cc: Melissa Sawatske
Subject: LMCC response to Delta Coal Mannering Colliery and Chain Valley Colliery management plans consultation

Hi Chris,

Thankyou for providing Council the opportunity to comment on your management plans. I provide the following feedback:

Plan	LMCC Comments
CVC Rehabilitation Management Plan	Any infrastructure (slabs, pits, pipes, etc.) that is to be abandoned and covered over should be mapped and this map made available to any future user or purchaser of the site. Spelling mistake "mircobat"
CVC Benthic Communities Management Plan	No comments
CVC Seagrass Management Plan	*Page 25, Table 5 – Environment and Community Coordinator ' Send annual Seagrass Monitoring Reports to DPI Fisheries and……' there is information missing here with respect to who the reports would be sent to.*
CVC Built Features Management Plan	No comments – no identified built features fall within the LMCC boundary or jurisdiction. Central Coast Council should provide comment for the dwellings at Summerland Point.

For future iterations of these plans, could you please send the plans to Council@lakemac.nsw.gov.au addressed to "Development Assessment and Certification officer." The plans will be allocated to a DAC officer to coordinate comments from the relevant sections of Council.
It would help us if you can include a note about the purpose of the consultation (as per the "Audit and Review" section of the management plans), and ideally send a copy that has been marked up with the changes that have occurred, as this allows us to focus quickly on the relevant changes.

Geoffrey Keech
Development Planner
LAKE MACQUARIE CITY
T 02 4921 0025 **M** 0429 124 904
E gkeech@lakemac.nsw.gov.au
lakemac.com.au

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DPIE Resource Assessments - Benthic Communities Management plan related comments	**Response**
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Appendix 2: Development Consent Summary

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Table A2: Requirements from Chain Valley Colliery Development consent SSD-5465

Condition No.	Requirement	Relevant section of this document
	Schedule 2 Administrative Conditions	
18	***Updating and Staging Strategies, Plans or Programs*** *The Applicant must regularly review the strategies, plans and programs required under this consent and ensure that these documents are updated to incorporate measures to improve the environmental performance of the development and reflect current best practice in the mining industry. To facilitate these updates, the Applicant may at any time submit revised strategies, plans or programs for the approval of the Secretary.* *With the agreement of the Secretary, the Applicant may also submit any strategy, plan or program required by this consent on a staged basis. With the agreement of the Secretary, the Applicant may prepare a revision or stage of any strategy, plan or program required under this consent without undertaking consultation with all parties nominated under the applicable condition in this consent.* *Notes:* • *While any strategy, plan or program may be submitted on a staged basis, the Applicant must ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times.* • *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program.*	**Section 8**
	Schedule 3 Specific Environmental Conditions	
2	***Performance Measures- Natural Environment*** *The Applicant shall ensure that the development does not cause any exceedance of the performance measures in Table 8 to the satisfaction of the Secretary.* *Table 8: Subsidence Impact Performance Measures* ***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*	**This document**

	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 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

3	***Offsets*** *If the Applicant exceeds the performance measures in Table 8 and the Secretary determines that: (a) it is not reasonable or feasible to remediate the impact or environmental consequence; or (b) the remediation measures implemented by the Applicant have failed to satisfactorily remediate the impact or environmental consequence; then the Applicant shall provide a suitable offset to compensate for the impact or environmental consequence to the satisfaction of the Secretary. Note: Any offset required under this condition must be proportionate with the significance of the impact or environmental consequence*	**Section 4**
7	***Extraction Plan*** ***(h)*** *include a Benthic Communities Management Plan, which has been prepared in consultation with OEH, 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 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 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.* *The Applicant shall implement the approved management plan as approved from time to time by the*	**This document**

	Secretary. *Notes:* *• To identify the underground mining areas approved under this consent referred to in this condition, see Appendix 3.* *• This condition does not limit secondary extraction under a Subsidence Management Plan approved as at the date of this consent.*	
8	*The Applicant shall 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*	**Section 4 and 6**

Appendix 8 Seagrass Management Plan

Delta coal	□□□ □ □□er□ **Environment and Community Coordinator** □□□ □□□

CHAIN VALLEY COLLIERY

Seagrass Management Plan

ENVIRONMENTAL MANAGEMENT PLAN

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Table of Contents

1 Introduction

1.1 Purpose

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1.2 Background

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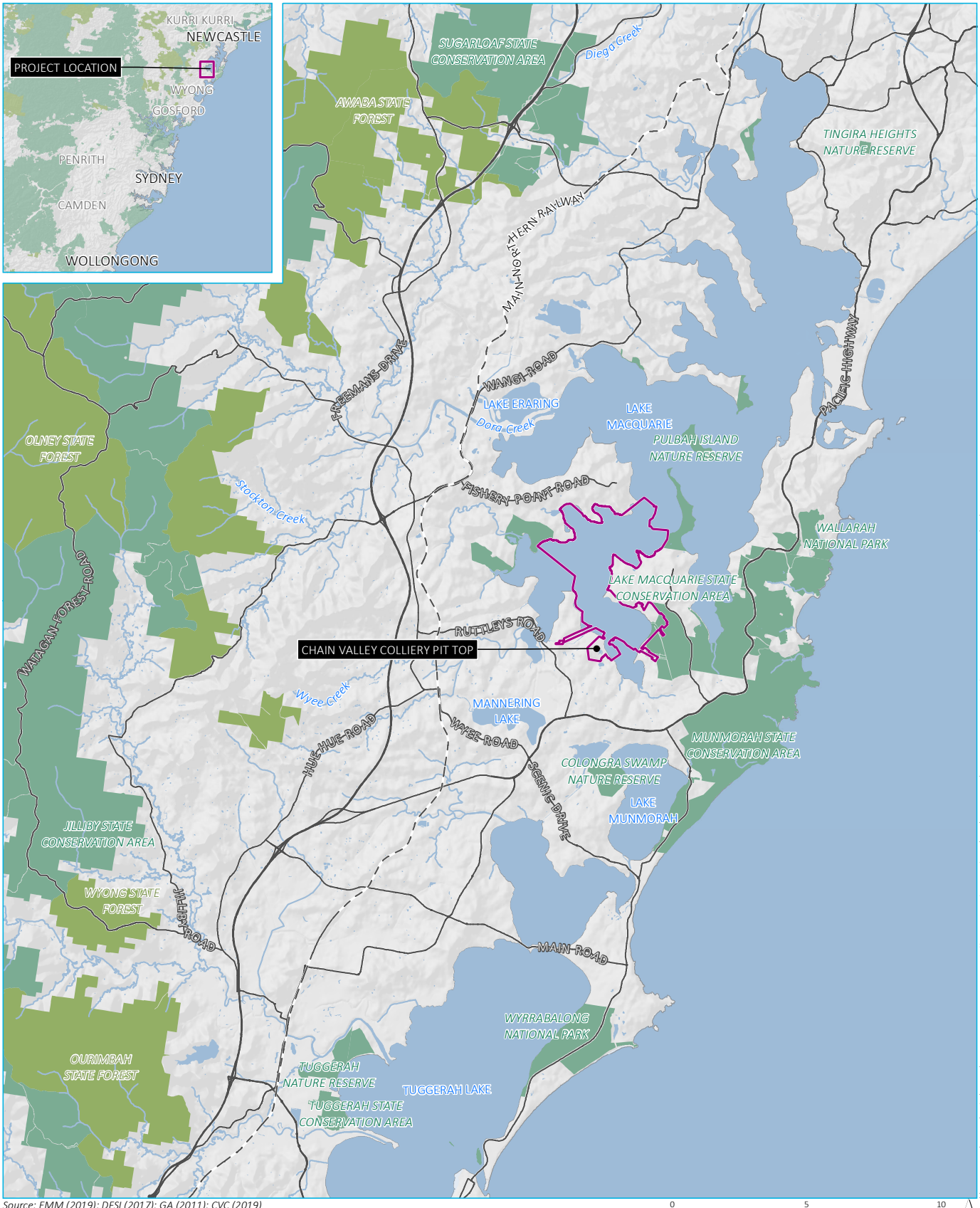

Source: EMM (2019); DFSI (2017); GA (2011); CVC (2019)

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KEY

- Chain Valley Colliery development consent boundary
- Rail line
- Main road
- Watercourse/drainage line
- Waterbody
- NPWS reserve
- State forest

CVC regional context

Chain Valley Colliery
Figure 1

EMM
creating opportunities

1.3 Consultation

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Table 1: Consultation Summary

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2 Statutory Requirements

2.1 Key Legislation, Policy and Guidelines

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- *Environment Protection and Biodiversity Conservation Act 1999* □□□□□ □□□□□
- *Protection of the Environment Operations Act 1997* □□□ □□ □□□□□
- *Environmental Planning and Assessment Act 1979* □□□□□ □□□□□
- *Mining Act 1992*□
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2.2 Development Consent SSD-5465 (as modified)

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"7. The Applicant shall prepare an Extraction Plan for all second workings on site, to the satisfaction of the □e□re□r□□□□□□ □□□r□□□i□□ □□□□ □u□□

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Table 2: Subsidence Impact Performance Measures - Natural and Heritage Features

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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 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.*

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3 Background

3.1 Operations

[illegible]

[illegible]

[illegible]

[illegible] **Figure 2** [illegible]

3.2 Seagrass Communities

[illegible]

- [illegible] (*Zostera capricorni*)
- [illegible] (*Halophila ovalis*)
- *Ruppia sp* [illegible]
- [illegible] (*Posidonia Australia*) [illegible] *Fisheries Management Act, 1994*

[illegible]

[illegible]

[illegible]

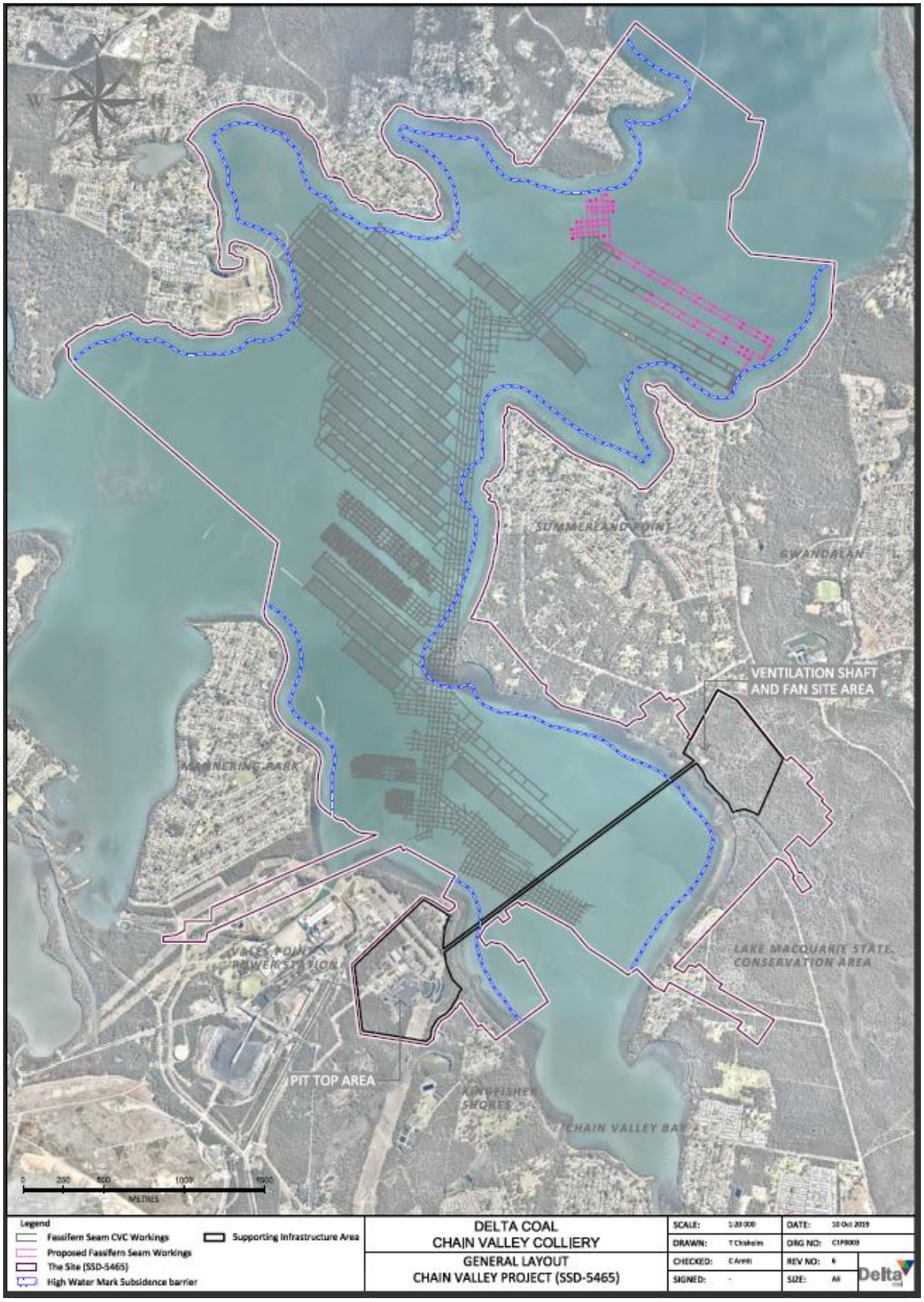

Figure 2: General Layout of the Chain Valley Northern Mining Domain

[illegible] *Seagrass Survey of Chain Valley Bay, Summerland Point, Bardens Bay and Crangan Bay, Lake Macquarie, NSW (Results for 2008 to 2017)* [illegible]

[illegible]

[illegible]

[illegible] *Zostera capricorni* [illegible]

[illegible]

[illegible] **Figure 1** [illegible]

[illegible] *Zostera capricorni* [illegible] *Zostera capricorni* [illegible] *Halophila ovalis* [illegible]

[illegible]

Seagrass is a vital component of Lake Macquarie's [illegible] ecosystem. It captures the sun's energy and [illegible]

3.3 Seagrass Mapping

[illegible] *Zostera capricorni* [illegible]

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3.4 Subsidence Predictions and Modelling

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4 Seagrass Management

4.1 Management Practices

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4.2 Seagrass Protection Limits

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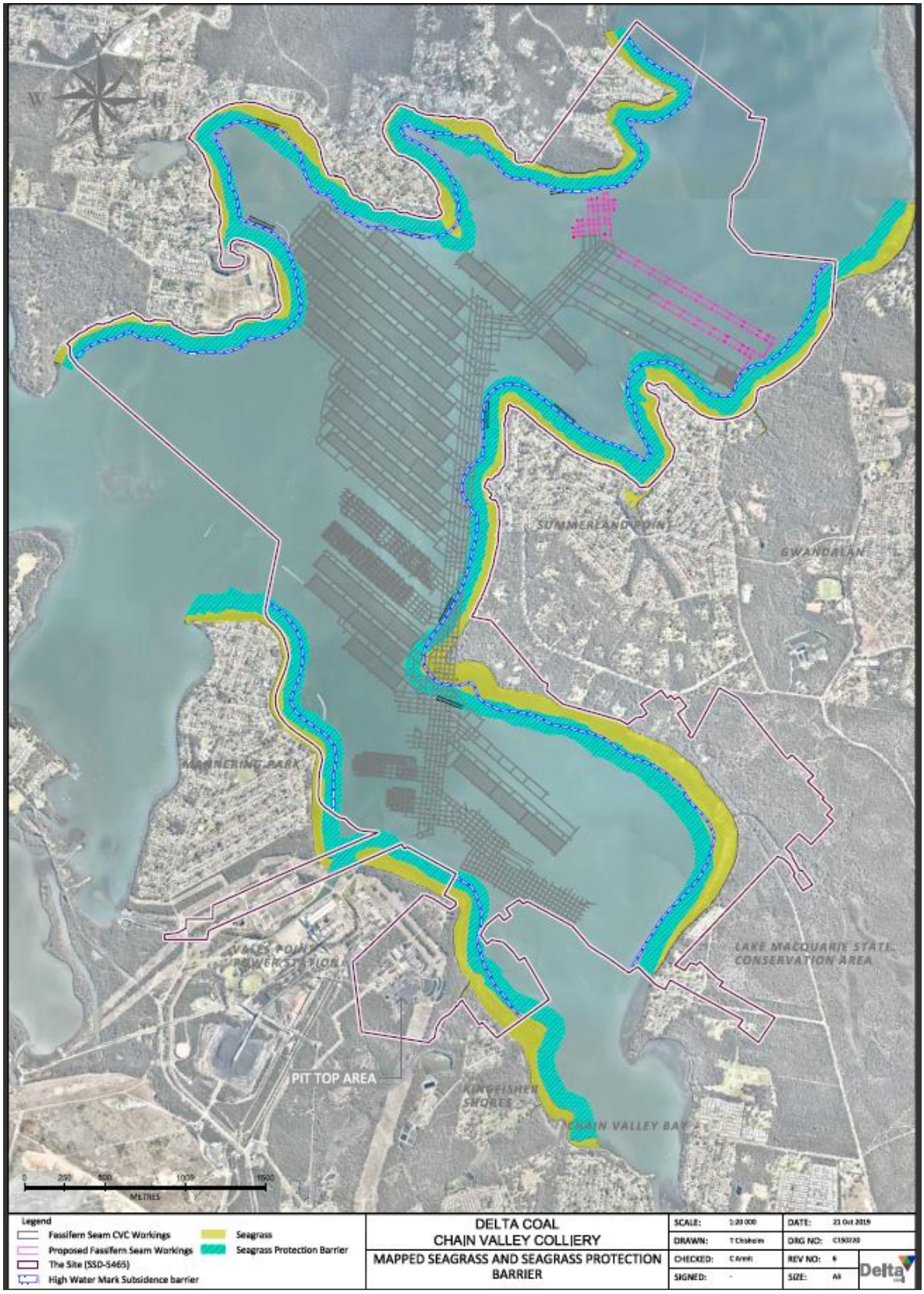

Figure 3: Mapped Seagrass and Protection Barrier

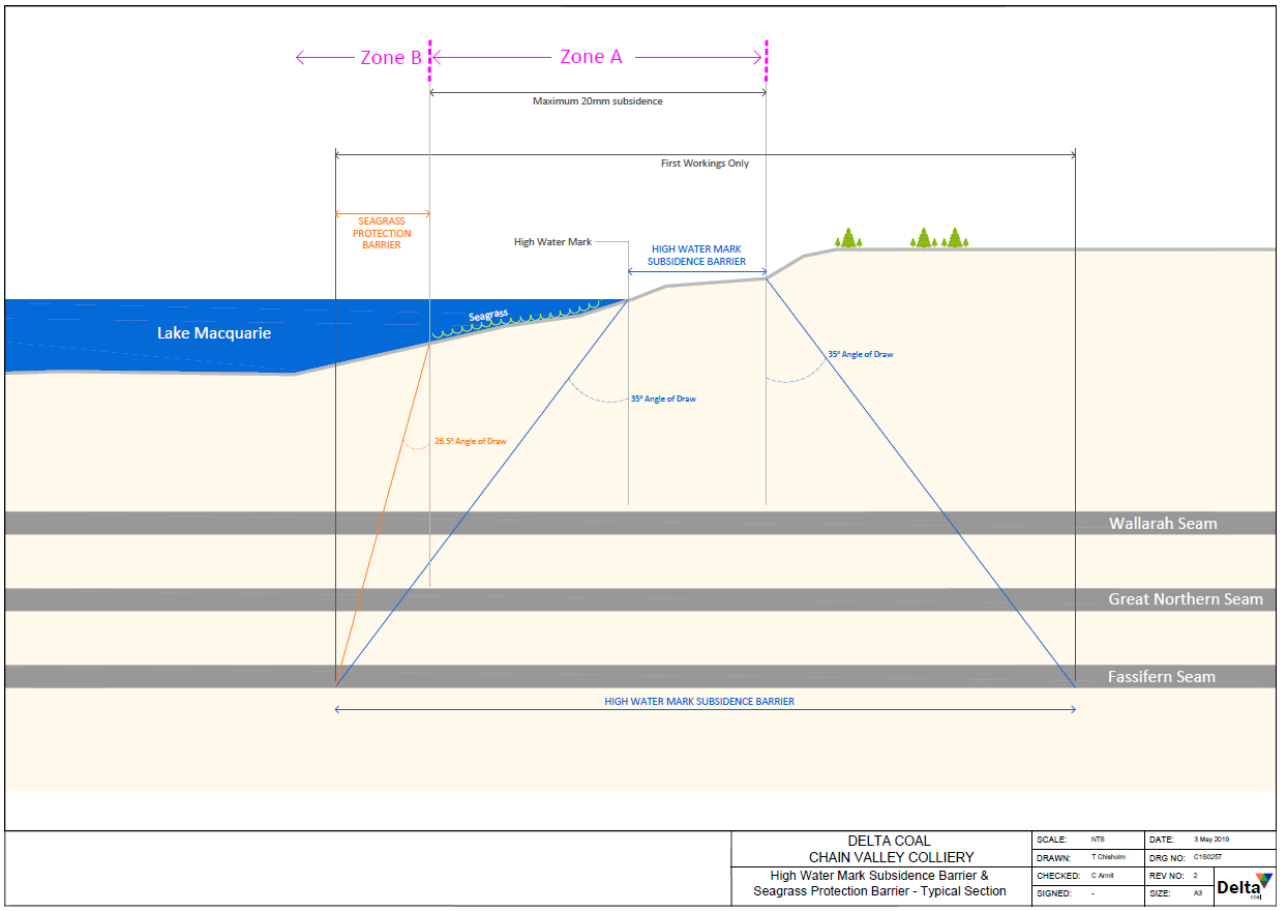

Figure 4: Protection Barrier Schematic cross section

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4.3 Seagrass Impact Mitigation

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5 Seagrass Monitoring

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5.1.1 Seagrass Photography

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5.1.2 Surveying Methods

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5.2 Monitoring Locations

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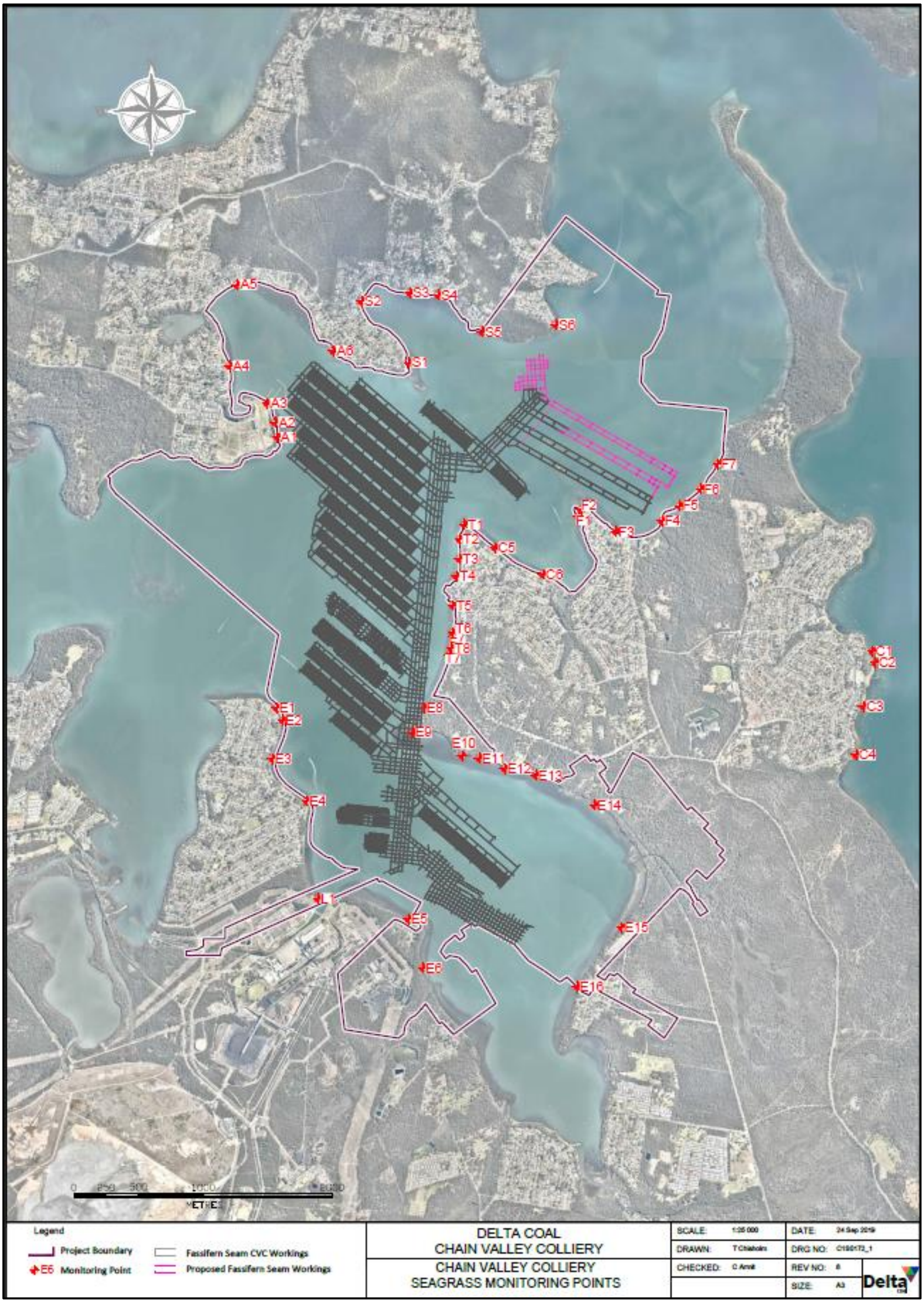
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Project Boundary
E6 Monitoring Point
Fassifern Seam CVC Workings
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CHAIN VALLEY COLLIERY
CHAIN VALLEY COLLIERY
SEAGRASS MONITORING POINTS
SCALE: 1:25 000
DRAWN: T Chisholm
CHECKED: C Arndt
DATE: 24 Sep 2019
REV NO: 8
SIZE: A3
Delta

Figure 1: Locations of Seagrass Monitoring Transects

Table 3: Seagrass Monitoring Transect Coordinates

Site	Easting	Northing	Reduced Level (m) – inner transect	Reduced Level (m) – outer transect
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Site	Easting	Northing	Reduced Level (m) – inner transect	Reduced Level (m) – outer transect
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6 Reporting

6.1 Regular reporting

[illegible]

[illegible] *Subsidence Impact Performance Measures - Natural and Heritage Features* [illegible] **Section 4.2** [illegible]

6.2 Annual review

[illegible]

[illegible]

6.3 Incident or Non Compliance Reporting

[illegible] **Section 4.2** [illegible]

[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible]

[illegible]

7 Stakeholder Management, Response and Training

7.1 Complaint Protocol

DC has a 24-□ur □e□□□□e hotl□ne (1800 115 277) □r□ug□ which □e□ □er□ of th□e □u□i□ can □dge compla□nts, conc□erns, □r to r□i□e i□□ue□ assoc□a□ed with th□e □□er□i□□. □i□ □er□i□e a□ms □ promptly □□d e□□e□i□e□ □ddre□□ □□□ □u□i□ con□erns □□d e□□ir□□□ e□□□□ □ □□er. □□□ □□□ □□i□□ □re re□□rded □□d re□□□□ded to. Th□e info□ma□ion re□□rded i□ th□e compla□nt regi□□er i□□ude□:

- d□□e □□d i□e th□e compla□nt was □dged;
- p□rsonal de□i□□ □r□□ided by th□e compla□nant;
- □□□ure of th□e compla□nt;
- ac□ion ta□□n □r i□no ac□ion was tak□n, th□e reason why; an□d
- follow u□ cont□ct w□th□e compla□nant □

7.2 Independent Review

As de□i□ed i□ □□di□□ 2, □□edu□e 5 of SSD-5465, an □de□e□de□□e□ie□ can □e re□ue□ed by a □□d□□er who "*considers the development to be exceeding the relevant criteria in Schedule 3".*

□the □e□re□r□i□ □□i□ied that an i□de□e□de□re□ie□ i□ □□rr□□ed, □e□ □i□i□ 2 months of □e □e□re□ry's de□i□□□ □e App□i□ant sha□l □

(a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the 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 Secretary and landowner a copy of the independent review

7.3 Dispute Resolution

If any di□□u□e□ □re not □de□u□e□ □ddre□□ed by th□e compla□nts □□□di□g □r□□e□□ then th□ey will □e □□□di□ed by □□e Env□ronm□ent □□d Comm□unity □□□rdi□□□r. If □□e re□□□□□e of CVC □□ not □□□□idered to sa□is□acto□ri□y □ddre□□ th□e conc□ern of □□e compla□nant, a □□e□i□g may □e □□□□e□ed with th□e compla□nant, Mi□e M□□□ger □□ge□□er with □□e Env□ronm□ent and Comm□unity Coo□rdinato□r to de□er□i□e any □ur□□er op□ions to redu□e □□e□i□□ impacts.

Any ac□ions □greed □□□ □□e □□e□i□g □i□□e i□ □□e□e□ed by CVC. □□□er i□ □□e□e□□i□□ of □□e □r□□□□ed ac□ions th□e compla□nant w□ill □e contac□ed and □d□i□e so□ught as to th□e sa□isfac□ion □r □□□er□i□e with th□e □e□□ure□ tak□en.

□□ no □greed outcom□e i□ de□er□i□ed □r th□e compla□nant i□ s□ill not □□i□ied by □□e ac□ion ta□□n, □□e□ an □de□e□de□□e□ie□ may □e re□ue□ed by th□e compla□nant. If de□er□i□ed to □e □□rr□□ed by th□e □e□re□r□, an i□de□e□de□□re□ie□ will □e u□der□□□e□ i□ acco□rdanc□e with □□e proc□ess ide□i□ied i□ □□□edu□e 5 of SSD-5465.

7.4 Training, Awareness and Competence

[illegible]

[illegible]

8 Audit and Review

8.1 Review and improvement

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]

8.2 Audits

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] IEA's will be scheduled for every three years thereafter (unless the Secretary directs [illegible]

9 Records and Document Control

9.1 Records

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9.2 Document Control

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Table 4: Document Revision Details

Version	Date	Details of Revision	Company	Reviewed by/ Authorised by
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REVIEW DATE	NEXT REVIEW DATE	REVISION NO	DOCUMENT OWNER	□□□□ □□ □□3□
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DOCUMENT UNCONTROLLED WHEN PRINTED

10 Roles and Responsibilities

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Table 5: Seagrass Management Roles and Responsibilities

Role	Responsibilities
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11 References & Associated Documents

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Table 6: References and Associated Documents

Reference type	Document
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□egi□□□i□□ □□d regu□□i□□□	□□□ □□□□□□□□□*PrimeFacts 629 - Seagrasses*□ □□□ □□□□□□□ □□□□ *Environment Protection License 1770* □□□–□□□□ □e□e□□□□ e□□□ □□□e□□□ □□ □□□□□ □M□di□i□□i□□ □□d□ed □□ □e□e□ □er □□□□ □□r □□e Mi□i□g □□e□□i□□ □ □r□e□□ □□ □□ □□□□□□□ □r□e□i□□ □□□□e □□□ir□□□ e□□ □□er□i□□□ □□□□□□□□
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12 Definitions

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DPI Fisheries Department of Primary Industries □□□ □e□□r□□ e□□□□□ri□ □r□□□du□rie□ – Fi□□erie□

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POEO Act *Protection of the Environment Operations Act 1997*

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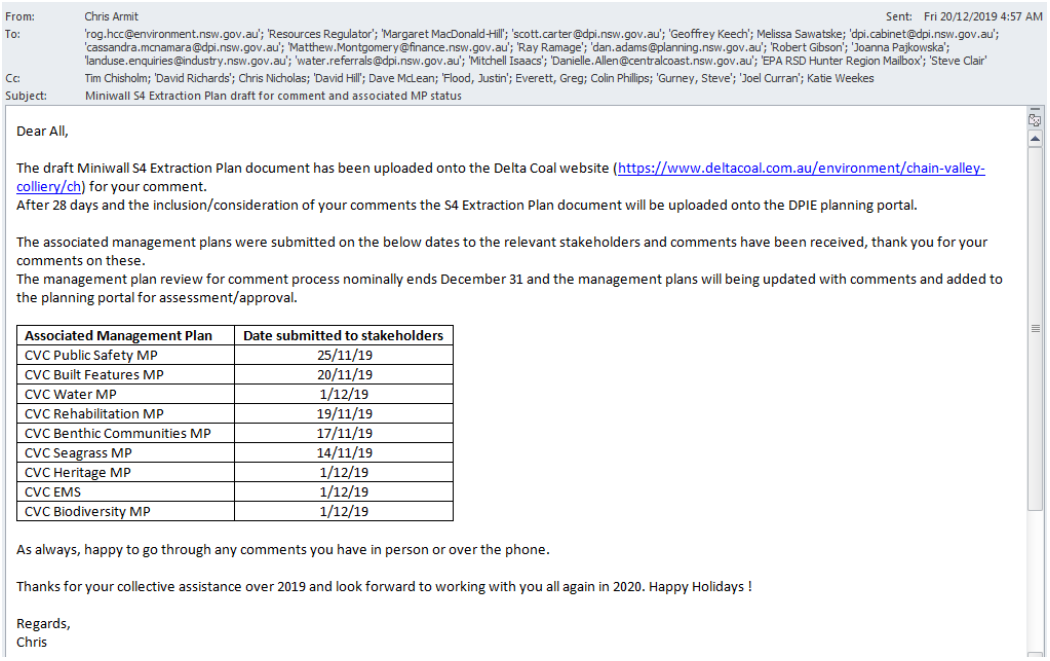
Appendix 1: Consultation



From: Chris Armit Sent: Fri 20/12/2019 4:57 AM
To: 'rog.hcc@environment.nsw.gov.au'; 'Resources Regulator'; 'Margaret MacDonald-Hill'; 'scott.carter@dpi.nsw.gov.au'; 'Geoffrey Keech'; Melissa Sawatske; 'dpi.cabinet@dpi.nsw.gov.au'; 'cassandra.mcnamara@dpi.nsw.gov.au'; 'Matthew.Montgomery@finance.nsw.gov.au'; 'Ray Ramage'; 'dan.adams@planning.nsw.gov.au'; 'Robert Gibson'; 'Joanna Pajkowska'; 'landuse.enquiries@industry.nsw.gov.au'; 'water.referrals@dpi.nsw.gov.au'; 'Mitchell Isaacs'; 'Danielle.Allen@centralcoast.nsw.gov.au'; 'EPA RSD Hunter Region Mailbox'; 'Steve Clair'
Cc: Tim Chisholm; 'David Richards'; Chris Nicholas; 'David Hill'; Dave McLean; 'Flood, Justin'; Everett, Greg; Colin Phillips; 'Gurney, Steve'; 'Joel Curran'; Katie Weekes
Subject: Miniwall S4 Extraction Plan draft for comment and associated MP status

Dear All,

The draft Miniwall S4 Extraction Plan document has been uploaded onto the Delta Coal website (https://www.deltacoal.com.au/environment/chain-valley-colliery/ch) for your comment.
After 28 days and the inclusion/consideration of your comments the S4 Extraction Plan document will be uploaded onto the DPIE planning portal.

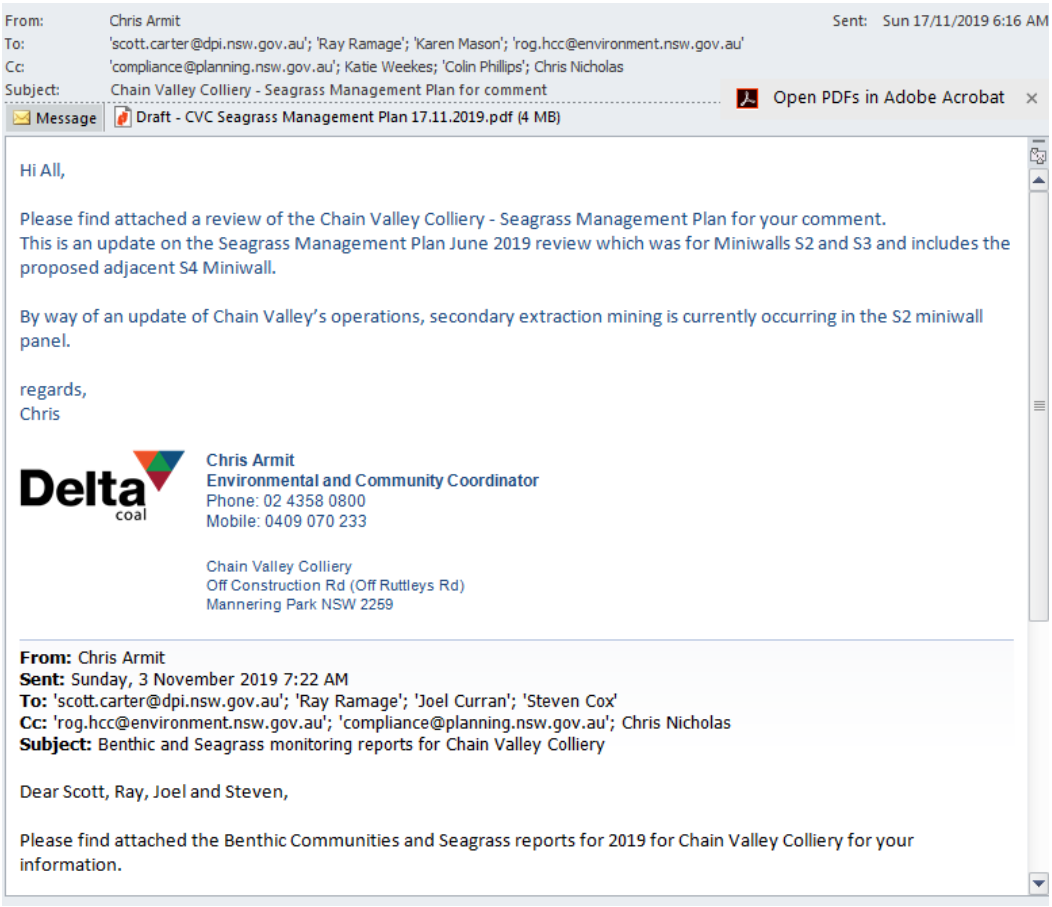
The associated management plans were submitted on the below dates to the relevant stakeholders and comments have been received, thank you for your comments on these.
The management plan review for comment process nominally ends December 31 and the management plans will being updated with comments and added to the planning portal for assessment/approval.

Associated Management Plan	Date submitted to stakeholders
CVC Public Safety MP	25/11/19
CVC Built Features MP	20/11/19
CVC Water MP	1/12/19
CVC Rehabilitation MP	19/11/19
CVC Benthic Communities MP	17/11/19
CVC Seagrass MP	14/11/19
CVC Heritage MP	1/12/19
CVC EMS	1/12/19
CVC Biodiversity MP	1/12/19

As always, happy to go through any comments you have in person or over the phone.

Thanks for your collective assistance over 2019 and look forward to working with you all again in 2020. Happy Holidays !

Regards,
Chris



From: Chris Armit Sent: Sun 17/11/2019 6:16 AM
To: 'scott.carter@dpi.nsw.gov.au'; 'Ray Ramage'; 'Karen Mason'; 'rog.hcc@environment.nsw.gov.au'
Cc: 'compliance@planning.nsw.gov.au'; Katie Weekes; 'Colin Phillips'; Chris Nicholas
Subject: Chain Valley Colliery - Seagrass Management Plan for comment
Open PDFs in Adobe Acrobat
Message Draft - CVC Seagrass Management Plan 17.11.2019.pdf (4 MB)

Hi All,

Please find attached a review of the Chain Valley Colliery - Seagrass Management Plan for your comment.
This is an update on the Seagrass Management Plan June 2019 review which was for Miniwalls S2 and S3 and includes the proposed adjacent S4 Miniwall.

By way of an update of Chain Valley's operations, secondary extraction mining is currently occurring in the S2 miniwall panel.

regards,
Chris

Delta coal

Chris Armit
Environmental and Community Coordinator
Phone: 02 4358 0800
Mobile: 0409 070 233

Chain Valley Colliery
Off Construction Rd (Off Ruttleys Rd)
Mannering Park NSW 2259

From: Chris Armit
Sent: Sunday, 3 November 2019 7:22 AM
To: 'scott.carter@dpi.nsw.gov.au'; 'Ray Ramage'; 'Joel Curran'; 'Steven Cox'
Cc: 'rog.hcc@environment.nsw.gov.au'; 'compliance@planning.nsw.gov.au'; Chris Nicholas
Subject: Benthic and Seagrass monitoring reports for Chain Valley Colliery

Dear Scott, Ray, Joel and Steven,

Please find attached the Benthic Communities and Seagrass reports for 2019 for Chain Valley Colliery for your information.

From: Geoffrey Keech [mailto:gkeech@lakemac.nsw.gov.au]
Sent: Thursday, 12 December 2019 3:41 PM
To: Chris Armit
Cc: Melissa Sawatske
Subject: LMCC response to Delta Coal Mannering Colliery and Chain Valley Colliery management plans consultation

Hi Chris,

Thankyou for providing Council the opportunity to comment on your management plans. I provide the following feedback:

Plan	LMCC Comments
CVC Rehabilitation Management Plan	Any infrastructure (slabs, pits, pipes, etc.) that is to be abandoned and covered over should be mapped and this map made available to any future user or purchaser of the site. Spelling mistake "mircobat"
CVC Benthic Communities Management Plan	No comments
CVC Seagrass Management Plan	*Page 25, Table 5 – Environment and Community Coordinator ' Send annual Seagrass Monitoring Reports to DPI Fisheries and……' there is information missing here with respect to who the reports would be sent to.*
CVC Built Features Management Plan	No comments – no identified built features fall within the LMCC boundary or jurisdiction. Central Coast Council should provide comment for the dwellings at Summerland Point.

For future iterations of these plans, could you please send the plans to Council@lakemac.nsw.gov.au addressed to "Development Assessment and Certification officer."
The plans will be allocated to a DAC officer to coordinate comments from the relevant sections of Council.
It would help us if you can include a note about the purpose of the consultation (as per the "Audit and Review" section of the management plans), and ideally send a copy that has been marked up with the changes that have occurred, as this allows us to focus quickly on the relevant changes.

Geoffrey Keech
Development Planner
LAKE MACQUARIE CITY
T 02 4921 0025 **M** 0429 124 904
E gkeech@lakemac.nsw.gov.au
lakemac.com.au

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DPIE Resource Assessments - Seagrass Management plan related comments	Response
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Appendix 2: Development consent summary

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Table A2: Requirements from Chain Valley Colliery Development Consent (SSD-5465)

Condition No.	Requirements	Relevant section of this document
Schedule 4 Environmental Conditions – Underground Mining		
2	***Performance Measures- Natural Environment*** *The Applicant shall ensure that the development does not cause any exceedance of the performance measures in Table 8 to the satisfaction of the Secretary.* *Table 8: Subsidence Impact Performance Measures*	**Section 1**

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*
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 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*	
3	***Offsets*** *If the Applicant exceeds the performance measures in Table 8 and the Secretary determines that: (a) it is not reasonable or feasible to remediate the impact or environmental consequence; or (b) the remediation measures implemented by the Applicant have failed to satisfactorily remediate the impact or environmental consequence; then the Applicant shall provide a suitable offset to compensate for the impact or environmental consequence to the satisfaction of the Secretary. Note: Any offset required under this condition must be proportionate with the significance of the impact or environmental consequence* □	**Section 4**
7	***Extraction Plan*** ***(h)*** *include a Benthic Communities Management Plan, which has been prepared in consultation with OEH, 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 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 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.* *The Applicant shall implement the approved management plan as approved from time to time by the Secretary.* *Notes:* • *To identify the underground mining areas approved under this consent referred to in this condition, see Appendix 3.* • *This condition does not limit secondary extraction under a Subsidence Management Plan approved as at the date of this consent.*	**This document**

8	*The Applicant shall 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*	**Section 4 and 6**

Appendix 9 Heritage Management Plan

Delta coal	Doc Owner: **Environment and Community Coordinator** Doc No:

CHAIN VALLEY COLLIERY

Heritage Management Plan

Reviewers	Katie Weekes EMM Consulting
	Ryan Desic EMM Consulting
	Chris Armit EMM Consulting
Authorised by:	Chris Armit
	Environment and Community Coordinator
Date:	1 December 2019

Contents

Acknowledgement

Delta Coal would like to acknowledge and pay respect to the traditional custodians of the area and their unique cultural heritage, spiritual beliefs and continuing relationship with the land and water.

We pay our respect to the Elders, past, present and emerging, and recognise their strength, resilience and rich contribution to society.

Delta Coal recognises the role of the registered Aboriginal parties in the management of the Aboriginal cultural heritage sites, landscape features and values of the area around Chain Valley Colliery and support their custodial and legislative rights and obligations to manage and participate in Caring for Country.

1 Introduction

1.1 Purpose

This management plan addresses the requirements for Development Consent SSD-5465, Schedule 3, Condition 21. The condition required the preparation of a Heritage Management Plan (HMP).

The HMP outlines the requirements to be undertaken to ensure compliance with statutory requirements and applies to the surface operations at Chain Valley Colliery (CVC) including pit top facilities and lands where additional infrastructure that may be constructed.

The purpose of this management plan is to:

- provide an overall framework for consultation related to heritage items;
- detail the regulatory requirements and commitments made in relation to management of Aboriginal and non-indigenous heritage at CVC;
- identify measures to minimise impacts to heritage items;
- detail monitoring requirements for known heritage sites (if required);
- facilitate the effective management heritage issues;
- outline the requirements and actions to be taken upon the discovery of heritage items;
- define specific responsibilities of all stakeholders and function as a management tool for all relevant operational personnel; and
- identify the requirements for review of the document and a procedure for continual improvement.

The overall aim of this management plan is to promote a high level of environmental performance through the minimisation of heritage impacts.

1.2 Background

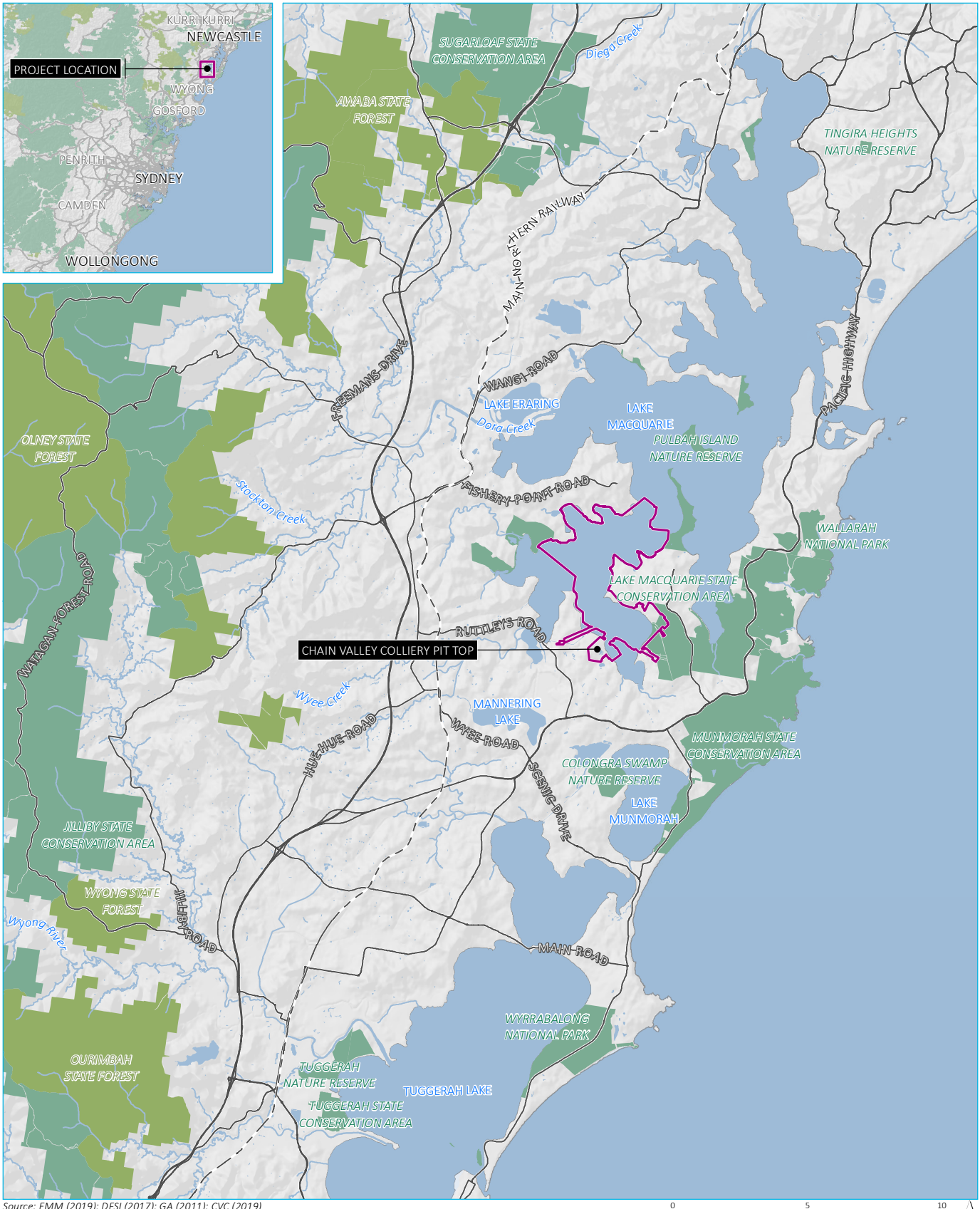
Chain Valley Colliery (CVC) is an underground coal mine located on the southern side of Lake Macquarie approximately 60 km south of Newcastle and 80 km north of Sydney (see **Figure 1**). The pit-top is located approximately 1 km south-east of the township of Mannering Park at the southern extent of Lake Macquarie.

In August 1960, J&A Brown and Abermain Seaham Collieries Ltd commenced clearing the present site with drift and shaft sinking starting a few months later. Production of coal from the Wallarah Seam, commenced with the first delivery to the adjacent Delta Electricity's Vales Point Power Station (VPPS) in April 1963.

LakeCoal was formed in 2001 to acquire BHP Billiton's 80% share in the Wallarah Coal Joint Venture (WCJV), the remaining 20% share was owned by Sojitz. In October 2006, Peabody Energy, a US listed company acquired LakeCoal Pty Limited.

In November 2009 LDO Coal Pty Limited purchased LakeCoal Pty Limited. LDO Coal is a consortium consisting of LD Operations, AMCI and private investors. In March 2011 the 20% share in the WCJV which Sojitz held was acquired by LDO Coal shareholders through the entity Fassi Coal Pty Ltd. The WCJV had operated the Wallarah, Moonee and Chain Valley underground coal mines and the Catherine Hill Bay Coal Preparation Plant, all located at the southern end of Lake Macquarie. At the time of LakeCoal's acquisition by LDO Coal, both the Wallarah and Moonee mines were closed.

In 2013 the owners of Mannering Colliery (MC) and CVC entered into an agreement which enabled LakeCoal to operate the MC until 2022. LakeCoal became the operator of MC effective 17 October 2013, with the underground link between CVC and MC completed in October 2017.



Source: EMM (2019); DFSI (2017); GA (2011); CVC (2019)

0 5 10 km

GDA 1994 MGA Zone 56

N

KEY

- Chain Valley Colliery development consent boundary
- Rail line
- Main road
- Watercourse/drainage line
- Waterbody
- NPWS reserve
- State forest

Regional and local context

Chain Valley Colliery
Figure 1

EMM
creating opportunities

\\emmsvr1\EMM\Jobs\2018\H180389 - LakeCoal CVC and MC noise monitoring\8 GIS\02_Maps\N005_RegionalLocalContext_20191113_01.mxd 13/11/2019

LakeCoal was placed into Voluntary Administration on 3 October 2018. The receivers continued operation of the mines in the period 3 October 2018 to 1 April 2019. As of 1 April 2019, Great Southern Energy Pty Ltd (trading as Delta Coal, DC) own and operate the two underground coal mines, CVC and MC.

1.3 Operations

CVC is an underground coal mine which extracts coal through both first workings and miniwall extraction methods (second workings). Mining is currently undertaken at CVC, with the ROM coal being transported underground to MC where the coal is crushed and screened and sent to VPPS.

The surface infrastructure comprises limited facilities at the 14 hectare pit top area adjacent to the Vales Point Power Station, off Construction Road at Mannering Park, and another 0.3 hectare area at the ventilation facility situated at Summerland Point. Both the pit top and ventilation facilities have remained largely unchanged since their establishment.

Modification 2 to Development Consent SSD-5465 allowed for minor vegetation clearing/disturbance adjacent to some infrastructure at CVC's pit top and the ventilation fan site at Summerland Point to enable the extension/establishment of asset protection zones (APZs) for bushfire protection purposes.

Given the above, potential sources of heritage impact are confined to:

- subsidence associated with secondary extraction;
- clearing of any previously undisturbed areas associated with any planned civil works; and
- establishment of asset protection zones (APZ).

1.4 Statement of Significance

Following is a Statement of Significance by the Awabakal and Guringai Peoples for the CVC Revised Heritage Management Plan 2014. No changes to the Statement of Significance have been made and the statement has been reproduced with permission.

"Awabakal and Guringai is one of the 600 or more language groups or 'nations' that existed across Australia at the time of European contact and are part of the oldest and continuous living Culture in human history.

Our People were recorded in this area and acknowledged in the first records ever made of the Aboriginal People of the Lake Macquarie, Newcastle and Central Coast areas. Prominent people such as L.E.Threlkeld, Jonathon Warner and many others documented our People, Cultural Heritage and Language in detail going back to the very early 1800's.

Our people believe that all Aboriginal sites and Traditional Culture that has existed for many thousands of years within our area are a tangible link to our Ancestors and our past. Surveys and assessments within the Chain Valley Colliery area has identified Aboriginal Cultural Heritage Sites (the tangible evidence of occupation) and (the intangible evidence) of landscape features of cultural value embedded within a landscape that provided physical and spiritual sustenance to the Awabakal and Guringai and those Aboriginal People they invited into their Country. The survival of these sites is significant to the continuation of collective knowledge and inspiration for our young people and coming generations of Awabakal and Guringai People. We acknowledge our Ancestors for passing on knowledge and also the legacy for us to continue what they put into place, to pass on our Cultural Heritage and to protect our sites for all those in the future.

The Awabakal and Guringai presence within the Chain Valley Colliery area extends from the present day back many thousands of years and is reflected in both tangible and intangible aspects of Aboriginal Culture and history. As Awabakal and Guringai People, we hold Cultural Knowledge that has been passed down from our Ancestors about our Traditional Country for thousands of years and a spiritual awareness, presence and connectedness of place that is what makes us one with the Land of our People. Therefore, the Awabakal and Guringai People have a continuing, contemporary history of trying to protect and preserve the Cultural Heritage within the surrounding areas.

We maintain concerns over Mining and Development licences being approved within the area and the adverse impacts this has on our Cultural Values and landscape features, and footprints of our Ancestors which are being impacted through cumulative and overlapping development, mining and unmonitored and unmanaged human recreational activities.

As indicated by the statements provided by the Traditional Owners, the mental, physical and spiritual wellbeing of the Awabakal and Guringai People and those Aboriginal Peoples that feel a connection to this landscape is also a contemporary phenomenon and not just 'a thing of the past'.

The Project Area contains Registered Aboriginal Cultural Heritage sites identified as having Aboriginal Cultural value and are numerous within LakeCoal Project area. The sites and landscape features link contemporary Awabakal and Guringai People with generations of their Ancestors and are extremely important teaching places and places of spiritual renewal.

We, as the Traditional People of these areas since colonisation of our land, have had to endure many deprivation and degradation along with the subsequent loss of not just our People and land but many aspects of our Culture and Heritage. This has been brought about through the damage and neglect of many ventures both modern and historically that have taken place, the result being, significant loss of Cultural places and artefacts that for thousands of years have given substance and meaning to the lives of Awabakal and Guringai People.

We as Traditional Owners today have vowed to protect our Cultural Heritage and those significant places remaining, so we and our young people and those to come will not go the way of many other Aboriginal People and their Culture and Heritage to become just a name in history books of what was. It has been quite a struggle for our people, with our numbers reduced to a handful after the white fella arrived in Australia in 1788. It would seem we were doomed to the fate of many other First Peoples that have disappeared from countries all around the world, but we are still here, we have survived and are proud to be called Awabakal and Guringai.

Although the impact of European invasion dramatically changed Aboriginal life in Australia, not to mention the lives of our own People forever, the recent history of the Lake Macquarie area is also characterised by the Cultural resilience of Aboriginal Peoples, for both those who have retained connection to Country and those that are reconnecting to Country. Recent history is also characterised by the movement of other Aboriginal Peoples into the Country of the Awabakal and Guringai and the development of their own more recent attachments to the area. Whilst a diversity of attachment and experience is recognised, it is also necessary to recognise that the landscape, vegetation and watercourses of the Chain Valley Colliery area forms a unique part of the Cultural Heritage and Cultural landscape of the Awabakal and Guringai People.

Aboriginal lore requires that the Aboriginal cultural landscape of the Chain Valley Colliery area (which includes Aboriginal heritage sites, landscape features of Cultural value, the plants, animals and water) is cared for so that it will survive for future generations of Aboriginal Peoples.

The custodial rights and obligations of Aboriginal people Caring for Country underpin the principles of this HMP. It is highlighted, however, that the Awabakal and Guringai People in no way support any impact to Aboriginal sites, landscape features of Aboriginal cultural value or any aspect of the natural environment of the Chain Valley Colliery Area. Aboriginal people inherit the right and obligation to Care for Country, and endorsing any form of harm is assessed as culturally and ethically inappropriate". (**© Awabakal & Guringai 2014)**

1.5 Consultation

The original draft of this HMP was issued to the previously identified Aboriginal stakeholders for comment on 7 August 2012. Responses were received from:

- Darkinjung Local Aboriginal Land Council (DLALC);
- Bahtabah Local Aboriginal Land Council (BLALC);
- Awabakal Traditional Owners Aboriginal Corporation (ATOAC); and
- Awabakal Descendants Traditional Owners Aboriginal Corporation (ADTOAC).

These stakeholders identified the issues of accurate background information, inclusion of Aboriginal stakeholders in certain management measures and review timing. At meetings with BLALC, ATOAC and ADTOAC at the CVC offices on 30 August 2012 the wording of the HMP was discussed in more detail and amendments were incorporated into the final version of the HMP which was subsequently approved on the 1 July 2013.

Version 2 of the management plan was based on the work completed for the heritage assessment of SSD-5465 and subsequent site inspection and workshop held in September 2013. At this site inspection representatives of the ADTOAC, ATOAC, Guringai Tribal Link Aboriginal Corporation and Awabakal Local Aboriginal Land Council were present for the fieldwork and, although unable to attend the fieldwork, an additional representative from the DLALC was able to attend the subsequent workshop.

A number of actions arose from the site inspection and workshop in September 2013 with all actions completed and incorporated into the HMP.

The Version 3 (Draft) HMP addressed actions resulting from Modification 2 to Development Consent SSD-5465, specifically the recommendations of the Aboriginal Cultural Heritage Assessment (ACHA) prepared for Chain Valley Colliery Modification 2 Statement of Environmental Effects (EMM, June 2015).

This HMP (Version 3 final), while based substantially on the previously approved LakeCoal HMP, has been updated to reflect the recommendations and minor changes of the Independent Environmental Audit (IEA) conducted by SLR in June 2019. The updates are administrative only and there are no changes to activities, impacts, the mine footprint or development consent requirements associated with CVC.

Registered Aboriginal Parties (RAPs) who have registered an interest to participate in the consultation process comprise the four groups consulted for the original HMP draft and six further Aboriginal organisations. The complete list of ten RAPs are:

- ATOAC;
- ADTOAC;
- BLALC;
- DLALC;
- Biriban Local Aboriginal Land Council;
- Daniella Chedzey;
- Cacatua Culture Consultants;
- Guringai Tribal Link;
- Wonn 1 Contracting; and
- Yula - Punaal Aboriginal Education and Healing Centre.

In accordance with the review and auditing process, a draft of this updated ACHMP, developed for CVC and was provided to the RAPs for comment on 1 December 2019. This HMP was also provided to the

Department of Planning, Industry and Environment (DPIE), Heritage Council of NSW and NSW Department of Premier and Cabinet-Heritage on 1 December 2019 for their review and comment. The stakeholders were given 14 days to respond with comments.

A summary of the comments received, and amendments subsequently made to the document prior to finalisation are detailed in **Table 1**. Evidence of consultation is provided in **Appendix 1**.

Table 1: Consultation Summary

Stakeholder	Comments	Response/Action
RAPs	•	•
NSW DPIE	•	•
NSW Premier & Cabinet - Heritage	•	•
Heritage Council of NSW	•	•

2 Statutory Requirements

2.1 Key Legislation, Policy and Guidelines

This HMP has been prepared in accordance with the principles of the Australia ICOMOS Burra Charter, 2013 (Burra Charter). The Burra Charter provides guidance for the conservation and management of places of cultural significance and sets a standard of practice for those who provide advice, make decisions about, or undertake works to places of cultural significance, including owners, managers and custodians.

Items of heritage significance in NSW are protected by a series of acts whose purpose it is to ensure that change is appropriately managed to ensure that significance is not lost. In NSW, the *Heritage Act 1977* and the *Environmental Planning and Assessment Act 1979* (EP&A Act) are the primary statutory controls protecting historical heritage and archaeology within NSW. Listing on statutory registers provides legal protection for heritage items.

2.2 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important heritage places as well as places that are owned by the Commonwealth, such as defence lands and postal facilities.

2.2.1 Native Title Act 1993

The Commonwealth Government enacted the *Native Title Act 1993* to formally recognise and protect native title rights in Australia following the decision of the High Court of Australia in Mabo & Ors v Queensland (No.2) (1992) 175 CLR 1 (“Mabo”.)

2.2.2 Aboriginal Land Rights Act 1983

The purpose of this legislation is to provide land rights for Aboriginal people within New South Wales and to establish Local Aboriginal Land Councils (LALCs). The land able to be claimed by Aboriginal Land Councils on behalf of Aboriginal people are certain Crown lands as detailed in s36 of the *Aboriginal Land Rights Act 1983*. Claims for land are by application to the Office of the Registrar, *Aboriginal Land Rights Act 1983*.

2.2.3 National Parks and Wildlife Act 1974

The primary state legislation relating to the protection of Aboriginal cultural heritage in NSW is Part 6 of the *National Parks and Wildlife Act 1974* (NPW Act).

The *National Parks and Wildlife Regulation 2009* (NPW Regulation) is subsidiary legislation made under its parent act, the NPW Act. The NPW Regulation provides codes of practice, documents and guidelines that relate to the NPW Act, including:

- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (DECCW 2010);
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010);
- *Aboriginal Consultation Requirements for Proponents 2010* (DECCW 2010); and
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011).

2.3 Heritage Act 1977

Historical archaeological relics, buildings, structures, archaeological deposits and features are protected under the *Heritage Act 1977* (as amended 1999) and may be identified on the State Heritage Register (SHR) or by an active Interim Heritage Order.

I. Relics Provision

Relics are defined by the Heritage Act are *"any artefact, object or material evidence which relates to the settlement of that area that comprises New South Wales, not being Aboriginal settlement, and is of State or local significance."* Relics are protected under Section 139 of the Heritage Act. Where the potential for relics exists, the land in which it is found cannot be disturbed or excavated without an excavation permit.

II. State Heritage Register

The SHR is a list of places and objects of particular importance to the people of NSW. When a place is listed on the SHR or is affected by an interim heritage order, approval under Section 60 of the Heritage Act is required for any major work. The purpose of this requirement is to ensure that change to significant places is managed appropriately and does not detract from the heritage significance of the place.

III. Section 170 Register

State government agencies have responsibilities under Section 170 of the *Heritage Act* that requires them to identify, conserve and manage heritage assets owned, occupied or managed by that agency. Each agency is required to maintain a s170 register of all heritage assets and assess the significance of each asset.

2.4 Environment Planning and Assessment Act 1979 (EP&A Act)

The EP&A Act establishes the framework for cultural heritage values to be formally assessed in the planning and development consent process in NSW. The EP&A Act requires that environmental impacts are considered before land development; this includes impacts on cultural heritage items and places as well as archaeological sites and deposits.

The EP&A Act requires that local governments prepare planning instruments, such as Local Environment Plans (LEPs) and Development Control Plans (DCPs) to provide guidance on the level of environmental assessment. This includes identification of heritage items, as listed on the heritage schedules of an LEP.

The Act regulates a system of environmental planning and assessment for NSW. Land use planning requires that environmental impacts are considered, including the impact on cultural heritage and specifically Aboriginal heritage, assessment documents prepared to meet the requirements of the EP&A Act.

2.5 Development Consent SSD-5465

This plan has been prepared in accordance with Schedule 3, Condition 21 of SSD-5465, which states the requirements of the Heritage Management Plan (HMP) and what it must address. Cultural heritage related requirements of SSD-5465, including specific requirements that are to be addressed in this plan, and where they are addressed, are detailed in **Appendix 2**.

In accordance with Schedule 2, Conditions 2 and 2A, in addition to carrying out the works in accordance with the conditions of SSD-5465, DC will also carry out works generally in accordance with the Environmental Impact Statement (EIS), Statement of Environmental Effects (SEE) (Mod 1), SEE (Mod 2), Project Layout Plans, and Statement of Commitments.

3 Aboriginal Heritage Management

3.1 Background

The Awabakal is bordered generally by the Darkinjung to the south west, Wonnarua to the north west and by the Worimi to the north beyond Newcastle. The Awabakal language extended south to Brisbane Waters or even to Sydney Harbour North Head, if the Gringai (Kurringai) language is related to Awabakal (Shane Frost pers.comm. Aug 2012).

The Lake Macquarie area has been the focus of a number of surface investigations and a small number of excavations. In order to develop a predictive model of site location, distribution and type that occur in the vicinity of CVC, previous archaeological work undertaken within the region was reviewed.

As part of the Environmental Assessment (EA) (AECOM, 2011) and Environmental Impact Statement (EIS) (EMM, 2013) both Aboriginal and non-indigenous cultural heritage assessments were completed.

It was determined that there were no items of non-indigenous heritage significance within the existing or proposed disturbance or mining areas, although a number of items were located nearby. These are discussed further in Section 4.

A number of Aboriginal heritage sites were identified within the CVC site and areas of proposed mining, as discussed in further detail below.

3.2 Previous Assessments

3.2.1 Overview

There have been numerous archaeological studies undertaken for the Lake Macquarie region, starting from the 1970s until the present (eg Haglund 1986; Navin Officer and Saunders 1996; Umwelt 2011; EMM 2012). These studies have largely been undertaken as part of commercial, linear infrastructure and mining developments.

Archaeological investigations have identified that Aboriginal subsistence was focused on the estuarine shell beds on the lake margins. There is a strong association with shell midden sites and the lake shore, whereas stone artefact sites are often mixed with midden sites but also distributed adjacent to watercourses in the hinterland of Lake Macquarie. Furthermore, studies have found that Aboriginal scarred or carved trees may be adjacent to water sources in areas of uncleared forest.

3.2.2 Environmental Assessment (AECOM 2011)

For the EA (AECOM, 2011), a search of Office of Environment and Heritage (OEA) Aboriginal Heritage Information Management System (AHIMS) database was conducted on 30 September 2009 and revealed six registered Aboriginal sites within the area. In addition to this, as part of the EA process, consultation and field work was undertaken with Aboriginal stakeholders within the study area of the EA, which resulted in the identification of an additional five Aboriginal sites.

3.2.3 Environmental Impact Statement (EMM 2012)

An extensive search of the AHIMS register was also conducted during 2012 as part of the EIS for an area of 10 km by 10 km surrounding the CVC. The search revealed a total of 99 registered sites, the majority of which occurred along the Lake Macquarie foreshore. Middens accounted for 60% of the total sites registered, isolated finds accounted for 11% and scarred trees represented 10%. Subsequent fieldwork undertaken by EMM in conjunction with RAPs identified one new site (45-7-0339) and also redefined the extents of sites 45-7-0154 (at Fishery Point, Sunshine) and 45-7-0157 (at Casuarina Point, Sunshine).

Notwithstanding the high significance of Aboriginal sites and objects to Aboriginal people, Aboriginal stakeholders advise that all of the land is of significance to Aboriginal people.

In the 2014 HMP it was noted that the Awabakal and Guringai People had a Registered Native Title claim over the site and surrounding areas including the Lake Macquarie City Council and Wyong Shire Council Local Government Areas (LGAs) along with other LGAs. The Native Title claim was registered on 13 June 2013 and discontinued as at 30 June 2017.

In addition, there is a current claim by Johnson and Kendall Grange. The Native Title claim was registered on 27 April 2007 and is not yet determined.

3.2.4 ACHA (EMM, 2015)

In addition to the above assessments, an Aboriginal Cultural Heritage Assessment (ACHA) was completed as part of the Statement of Environmental Effects prepared for Modification 2 (EMM, June 2015). This report identified Aboriginal site 45-7-0157 would be subject to subsidence impacts at a negligible level as a result of the proposed modification, and recommended monitoring requirements. The assessment also recommended Aboriginal site 45-7-0154 be removed from the monitoring program as it will no longer be undermined.

3.2.5 Aboriginal due diligence assessments for subsidence monitoring (EMM, 2017 and 2019)

EMM was engaged in 2017 and 2019 to undertake Aboriginal due diligence assessments in relation to the installation of subsidence monitoring lines along Summerland Point/Chain Valley Bay foreshore (2017) and the Point Wollstonecraft Foreshore (2019). The assessments were a part of ongoing subsidence monitoring associated with mining operations. Although both assessments identified shell material associated with naturally occurring deposits, and cultural deposits at existing AHIMS site, no further sites were identified. No impacts to Aboriginal sites or objects were proposed by the subsidence monitoring activities.

3.2.6 Management Plan Review (EMM, 2019)

Methods used to identify potential Aboriginal cultural heritage sites and/or objects for inclusion in this revised HMP were as follows:

- a review of the previous archaeological investigations undertaken at CVC and its surrounds;
- an extensive search of the AHIMS database to identify previously recorded Aboriginal sites; and
- objects in and around the CVC project approval boundary.

An updated AHIMS search was conducted on 30 July 2019 with results provided in **Appendix 3**. A total of 82 Aboriginal sites were identified within the search area, the majority of which were located around the Lake Macquarie foreshore. Of these sites, 27 are located within the current CVC project area boundary as detailed in **Table 1**. Thirteen additional Aboriginal sites have been included in this HMP within or near the CVC development consent boundary in comparison with the 2014 HMP.

Table 2:	AHIMS ID(s)	Site name	Site type/features
1	45-3-0334	Tiembula Creek Midden	Shell Midden
2	**45-7-0131**	Summerland Point	Shell Midden
3	**45-7-0166**	M8, Sugar Bay	Shell Midden
4	**45-7-0167**	Camp Brightwaters	Shell Midden
5	**45-7-0176**	Gwandalan	Shell Midden
6	45-7-0178	Hembula Creek	Scarred Tree (x2)
7	45-7-0179	Black Neds Point	Shell Midden
8	45-7-0181	Chain Valley Bay 1	Shell Midden
9	45-7-0182	Chain Valley Bay 2	Shell Midden
10	45-7-0189	Sandy Beach 1	Shell Midden
11	**45-7-0227**	St Johns 1	Artefact
12	**45-7-0255**	Trinity Point GG2	Grinding Groove
13	**45-7-0257**	Trinity Point Ochre	Ochre Quarry
14	**45-7-0258**	Trinity Point IF1	Artefact
15	**45-7-0262**	SJOG 7	Grinding Groove
16	**45-7-0263**	SJOG 6	Shell Midden
17	45-7-0271	CV-08-09	Shell Midden
18	45-7-0272	CV-09-09	Shell Midden
19	45-7-0273	CV-10-09	Shell Midden
20	45-7-0277	CV-16-09	Shell Midden
21	**45-7-0279**	CV-18-10	Shell Midden
22	**45-7-0281**	CV-20-10	Shell Midden
23	45-7-0282	CV-21-10	Shell Midden
24	**45-7-0293**	RPS MP3	Modified Tree (Carved or Scarred)
25	45-7-0154	M7	Shell Midden
26	45-7-0157	M10	Shell Midden
27	45-7-0339	CV-001	Isolated artefact

Sites listed in bold are sites note included in the 2014 HMP. It may be that some are located just outside the development consent boundary, but have been included in this management plan for completeness.

3.3 Items of Significance

3.3.1 Artefact Scatters and Isolated Finds

The distinction between artefact scatters and isolated finds comes down to the interpretive value of these sites. An isolated find, as the name suggests, comprises of a single stone artefact which often cannot be contextualised by other artefacts in the landscape. Artefact scatters contain more than one artefact and have more interpretive value because they may provide information on processes such as procurement, manufacture, usage and discard (Holdaway et al 2002). These two types of sites are usually classified as "open" because they are usually set in exposed landscape (i.e. not a rock shelter) and the extent of these sites are based on an arbitrary boundary according to changes in density level and/or landform units (for artefact scatters). Isolated finds occur as a single artefact and are not generally found within 50 m of another artefact/artefact scatter.

3.3.2 Middens

Shell middens are commonly made up of the remains of edible shellfish, and could be the result of a single meal or many meals at the same location over many years. A midden may also contain fish and animal bones, stone tools, or charcoal. They can vary in size and depth. Middens are sometimes associated with burials. Middens can be found on headlands, sandy beaches and dunes, around estuaries, swamps and tidal stretches of creeks and rivers, and along the banks of inland rivers, creeks and lands. Middens may also be found in the open or in rock shelters. Middens can indicate that a place was, and may continue to be, a key meeting place of significance. Middens can also provide information about the environment that existed when Aboriginal people collected the shellfish, such as changes in species, and tools or raw materials that were used. Middens which contain burials are particularly significant. Middens are amongst the most fragile cultural sites. They can be exposed by wind or degraded by human and animal activity. Effective management of midden sites may include stabilising the surface, such as by encouraging vegetation cover, or by restricting access to the site by erecting fencing (Excerpt from due diligence guidelines, DECCW 2010).

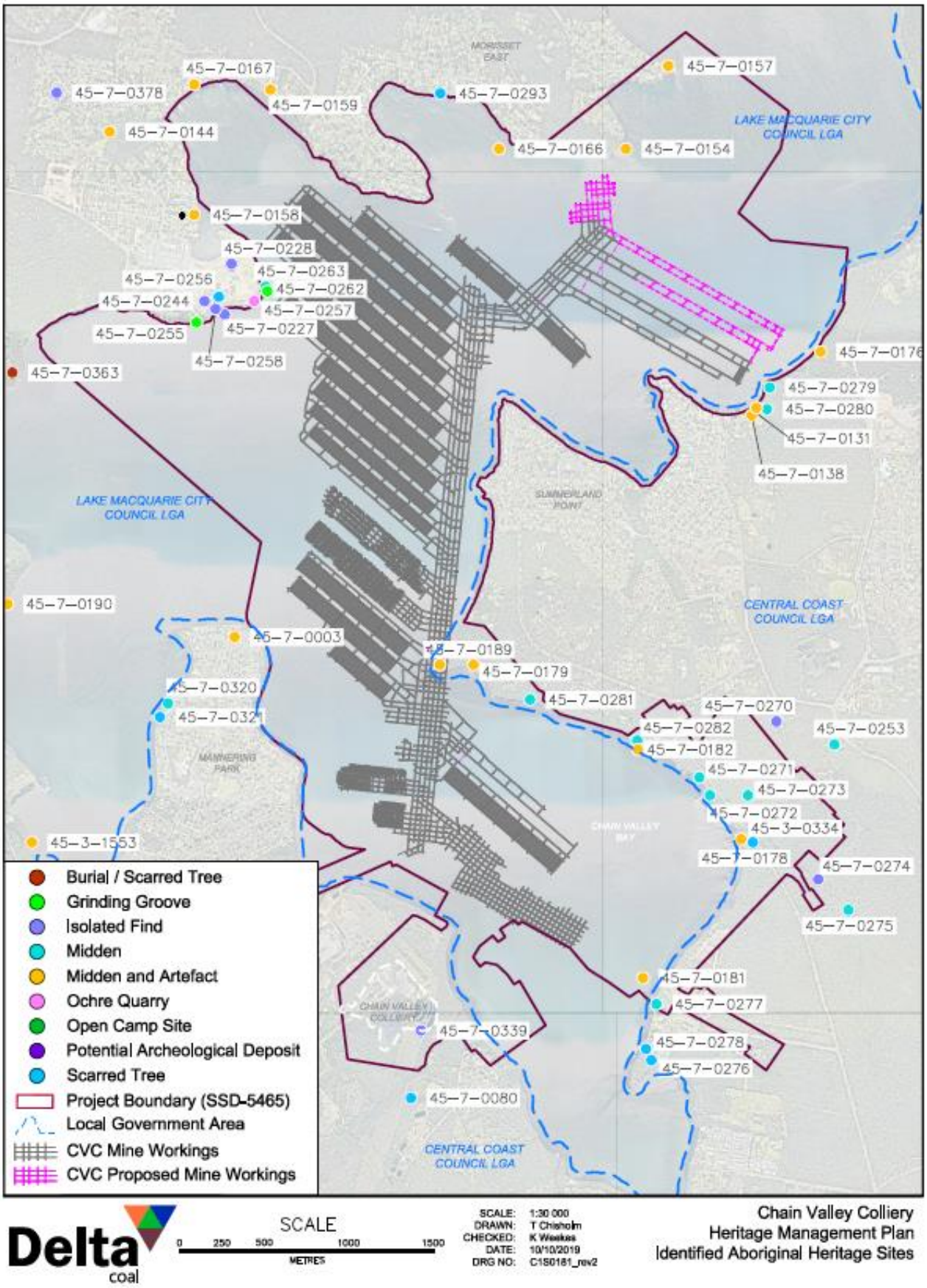


Figure 2: AHIMS sites in and around CVC project area

3.3.3 Stone Arrangements

Aboriginal stone arrangements are places where Aboriginal people have positioned stones deliberately in the landscape to form shapes or patterns. Although it is not certain why stone arrangements were made, scholars (O'Conner et al 2007) have suggested that they may have served a spiritual function (ie: rituals and ceremonial usage) or for practical subsistence purposes (ie: demarcating territorial boundaries or as fish traps along coastal regions). There are over 1000 known stone arrangements in NSW and Qld alone (Mulvaney & Kamminga 1999:25).

Stone arrangements are characterised as low height constructions, usually less than a metre high, and generally occur where there is a plentiful supply of boulders and suitable rock material to arrange. Although inferences can be made as to the reasons why particular stone arrangements were created based on research and intensive archaeological investigation, it is not possible to assign a generic function to stone arrangements. These types of sites can vary in size and shape and the choice of materials used in their construction can also vary greatly based on the availability of resources and selectivity of material. The spatial distribution of these arrangements may also have an interpretive implication on their function and usage.

Ground surface clearing activities and subsidence/upsidence can potentially harm stone arrangements. In terms of the potential harm associated with ground surface works, this can take place in the form of earth works activity directly where the site is located. However, these types of sites are more clearly identifiable in the natural landscape than artefact scatters and isolated finds because they are more physically imposing. Subsidence/upsidence may harm stone arrangements if the movement of the ground surface cause the stones move; thus, altering their original arrangement. Secondary effects of subsidence may include changes in drainage patterns which can also pose a risk to moving the stones in the arrangement.

3.3.4 Historic/Social/Ceremonial/Spiritual/ Dreaming Sites

Aboriginal ceremonial/Dreaming/spiritual sites are linked to cultural traditions and their function and significance are determined by the Traditional Owners. These types of sites can be for different types of purposes and would therefore need to be assessed individually. Although it is possible that archaeological remains can be associated with these types of sites, this however is not a necessary qualifier because their value largely hinges on the oral histories and traditions passed down in Aboriginal culture.

3.3.5 Grinding Grooves and Rock shelters

Natural processes such as the constant water flow over sandstone structures can cause erosion. Surface exfoliation can occur due to the heat of bush fires. Mining activities can also cause harm to grinding groove and rock shelter sites. It is observed that natural ground swell movement in Lake Macquarie region range between 7 mm and 58 mm with an average of 29 mm (Delany et al). This research suggests that any movement of the ground surface <58 mm could be attributed to natural processes rather than the result of mining inducted ground subsidence.

3.3.6 Scarred Trees/ Carved Trees

Aboriginal modified trees are trees which have been scarred or carved by Aboriginal people through the deliberate removal of bark or wood (Long 2005:6). There are numerous reasons why Aboriginal people removed bark from trees because it is a versatile and plentiful material. It can be used for a range of domestic activities including the manufacture of shelters, watercrafts, containers, weapons (shields/woomeras), etc.

All Aboriginal scarred trees are protected under state legislation and are recognised as sites. Given that the coastal margins of NSW and the valley are among the oldest European settlements in Australia, dating to the 1780s around Sydney and the 1800s in the Newcastle region (Long 2005:52), modified trees in the northern holdings would be expected to be older than 240 years.

The potential risk of subsidence/upsidence to scarred/carved tree sites is largely dependent on the condition of the tree (health) and where it is located in the landscape. If mature scarred/carved trees are healthy and

alive, they generally have well established root systems which can keep them firmly affixed to the ground surface at the onset of subsidence.

Although a tree might be healthy, the ground condition and location of the site can also affect the sites stability. If the site is located on a precarious ledge along a ridge line or in loose or eroded soils, this would impact on how firmly affixed the tree is to the ground surface. Ground surface activity such as earthworks (including the construction of buildings, roads, vents, pollution ponds, stockpile areas) can harm scarred tree sites if they are within the area of proposed works. Changes in ground water levels or ponding areas, as a result of subsidence, may also lead to changes in tree health and potentially increase the risk of impact.

4 Non-Indigenous Heritage Management

This management plan included searches of the EPBC Act Matters of National Significance Register, the NSW State Heritage Register, Heritage and Conservation (Section 170) Register, Commonwealth Heritage List, World Heritage List, Lake Macquarie City Council LEP 2014, Wyong Local Environmental Plan 2013 and City of Lake Macquarie Heritage Study (1993). The following items were identified in the vicinity of the project area but are not expected to be impacted by CVC. The locations of these sites are shown on **Figure 3**.

4.1 Morisset Hospital Precinct

Morisset Hospital site comprises almost 100 historic buildings on 1,244 hectares. It is approximately 3 km south-west of the township of Morisset. The Morisset Hospital Precinct is listed by the Heritage Council under the *NSW Heritage Act 1977.* Within the Morisset Hospital Precinct, 31 heritage items are individually listed by Local Government and State agencies. As outlined by the Heritage Council of NSW, the heritage items in the Morisset Hospital Precinct meet one or more criteria for listing on the SHR. The precinct is listing number 00827 and is of high state significance in the category of Health Services. Significant items also include impressive specimens of indigenous and introduced tree species, vegetation groups and native fauna.

The heritage item is listed as of state significance, item number 118 under the Lake Macquarie Local Environmental Plan 2014.

The Morisset Hospital Precinct area extends from the shoreline of Lake Macquarie and is west of the approval area.

4.2 Eaton Bulk Store Building

The Eaton Bulk Store Building is located at 464 Ruttleys Road, Mannering Park (Lot 11 DP 1091396), approximately 1.9 km south-west of the entrance road to CVC.

The heritage item is listed as of local significance, item I39 under the Wyong Local Environmental Plan 2013. The Council statement of significance:

'The bulk store building is significant locally as a representative example of a riveted steel building structure of the early twentieth century, which is historically part of nearby Wyee Colliery and illustrates the practice of building relocation and re-use typical of the mining industry in New South Wales. As a relocated structure, it provides evidence of the integrated management of multiple mining and generation sites. It retains this value despite its alterations for its reconstruction in a new site. It is a relic of the period of State ownership of electricity generation undertakings, including their fuel supplies in New South Wales. It is a type of building unusual in its vicinity and may have additional association significance arising from its origins at another site, possibly the Harbour Bridge Workshops.'

4.3 Great Northern Railway

The Great Northern Railway line passes through Lake Macquarie from Wyee to Garden Suburbs. The line is listed by Lake Macquarie City Council LEP 2014 as a heritage item (item 189) of local significance.

4.4 Wyee Coal Conveyor Rail Loop

The Wyee coal conveyor rail loop is located on the eastern side of the Great Northern Railway, north of Wyee. The line is listed in the Lake Macquarie City Council LEP 2014 as a heritage item (item 225) of local significance.

4.5 Wyee Channel

Wyee Channel is listed as a heritage item (Item 226) of local significance under the Lake Macquarie City Council LEP 2014.

Wyee Channel extends north from the Wyee Dam to Wyee Bay, extending under Summerhayes Road.

4.6 Vales Point Power Station

The WSC Heritage Review (Scobie Architects Pty Ltd 2010) investigated the historical context of the Wyong LGA and it identified the VPPS, located approximately 200 m west of CVC as an item of local heritage significance. It was recommended for inclusion in the Schedule of Heritage items within the Draft Wyong LEP by Scobie Architects Pty Ltd (2010) though it was ultimately not listed and is, therefore, not considered to have local or state heritage significance.

Source: EMM (2019); DFSI (2017); GA (2011)

0 1 2 km

GDA 1994 MGA Zone 56

N

KEY

- Chain Valley Colliery development consent boundary
- Main road
- Local government area
- Eatons bulk store building ruttleys road
- Great northern railway
- Morisset hospital precinct
- Wyee channel
- Wyee coal conveyor rail loop

Non-indigenous heritage sites

Chain Valley Colliery
Figure 3

EMM
creating opportunities

5 Monitoring, Management and Mitigation Measures

5.1 Aboriginal heritage

5.1.1 Identified Aboriginal Sites

As shown in **Figure 2**, all but two of the identified Aboriginal sites are located outside the pit top area, ventilation facility area or subsidence footprint. Site 45-7-0189 is located above existing or proposed areas of first workings on Summerland Point, with the remaining site identified at the pit top area in the vicinity of the dams (45-7-0339).

Monitoring of one site (45-7-0189) was previously committed to as part of the Statement of Commitments and the original Heritage Management Plan. Monitoring of site 45-7-0189 commenced in January 2013 (1st year), 2015 (3rd year) and concluded in 2017 (5th year) with no site impacts identified relating to subsidence caused by the mining activities (AECOM, 2018).

In addition to the above monitoring program, a due diligence site inspection of the area to be disturbed by the sediment dam D10 embankment and spillway upgrade was completed (AECOM) prior to commencement of works in those areas. Site CV-001 (45-7-0339) was fenced to exclude access to the area during upgrade works. No additional sites were found during the due diligence inspection or construction works.

Procedures for the discovery of previously unidentified sites or skeletal remains are covered in Section 5.6 and Section 5.7 respectively.

5.1.2 Monitoring of Aboriginal Sites

If monitoring is required for any future underground workings or surface works which could result in disturbance an initial visual inspection of the site by an archaeologist and Aboriginal stakeholders will be conducted. In order to identify any changes to the land surface over time, particularly in view of the negligible subsidence expected, monitoring of each site will be assisted by the:

- establishment of fixed datum point with defined relative level to Australian Height Datum by registered surveyor;
- placement of stakes with horizontal markings on either extent of the site to enable accurate recording of landscape shifts;
- installation of a control reference point with defined Relative Level established outside proposed subsidence area such as a building;
- collecting photographic records from the fixed datum point to enable inter survey photographic comparisons. Photos will be large format with clear distinguishable features; and
- production of a letter report to be retained by DC with copies provided to Aboriginal stakeholders as requested.

A clear distinction will be made between natural processes of bioturbation, erosion, sand shifting events and landscape modification due to subsidence.

No additional monitoring aside from the above is considered necessary due to all secondary extraction and resultant subsidence occurring beneath Lake Macquarie.

5.1.3 Management of Aboriginal Heritage Sites

If mine-induced subsidence levels exceed 20 mm, a review will be undertaken to identify any potential impacts to cultural heritage in consultation with DPIE.

In the event of disturbance, the following management strategy should be implemented. The strategy will include an accurate recording of the heritage item including:

- mapping of the site;
- photographic recording; and
- detailed survey.

In addition, a monitoring program is to be established based on the placement and monitoring of control points. If there is unforeseen impact on the heritage item, appropriate remediation works should be implemented following advice from DPIE, the Environment and Community Coordinator on-site and the heritage consultant.

DC will endeavour to protect the heritage site from harm wherever practicable. Where relevant, this will be in consultation with RAPs by using non-invasive measures which may include barrier fencing, erosion control, supports or bracing.

DC will undertake all mining operations, Aboriginal stakeholder consultation, site surveys, reporting, impact assessment, site assessment, monitoring and management of Aboriginal sites in accordance with this HMP that has been developed in consultation with the RAPs.

It is advised that if the sites are at risk of harm, a Section 90 AHIP to salvage or destroy the site should be applied for (if the project is not under the State Significant Development or Part 3A provisions of the EP&A Act). In any instance where Aboriginal artefacts are salvaged, a care and control application will also need to be lodged for storage arrangements of artefacts.

Remediation measures must aim to repair the site to maintain the sites cultural significance and reduce any further impacts to the site. Remediation measures may include infilling of cracks in sandstone rock bars or overhangs to reduce the naturally weathering process which can result in further damage or undertake repairs to areas of erosion upstream of grinding grooves. Mitigation measures may involve not undertaking any actions at all if it is determined culturally inappropriate to do so by the relevant Aboriginal parties.

With the exception of site CV-001 45-7-0339, all Aboriginal sites identified within the approved CVC mine area do not occur on land controlled by CVC, nor are these sites in areas that would be impacted by the proposed mining activities.

For the Aboriginal sites that are both outside potential impact areas and not within land controlled by CVC, passive management is proposed. Passive site management will comprise avoidance of mapped site localities in accordance with this HMP. Passive site management is preferable to active management as there are no activities proposed in these areas and active management measures such as fencing and signage would likely draw unwanted attention to sites.

5.1.4 Obligation to Avoid Harm

All employees, contractors, sub-contractors and visitors to CVC have an obligation to avoid harming Aboriginal heritage unless engaged in an Aboriginal heritage management activity described in this plan. The *National Parks and Wildlife Act 1974 (*NPW Act) defines "harm" to an object or place as any act or omission that:

(a) destroys, defaces or damages the object or place, or

(b) in relation to an object-moves the object from the land on which it had been situated, or

(c) is specified by the regulations, or

(d) causes or permits the object or place to be harmed in a manner referred to in paragraph (a), (b) or (c),

(e) desecrates the object or place, or

(f) is trivial or negligible, or

(g) is excluded from this definition by the regulations.

Any Aboriginal objects or sites at CVC will be made aware for all employees, contractors and sub-contractors by the Environmental and Community Coordinator. This will include a message detailing:

- that the objects or sites are protected by law;
- potentially be distributed across the project area and that new sites may be exposed in areas outside of the disturbance footprints;
- are of significance to the Aboriginal community, and important to the wider community and must be treated with respect;
- have included stone tool sites; and
- can be hard to recognise, therefore reference must be made to the Aboriginal heritage map in this HMP in order to clearly identify them.

In the process of undertaking any mining activities there is potential to impact Aboriginal objects or sites. Any activity which results in the disturbance of the surface has the potential to harm Aboriginal heritage sites. The level of impact to Aboriginal sites depends on the nature of the surface works/subsidence and the physical characteristics of the Aboriginal site types. The Mannering Colliery project approval currently allows for first workings mining only in the Great Northern and Fassifern seams, with <20 mm surface, negligible subsidence effects. This is less than the average natural ground swell movement of 29 mm (Delany et al). This first working mining method is the key management tool to avoiding harm to aboriginal heritage.

5.1.5 Assessment of Potential Impact

If mining or mining associated activities have the potential to harm Aboriginal site/s, an assessment of the potential and likely impact must be undertaken in the form of an Aboriginal Cultural Heritage Impact Assessment. It is important that all aspects of Aboriginal heritage be considered in the assessment and technical information is appropriately balanced with an assessment of cultural values.

The Aboriginal Cultural Heritage Impact Assessment must be developed in accordance with the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH 2011) and any other relevant guidelines applicable to the planning instrument. As a minimum, The Aboriginal Cultural Heritage Impact Assessment must contain the following:

- a description of the Aboriginal object/s and declared Aboriginal places located within the area of the proposed activity;

- a description of the cultural heritage values, including the significance of the Aboriginal objects and declared Aboriginal places that exist across the whole area that will be affected by the proposed activity and the significance of these values for the Aboriginal people who have a cultural association with the project area and the surrounding land;
- how the requirements for consultation with Aboriginal people have been met;
- actual or likely harm posed to the Aboriginal object/s or declared Aboriginal places from the proposed activity with reference to the cultural heritage values identified and any practical measures that may be taken to protect and conserve those Aboriginal object/s or declared Aboriginal places; and
- any practical measures that may be taken to avoid or mitigate actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm in accordance with this HMP and in consultation with the registered Aboriginal parties.

5.1.6 Unexpected Finds Procedure

As identified in the EA (AECOM, 2011), the following predictions were made with respect to the distribution of Aboriginal archeology in the vicinity of the site:

- Aboriginal shell midden sites are likely to occur in areas adjacent to lakes, creeks and coastal areas in the region;
- Aboriginal scarred or carved trees may be present where mature native trees remain, particularly in areas adjacent to lake foreshores and creek lines;
- stone artefacts, comprising artefact scatters or isolated finds, may occur associated with Aboriginal shell midden sites; and
- stone artefacts may occur across the landscape as random occurrences but are most likely to be associated with water bodies.

In light of the above predictive statements, Aboriginal archaeological sites including shell middens and artefact scatters are likely to occur on the Lake Macquarie foreshore and in areas adjacent to creek lines, particularly higher order creek lines.

In the event any new Aboriginal sites are discovered as part of any future archaeological investigations, or should unanticipated Aboriginal objects be found during approved site clearing or construction activities, the following actions will be undertaken:

- work will halt in the vicinity of the site;
- the site Manager and Environment and Community Coordinator are to be notified;
- the site will be assessed by a qualified archaeologist with the RAPs;
- where possible the site should be avoided, but if this is not feasible and the site is likely to be impacted, appropriate mitigation measures will be determined in consultation with the Aboriginal stakeholders;
- work will only recommence once the Environment and Community Coordinator advises that the site can be avoided or statutory approval for impact has been obtained; and

- an AHIMS site card will be completed and submitted in compliance with s.89A of the NPW Act 1974 within 21 days of discovering the site.

5.1.7 Discovery of Human Skeletal Remains

In the event that known or suspected human skeletal remains are encountered within the CVC mine area, the following procedure must be followed:

- the immediate vicinity will be secured to protect the find and the find will be immediately reported to the work supervisor who will immediately advise the site supervisor or other nominated senior staff member, including the Mine Manager and Environment and Community Coordinator;
- the Environment and Community Coordinator or other nominated senior staff member will notify the police and the state coroner on the same day of the find (as required for all human remains discoveries);
- if the remains are historical and not of Aboriginal origin, BCD will be notified for further instruction; and
- works will not recommence until written approval is received.

5.2 Non-indigenous heritage

There are no identified non-indigenous heritage items within the development consent boundary and therefore no management actions are currently proposed. Notwithstanding, unidentified historical relics are protected under Section 139 of the Heritage Act and if potential relics are uncovered during project-related activities, the land in which it is found cannot be disturbed or excavated without an excavation permit or other approval under SSD conditions. Considering the above, the following unexpected finds protocol applies for non-indigenous heritage:

- work will halt in the vicinity of the site;
- the site Manager and Environment and Community Coordinator are to be notified;
- the site will be assessed by a qualified archaeologist;
- where possible the site should be avoided, but if this is not feasible and the site is likely to be impacted, appropriate assessment, approvals and mitigation measures will be determined in consultation with the NSW Heritage Council; and
- work will only recommence once the Environment and Community Coordinator advises that the site can be avoided or statutory approval for impact has been obtained.

6 Reporting

6.1 Reporting impact to Aboriginal sites

An Aboriginal Site Impact Recording Form must be completed following impacts to AHIMS sites that are:

a) a result of test excavation carried out in accordance with the Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW;

b) authorised by an AHIP issued by the BCD;

c) undertaken for the purpose of complying with Secretary's environmental assessment requirements issued by the DPIE for:

   i) State Significant Development (SSD),

   ii) State Significant Infrastructure (SSI), or

   iii) a major project, or

d) authorised by an SSD/SSI/former Part 3A consent/approval under the EP&A Act.

Completed forms must be submitted to the AHIMS Registrar at the DPIE website. Aboriginal Site Impact Recording Forms can be downloaded from the DPIE website.

6.2 Annual Review

The results of the monitoring of any heritage sites will be reviewed upon receipt and a summary of any heritage monitoring undertaken will be included in the relevant Annual Review, along with a description of any actions being implemented or planned with respect to the known heritage sites. The Annual Review will be forwarded to the relevant authorities. The Annual Review will also be forwarded to members of the Community Consultative Committee, local Councils (Wyong and Lake Macquarie), to the Aboriginal stakeholders and be placed on the company's website.

6.3 Incident or Non-Compliance Reporting

If site inspections reveal that, as a direct result of CVC, there has been unpredicted damage to a site, then DC will conduct an investigation into the source of the damage with a suitably qualified and experienced archaeologist. The report will be provided to relevant people and/or groups, Councils and the Secretary of DPIE. The report will be provided to relevant people and/or groups including RAPs and BCD.

The report will:

- describe the date, time and nature of the observation;
- identify the cause (or likely cause) of the damage;
- describe what action has been taken to date; and
- describe the proposed measures to address the damage and prevent further such occurrences.

DC will implement any recommendations in order to prevent future occurrences. Confidential information about Aboriginal site location will not be included in any report that enters the public domain. Additional details of the incident reporting process are provided in the Environmental Management Strategy.

Any incident or complaint will be recorded and fully investigated to find root causes and corrective actions implemented where necessary.

7 Stakeholder Management and Response

7.1 Complaint Protocol

DC has a 24-hour telephone hotline (1800 115 277) through which members of the public can lodge complaints, concerns, or to raise issues associated with the operation. This service aims to promptly and effectively address community concerns and environmental matters.

All complaints are recorded and responded to and if, for some reason, no action is taken then the reason why is recorded. The information recorded in the complaint register includes:

- date and time the complaint was lodged;
- personal details provided by the complainant;
- nature of the complaint;
- action taken or, if no action was taken, the reason why; and
- follow up contact with the complainant.

7.2 Independent Review

As detailed in Condition 2, Schedule 5 of SSD-5465, an Independent Review can be requested by a landowner who "*considers the development to be exceeding the relevant criteria in Schedule 3".*

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

(a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the 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 Secretary and landowner a copy of the independent review

7.3 Dispute Resolution

If any disputes are not adequately addressed by the complaints handling process then they will be handled by the Environment and Community Coordinator. If the response of CVC is not considered to satisfactorily address the concern of the complainant, a meeting may be convened with the complainant, Mine Manager together with the Environment and Community Coordinator to determine any further options to reduce potential impacts.

Any actions agreed from the meeting will be implemented by CVC. After implementation of the proposed actions the complainant will be contacted and advice sought as to the satisfaction or otherwise with the measures taken.

If no agreed outcome is determined or the complainant is still not satisfied by the action taken, then an Independent Review may be requested by the complainant. If determined to be warranted by the Secretary, an independent review will be undertaken in accordance with the process identified in Schedule 5 of SSD-5465.

7.3.1 Conflict of Interest

The mediator must, prior to the commencement of the mediation, disclose to the parties to the best of his or her knowledge any prior dealings with any of the parties as well as any interests in the dispute. If in the course If, in the course of the mediation the mediator becomes aware of any circumstances that might reasonably be considered to affect the mediator's capacity to act impartially, the mediator must immediately inform the parties of these circumstances. In this instance, the parties will then decide whether the mediation will continue with that mediator or with a new mediator appointed by the parties.

7.4 Training, Awareness and Competence

Training is an essential component of the implementation phase of this HMP. The Environment and Community Coordinator will ensure that training and awareness processes are implemented to manage, identify and minimise potential impacts of CVC and to ensure personnel are aware of their roles and responsibilities in terms of cultural heritage management.

Generally training at CVC consists of induction training for new starters and contractors along with environmental awareness training at two-year intervals and ongoing "toolbox" training for all permanent employees as required.

As the document owner, the Environment and Community Coordinator is the contact point for any person that does not understand this document or their specific requirements, and will provide guidance and training to any person that requires additional training regarding this HMP.

7.4.1 Heritage Induction

Health safety and environment inductions will include content on the nature of heritage items present or likely to be present within the CVC leases. Records of inductions will be kept according to DC's standard practices.

The induction includes the following content:

- historic heritage sites have not been identified nor are considered likely to occur within the CVC project area;
- the CVC site is within the traditional land of the Awabakal Aboriginal people;
- Aboriginal sites are known to occur above current and future mining areas, and along certain parts of the Lake Macquarie foreshore;
- one site, a single artefact, has been identified, fenced off and signposted within the pit top area;
- Aboriginal sites known to occur are scarred trees and middens. Middens are made up of concentrations of mature shellfish such as oyster, cockle and club whelk;
- the burial remains of Aboriginal people have been found in some middens. Some middens also include Aboriginal stone artefacts which generally have the appearance of chipped stone; and
- all Aboriginal sites are protected by the NPW Act 1974, which provides significant penalties for harm to Aboriginal objects and sites. Any shellfish deposits or stone artefacts encountered must not be collected.

8 Audit and Review

8.1 Review and Improvement

In accordance with Schedule 6, Condition 5 of SSD-5465, this HMP shall be reviewed, and if necessary revised, within 3 months of the following:

- the submission of an Annual Review;
- the submission of an incident report;
- the submission of an independent environmental audit; and
- following any modification to the development consent.

Changes to this HMP will be made in the following circumstances:

- where new Aboriginal sites are discovered, they must be added to the inventory in this HMP within three months of the find; and
- where an AHIP is issued, this HMP will be reviewed and updated where necessary to comply with the requirements of any AHIP conditions.

Where changes are made to the HMP, a draft of the modified plan will be provided to RAPs for review. RAPs will not be required to review the HMP for minor plan updates. This comprises:

- when a new Aboriginal site is discovered and is at no risk of impact by the project. In this instance, the inventory of the HMP will be updated to acknowledge the site, but RAPs will not be required to review the HMP; and
- when the status of a site needs to be updated on the inventory of the HMP. For example, once a site has been salvaged the HMP will be updated to reflect the site's status. However, RAPs will not be required to review this action.

Although RAPs are not required to review the HMP for minor plan updates, they will be notified if new sites are identified and of updates relating to the status of Aboriginal cultural heritage sites.

Matters raised in consultation which are specific to the changes in the plan will be acknowledged and addressed in the modified plan.

Any changes made to this HMP will be made in consultation with the BCD with a copy of the revised management plan provided for approval.

8.2 Auditing

The objectives of an audit are to maintain compliance with the HMP. Audits shall be carried out by personnel who have the necessary qualifications and experience to make an objective assessment of the issues. The extent of the audit, although pre-determined, may be extended if a potentially serious deviation from this document is detected.

Any audit non-conformances and/or improvement opportunities will have corrective and preventative actions implemented to avoid recurrence, these actions will be loaded into the site Incident Database to ensure the actions are assigned to the relevant people and completed.

External audits will be conducted utilising external specialists and will consider this document and related documents. External auditors shall be determined based on skills and experience and upon what is to be accomplished.

An Independent Environmental Audit (IEA) was undertaken during June 2019. In accordance with SSD-5465 Schedule 6, Condition 9, IEA's will be scheduled for every three years thereafter (unless the Secretary directs otherwise) by an audit team whose appointment has been endorsed by the Secretary.

9 Records and Document Control

9.1 Records

Generally, the Environment and Community Coordinator will maintain all Environmental Management System records which are not of a confidential nature. Records that will be maintained include:

- monitoring data;
- environmental inspections and auditing results;
- environmental incident reports;
- the complaints register; and
- licences and permits.

All records will be stored so that they are legible, readily retrievable and protected against damage, deterioration and loss. Records will be maintained for a minimum of 4 years or as otherwise required under any legislation, licence, lease, permit or approval.

If the relevant RAPs would like to undertake further documentation and archival recording of particular sites and places of spiritual significance or would like to document and record their oral histories about the County, these matters should be internally resourced from within their own organisations. However, if the RAPs seek assistance from DC to facilitate any cultural requests, then a meeting will be held to discuss the nature of the assistance, the scope of works involved and whether DC is able to facilitate the request.

In the event that DC agrees to assist with any cultural requests, a written agreement must be produced which specifies who will be undertaking the archival recording and lodgement of information (being either the Aboriginal parties or Delta), the recording methodology to be adopted and matters related to the care and control of the intellectual property.

9.2 Document Control

This document and all others associated with the Environmental Management System shall be maintained in a document control system which is in compliance with the site Document Control Standard which is available to all site personnel. Any proposed change to this document will be via the Environment and Community Coordinator.

A copy of this document is available on the DC website. Document revision details are provided in **Table 3**.

Table 3: Document Revision Details

Version	Date	Details of Revision	Company	Reviewed by/ Authorised by
1	06/11/2012	Original HMP	LakeCoal	N. Baker C. Ellis
2	23/06/2014	Reviewed	LakeCoal	Peter Campbell Robert Corbett C. Ellis
3	01/12/2019	Updated to Delta Coal format	Delta Coal	K. Weekes R. Desic C Armit

10 Roles and Responsibilities

All employees and contractors at CVC are responsible for environmental management. However, various positions in the organisation have roles, responsibilities and authorities for managing environmental aspects, action plans, programs and controls.

Roles and responsibilities specific to completing the requirements of this plan are identified in **Table 4**.

Table 4: Heritage Management Plan Roles and Responsibilities

Role	Responsibilities
Managing Director	• Ensure that adequate financial and personnel resources are made available for the implementation of the HMP.
Manager of Mining Engineering (Mine Manager)	• Maintain overall responsibility for environmental compliance with Mining Lease, EPL, development consent and other mining approvals as they pertain to the management of Aboriginal and non-indigenous cultural heritage. • Ensure that adequate training is provided to staff to minimise impacts to cultural heritage.
Environment and Community Coordinator	• Point of contact of all onsite personnel regarding heritage. • Document owner responsible for managing the implementation of the plan. • Arrange for reviews of HMP. • Inclusion of any heritage monitoring summarised within the Annual Review. • Document owner responsible for managing the implementation of the plan. • Coordinate relevant specialist personnel to conduct regular monitoring at the required time and frequencies if required. • Ensure inclusion of heritage in worker inductions through delivery or input to induction documents. • Arrange inductions and training for all personnel involved in implementing this HMP. • If inadvertent impact on a listed heritage item occurs, implement remediation works following consultation with BCD and heritage consultant. • Distribution of HMP copies as required. • Maintain a contact list for organisations and individuals who may need to be contacted under this HMP. • Be aware of the potential for further unrecorded heritage sites to occur.

Role	Responsibilities
Heritage Consultant	• Assist with the implementation of this HMP, as required. • Provide advice on remediation, if through unforeseen circumstances impact occurs on a heritage item. • Undertake the recording of new sites in accordance with government guidelines. • Provide heritage advice in accordance with relevant legislation. • Undertake recording of new sites in accordance with government guidelines. • Assist with updating this HMP when necessary.
All employees and contractors	• Comply with the requirements of this HMP. • Immediately notify Environment and Community Coordinator of possible heritage item or damage.

11 References

Documents referenced in the preparation of the HMP are detailed in **Table 5**.

Table 5: References

Reference	Title
Australian Standards	AS/NZS ISO 14001:2004 Environmental management systems – Requirements with guidance for use AS/NZS ISO 14004:2004 Environmental management systems – General guidelines on principles, systems and support techniques
Legislation and Regulations	*Environmental Planning and Assessment Act 1979* (EP&A Act) *Environment Protection and Biodiversity Act 1999* (EPBC Act) Environment Protection and Biodiversity Regulations 2000 Environment Protection Licence (EPL) 191 *Heritage Act 1977* Lake Macquarie City Council LEP 2014 *Mining Act 1992* *Protection of the Environment Operations Act 1997* (POEO Act) Project Approval (PA) 06_0311 (as modified) Wyong Local Environmental Plan 2013
Delta Coal documents	EMS Environmental Management Strategy.
External documents	Delany et al 2005, Field Monitoring of Expansive Soil behaviour in the Newcastle-Hunter Region, Australian Geomechanics, Vol 40, Issue 2. Department of Environment, Climate Change and Water (DECCW) 2010, Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales. Department of Environment, Climate Change and Water (DECCW) 2010, Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales. Department of Environment, Climate Change and Water (DECCW) 2010, Aboriginal Consultation Requirements for Proponents. Department of Environment, Climate Change and Water (DECCW) 2011, Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales. Department of the Environment and Energy (2013), EPBC Act Protected Matters Search Tool, Australian Commonwealth Government Department of Environment (2013), Matters of National Environmental Significance, Significant Impact Guidelines 1.1, Environment Protection and Biodiversity Conservation Act 1999, Commonwealth of Australia. Holdaway S et al. 2002, Artefact Visibility at Open Sites in Western New South Wales, Australia, Journal of Field Archaeology, Vol: 29, Number3/4, PP: 255-271 ICOMOS, (1999) The Burra Charter: The Australia ICOMOS Charter for

Reference	Title
	Places of Cultural Significance, Australia ICOMOS Inc. Long A (2005) Aboriginal Scarred Trees in New South Wales: A field Manuel, Department of Environment and Conservation NSW. Mulvaney J & Kamminga J 1999, Prehistory of Australia, Allen and Unwin Publishing, NSW O'Connor S et al 2007, Stone Construction on Rankin Island, Kimberley, Western Australia, Australian Archaeology, Number 64, PP: 15-22 Office of Environment and Heritage (OEH) 2011, Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW. Report to State of NSW and the Office of Environment and Heritage, Department of Premier and Cabinet. OEH (2019), State Heritage Register, NSW Government, Office of Environment & Heritage

12 Definitions

ACHA Aboriginal Cultural Heritage Assessment

ACHCR Aboriginal Cultural Heritage Consultation Requirements

AHIMS Aboriginal Heritage Information Management System

AHIP Aboriginal Heritage Impact Permit

BCD Biodiversity and Conservation Division, DPIE

CCC community Consultative Committee

CVC Chain Valley Colliery

DC Delta Coal

DPIE NSW Department of Planning, Industry and Environment

EL Exploration Licence

EA Environmental Assessment

EMS Environmental Management System

EP&A Act *Environmental Planning and Assessment Act 1979*

EPBC Act *Environment Protection and Biodiversity Act 1999*

EPL Environment Protection Licence

HMP Heritage Management Plan

ICOMOS International Council on Monuments & Sites

LEP Local Environment Plan

LGA Local Government Area

LMCC Lake Macquarie City Council

MC Mannering Colliery

NPW Act *National Parks and Wildlife Act 1974*

NPW Regulation National Parks and Wildlife Regulation 2009

NSW New South Wales

OEH Office of Environment & Heritage

PA Project Approval

PAD Potential Archaeological Deposits

POEO *Protection of the Environment Operations Act 1997*

RAPs Registered Aboriginal Parties

ROM Run of Mine

Secretary Secretary of the Department of Planning & Environment, or nominee

SHR State Heritage Register

Appendix 1: Consultation

Appendix 2: Development Consent Summary

Chain Valley Colliery Development Consent SSD-5465 Summary

This HMP has been prepared in accordance to Schedule 3, Condition 21 of SSD-5465, which states the requirements of the HMP and what it must address. **Table A2** outlines the requirements of the HMP and where this document addresses these requirements.

Table A2: Requirements from Chain Valley Colliery Development Consent (SSD-5465)

Condition No.	Requirement	Relevant section of this document
	Schedule 2 Administrative Conditions	
18	***Updating and Staging Strategies, Plans or Programs*** *The Applicant must regularly review the strategies, plans and programs required under this consent and ensure that these documents are updated to incorporate measures to improve the environmental performance of the development and reflect current best practice in the mining industry. To facilitate these updates, the Applicant may at any time submit revised strategies, plans or programs for the approval of the Secretary.* *With the agreement of the Secretary, the Applicant may also submit any strategy, plan or program required by this consent on a staged basis. With the agreement of the Secretary, the Applicant may prepare a revision or stage of any strategy, plan or program required under this consent without undertaking consultation with all parties nominated under the applicable condition in this consent.* *Notes:* • *While any strategy, plan or program may be submitted on a staged basis, the Applicant must ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times.* • *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program.*	**Section 8**
	Schedule 3 Specific Environmental Conditions	
18	*The Applicant shall prepare a Heritage Management Plan for the project to the satisfaction of the Secretary. This plan must:*	**This Document**
	a) be prepared in consultation with any relevant Aboriginal stakeholders;	**Section 1**
	b) be submitted to the Secretary for approval within 6 months of the date of this consent;	**Submission letter dated 20 November 2012; approval letter dated 1 July 2013**
	c) include consideration of the Aboriginal and non-Aboriginal cultural context and significance of the site;	**Section 3 and 4**
	d) detail the responsibilities of all stakeholders; and	**Section 10**

	e) *include programs/procedures and management measures for:* • *the ongoing monitoring of site 45-7-0189 at Summerland Point;* • *managing the discovery of any human remains or previously unidentified Aboriginal objects on site, including (in the case of human remains) stop work provisions and notification protocols;* • *ongoing consultation and involvement of the Aboriginal community in the conservation and management of Aboriginal heritage within the site; (including procedures for keeping records of this);* • *appropriate identification, management, conservation and protection of both Aboriginal and non-Aboriginal heritage items identified on the site; and* • *ensuring relevant workers on site receive suitable heritage inductions prior to carrying out any activities which may disturb Aboriginal sites, and that suitable records are kept of these inductions.* *The Applicant shall implement the approved management plan as approved from time to time by the Secretary.*	**Section 5**
	Schedule 6 Environmental Management, Auditing and Reporting	
3	***Management Plan Requirements*** *The applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:* *(a) detailed baseline data;* *(b) a description of:* • *the relevant statutory requirements (including any relevant approval, licence or lease conditions);* • *any relevant limits or performance measures/criteria;* • *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;* *(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;* *(d) a program to monitor and report on the:* • *impacts and environmental performance of the project;* • *effectiveness of any management measures (see (c) above);* *(e) 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;* *(f) a program to investigate and implement ways to improve the environmental performance of the development over time;* *(g) a protocol for managing and reporting any:* • *incidents;* • *complaints;* • *non-compliances with statutory requirements; and* • *exceedances of the impact assessment criteria and/or*	**This document**

	performance criteria; and *(h) a protocol for periodic review of the plan.* *Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.*	
5	***Revision of Strategies, Plans and Programs*** *Within 3 months of:* *(a) the submission of an annual review under Condition 4 above;* *(b) the submission of an incident report under Condition 7 below;* *(c) the submission of an audit report under Condition 9 below; or* *(d) any modification to the conditions of this consent (unless the conditions require otherwise),* *the Proponent must review, and if necessary revise, the strategies, plans, and programs required under this consent to the satisfaction of the Secretary. Where this review leads to revisions in any such document, then within 4 weeks of the review the revised document must be submitted for the approval of the Secretary.* *Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the project.*	**Section 8**
	Statement of Commitments	
	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. LakeCoal will:	
	• *review and revise the HMP to remove site #45-7-0154 and incorporate any other changes as a result of the proposed modification;*	**Section 5**
	• *update the HMP following approval of the Proposal to include the extended area to which it relates;*	**This document**
	• *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*	**Dam works complete**
	• *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. OEH 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.*	**Dam works complete**

Appendix 3: AHIMS Search

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : H190358_KA+JB

Client Service ID : 438293

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-7-0131	Summerland Point;	AGD	56	366820	6332970	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	Helen Brayshaw					**Permits**		
45-7-0138	Bonny Boy Gully;	AGD	56	366820	6332970	Open site	Valid	Shell : -, Artefact : -	Midden	1846
	Contact	**Recorders**	Helen Brayshaw					**Permits**		
45-7-0144	Windemere Ck 1;	AGD	56	363000	6334600	Open site	Valid	Shell : -, Artefact : -	Midden	2237
	Contact	**Recorders**	Anne Lloyd					**Permits**		
45-7-0154	M7 Fishery Point	AGD	56	366050	6334500	Open site	Valid	Shell : 2, Artefact : -	Midden	2685
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists (MDCA),Kerry Navin,Umwelt (Australia) Pty					**Permits**	597	
45-7-0157	M10 Casuarina Point Reserve	AGD	56	366300	6334990	Open site	Valid	Shell : -, Artefact : -	Midden	2685
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists (MDCA),Kerry Navin					**Permits**	597	
45-7-0158	M11;Lakeview Road, Bardens Bay;	AGD	56	363500	6334110	Open site	Valid	Shell : -, Artefact : -	Midden	2685
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists (MDCA),Kerry Navin					**Permits**	598	
45-7-0159	M12;Bulgonia Road, Bardens Bay;	AGD	56	363950	6334850	Open site	Valid	Shell : -, Artefact : -	Midden	2685
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists (MDCA),Kerry Navin					**Permits**	611	
45-7-0166	M8;Dandaraga Road, Sugar Bay;	AGD	56	365300	6334500	Open site	Valid	Shell : -, Artefact : -	Midden	2685
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists (MDCA),Kerry Navin					**Permits**		
45-7-0167	M9;Camp Brightwaters;	AGD	56	363500	6334880	Open site	Valid	Shell : -, Artefact : -	Midden	2685
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists (MDCA),Kerry Navin					**Permits**		
45-7-0176	Gwandalan;	AGD	56	367200	6333300	Open site	Valid	Shell : -, Artefact : -	Midden	2465,102129
	Contact	**Recorders**	Tom Griffiths					**Permits**		
45-7-0177	Camp Kanangra;	AGD	56	369500	6331500	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	Mr.David Lambert,Mr.Gavin Newton					**Permits**		
45-7-0178	Hembula Creek - Scarred Tree 1&2;HC-ST 1&2;	AGD	56	366800	6330400	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Mr.Gavin Newton					**Permits**		
45-7-0179	Black Neds Point;	AGD	56	365150	6331450	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	L.M Nelson					**Permits**		
45-7-0181	Chain Valley Bay 1	AGD	56	366150	6329600	Open site	Valid	Shell : -, Artefact : -	Midden	101093
	Contact	**Recorders**	L.M Nelson					**Permits**		
45-7-0182	Chain Valley Bay 2;	AGD	56	366120	6330950	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	L.M Nelson					**Permits**		
45-7-0183	Diamond Drill Pt. North;	AGD	56	368050	6333200	Open site	Valid	Artefact : -, Shell : -	Midden	102129
	Contact	**Recorders**	L.M Nelson					**Permits**		
45-7-0184	Gwandalan;	AGD	56	368500	6331800	Open site	Valid	Shell : -, Artefact : -	Midden	

Report generated by AHIMS Web Service on 30/07/2019 for Heritage Emm for the following area at Datum :GDA, Zone : 56, Eastings : 359462 - 369462, Northings : 6328206 - 6334206 with a Buffer of 1000 meters. Additional Info : As part of a report. Number of Aboriginal sites and Aboriginal objects found is 82

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : H190358_KA+JB

Client Service ID : 438293

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	L.M Nelson					**Permits**		
45-7-0186	Pt Wolstonecraft 1;	AGD	56	368350	6334200	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	L.M Nelson					**Permits**		
45-7-0189	Sandy Beach 1;	AGD	56	364950	6331450	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	L.M Nelson					**Permits**		
45-7-0201	Nord 1 (N1)	AGD	56	369600	6332600	Open site	Valid	Shell : -, Artefact : -	Midden	3022
	Contact	**Recorders**	Iain Stuart					**Permits**	698	
45-7-0207	The Hole 1 (TH1)	AGD	56	361820	6329800	Open site	Valid	Artefact : -	Open Camp Site	3697,101093
	Contact	**Recorders**	Kerry Navin,Mr.Kelvin Officer,P Saunders					**Permits**		
14-7-0149	Gwandalan	AGD	56	368000	6333300	Open site	Valid	Shell : -, Artefact : -	Midden	102129
	Contact	**Recorders**	Tom Griffiths					**Permits**		
45-3-3435	RPS HSO MwP1	AGD	56	359424	6334225	Open site	Valid	Shell : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	RPS Australia East Pty Ltd-Blacktown					**Permits**		
45-7-0290	Gwandalan 1	AGD	56	368088	6329979	Open site	Valid	Shell : -		
	Contact	**Recorders**	Doctor.Tim Owen,ERM Australia Pty Ltd- Sydney CBD					**Permits**		
45-7-0316	RPS Wyee Point 2	GDA	56	362237	6331450	Open site	Valid	Shell : -		
	Contact	**Recorders**	RPS Australia East Pty Ltd -Hamilton,Ms.Laraine Nelson					**Permits**		
45-7-0293	RPS MP3	GDA	56	365058	6335017	Open site	Valid	Modified Tree (Carved or Scarred) : -		
	Contact	**Recorders**	RPS Australia East Pty Ltd -Hamilton,Ms.Laraine Nelson					**Permits**		
45-7-0190	Wyee Point	AGD	56	362398	6331810	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	L.M Nelson,RPS Australia East Pty Ltd -Hamilton,Ms.Laraine Nelson					**Permits**		
45-7-0291	RPS HSO M1	GDA	56	361555	6331952	Open site	Valid	Shell : -		
	Contact Koompahtoo LALC	**Recorders**	RPS Australia East Pty Ltd -Hamilton,Ms.Laraine Nelson					**Permits**		
45-7-0357	Noamunga CR Midden	GDA	56	368583	6333118	Open site	Valid	Shell : -		
	Contact	**Recorders**	Ms.Sharon Hodgetts					**Permits**		
45-3-4287	Wyee 7	GDA	56	358559	6327310	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Insite Heritage Pty Ltd,Ms.Elizabeth Wyatt					**Permits**		
45-7-0226	K 4 Koompahtoo	AGD	56	360390	6334990	Open site	Valid	Artefact : -	Isolated Find	99218
	Contact	**Recorders**	William Smith					**Permits**		
45-3-3165	K 1 Koompahtoo	AGD	56	359490	6332490	Open site	Valid	Artefact : -	Open Camp Site	99218
	Contact	**Recorders**	William Smith					**Permits**		
45-7-0225	K 3 Koompahtoo	AGD	56	360650	6334900	Open site	Valid	Artefact : -	Isolated Find	99218

Report generated by AHIMS Web Service on 30/07/2019 for Heritage Emm for the following area at Datum :GDA, Zone : 56, Eastings : 359462 - 369462, Northings : 6328206 - 6334206 with a Buffer of 1000 meters. Additional Info : As part of a report. Number of Aboriginal sites and Aboriginal objects found is 82

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	William Smith					**Permits**		
45-7-0079	Crangan Bay;Stranger Gully;	AGD	56	368450	6330750	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	ASRSYS					**Permits**		
45-7-0001	Morisset Hospital	AGD	56	361550	6332450	Open site	Valid	Shell : -, Artefact : -	Midden	1263
	Contact	**Recorders**	L.M Nelson,A.J Barrett					**Permits**		
45-7-0003	Vales Point;Lake Macquarie;	AGD	56	363738	6331615	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	Wyong Shire Council					**Permits**	730	
45-3-1553	Wyee Bay;Ruttleys Road;	AGD	56	362540	6330400	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	Val Attenbrow,Glen Morris					**Permits**		
45-7-0262	SJOG 7	GDA	56	364036	6333848	Open site	Valid	Grinding Groove : 6		
	Contact	**Recorders**	Mrs.Angela Besant					**Permits**		
45-7-0263	SJOG 6	GDA	56	364026	6333875	Open site	Valid	Shell : -		
	Contact	**Recorders**	Mrs.Angela Besant					**Permits**		
45-7-0239	MP 1	AGD	56	362100	6334400	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact T Russell	**Recorders**	Mrs.Angela Besant					**Permits**	2115	
45-7-0253	Gwandalan 2	GDA	56	367386	6331169	Open site	Valid	Shell : -		
	Contact	**Recorders**	Doctor.Tim Owen					**Permits**		
45-7-0254	gwanddalan 1	GDA	56	368088	6329979	Open site	Valid	Shell : -		
	Contact	**Recorders**	Doctor.Tim Owen					**Permits**		
45-3-3166	K 2 Koompahtoo	AGD	56	359840	6332530	Open site	Valid	Artefact : -	Isolated Find	99218
	Contact	**Recorders**	William Smith					**Permits**		
45-7-0255	Trinity Point GG2 (Catherine Hill Bay)	GDA	56	363618	6333664	Open site	Valid	Grinding Groove : -		
	Contact	**Recorders**	Mrs.Angela Besant					**Permits**		
45-7-0256	Trinity Point Scarred Tree 2 (Catherine Hill Bay)	GDA	56	363749	6333815	Open site	Not a Site	Modified Tree (Carved or Scarred) : -		
	Contact	**Recorders**	Mrs.Angela Besant,Insite Heritage Pty Ltd,Urban Tree Management					**Permits**		
45-7-0257	Trinity Point Ochre (Catherine Hill Bay)	GDA	56	363958	6333791	Open site	Valid	Ochre Quarry : -		
	Contact	**Recorders**	Mrs.Angela Besant					**Permits**		
45-7-0258	Trinity Point IF1 (Catherine Hill Bay)	GDA	56	363730	6333744	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mrs.Angela Besant					**Permits**		
45-7-0338	RPS GWANDALAN IF1	GDA	56	368263	6331126	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	RPS East Australia Pty Ltd - Echuca Victoria					**Permits**		
45-7-0320	RPS Mannering 1	GDA	56	363449	6331411	Open site	Valid	Shell : 1		

Report generated by AHIMS Web Service on 30/07/2019 for Heritage Emm for the following area at Datum :GDA, Zone : 56, Eastings : 359462 - 369462, Northings : 6328206 - 6334206 with a Buffer of 1000 meters. Additional Info : As part of a report. Number of Aboriginal sites and Aboriginal objects found is 82

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	Ms.Laraine Nelson					**Permits**		
45-7-0321	RPS Mannering 2	GDA	56	363401	6331331	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	**Recorders**	Ms.Laraine Nelson					**Permits**		
45-7-0339	CV 001	GDA	56	364943	6329478	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mrs.Rebecca Newell,EMGA Mitchell McLennan					**Permits**		
45-7-0374	Gwan IF1	GDA	56	368302	6331050	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mrs.Angela Besant,Insite Heritage Pty Ltd					**Permits**		
45-7-0379	Nords Whard PAD	GDA	56	369883	6331871	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -, Shell : -		
	Contact	**Recorders**	MCH - McCardle Cultural Heritage Pty Ltd,MCH - McCardle Cultural Heritage Pty Lt					**Permits**	4341,4417	
45-7-0378	Dungutti Elders office Cloned	GDA	56	362791	6335021	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Miss.Jessica Wegener,Mount Grenfell Aboriginal Board of Management					**Permits**		
45-7-0384	32 marine parade	GDA	56	369777	6333058	Open site	Valid	Shell : -		
	Contact	**Recorders**	Mr.david ahoy,lower hunter aboriginal incorporated					**Permits**		
45-3-0334	Tiembula Creek Midden;Tiembula Creek;	AGD	56	366730	6330420	Open site	Valid	Shell : -, Artefact : -	Midden	1076
	Contact	**Recorders**	Mary Dallas Consulting Archaeologists (MDCA)					**Permits**		
45-7-0227	St Johns 1	AGD	56	363680	6333520	Open site	Valid	Artefact : -		100896
	Contact	**Recorders**	Mrs.Angela Besant					**Permits**	1947	
45-7-0228	St Johns 2	AGD	56	363720	6333820	Open site	Valid	Artefact : -		100896,101024
	Contact	**Recorders**	Mrs.Angela Besant					**Permits**	1947,3855,3981	
45-7-0230	K3 KOOMPAHTOO	AGD	56	360650	6334900	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Stephen Griffen					**Permits**		
45-7-0080	Mannering Park;	AGD	56	364780	6328890	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	101093
	Contact	**Recorders**	ASRSYS					**Permits**		
45-7-0244	St Johns 3	AGD	56	363560	6333600	Open site	Valid	Artefact : 1		100896,102504
	Contact T Russell	**Recorders**	Mrs.Angela Besant					**Permits**	2845,2846,3864,3981,3984,4115	
45-7-0268	CV-04-09	GDA	56	368381	6331136	Open site	Valid	Shell : 1		
	Contact	**Recorders**	Mr.Geordie Oakes					**Permits**		
45-7-0269	CV-06-09	GDA	56	368061	6328867	Open site	Valid	Artefact : 1		

Report generated by AHIMS Web Service on 30/07/2019 for Heritage Emm for the following area at Datum :GDA, Zone : 56, Eastings : 359462 - 369462, Northings : 6328206 - 6334206 with a Buffer of 1000 meters. Additional Info : As part of a report. Number of Aboriginal sites and Aboriginal objects found is 82

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0270	CV-07-09	GDA	56	367043	6331305	Open site	Valid	Artefact : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0271	CV-08-09	GDA	56	366587	6330975	Open site	Valid	Shell : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0272	CV-09-09	GDA	56	366650	6330868	Open site	Valid	Shell : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0273	CV-10-09	GDA	56	366875	6330868	Open site	Valid	Shell : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0274	CV-12-09	GDA	56	367290	6330372	Open site	Valid	Artefact : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0275	CV-14-09	GDA	56	367468	6330191	Open site	Valid	Shell : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0276	CV-15-09	GDA	56	366304	6329303	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0277	CV-16-09	GDA	56	366335	6329635	Open site	Valid	Shell : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0278	CV-17-09	GDA	56	366273	6329369	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0279	CV-18-10	GDA	56	367003	6333279	Open site	Valid	Shell : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0280	CV-19-10	GDA	56	366988	6333151	Open site	Valid	Shell : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0281	CV-20-10	GDA	56	365588	6331434	Open site	Valid	Shell : 1		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0282	CV-21-10	GDA	56	366221	6331192	Open site	Valid	Shell : -		
	Contact	Recorders	Mr.Geordie Oakes					Permits		
45-7-0340	Nords Wharf 1	GDA	56	369821	6331865	Open site	Valid	Artefact : 1		
	Contact	Recorders	Mr.Aaron Fogel					Permits	4341,4417	
45-7-0341	Nords Wharf 2	GDA	56	369858	6331788	Open site	Valid	Artefact : 1		
	Contact	Recorders	Mr.Aaron Fogel					Permits	4341,4417	
45-7-0342	Nords Wharf 3	GDA	56	369788	6331822	Open site	Valid	Artefact : 1		

Report generated by AHIMS Web Service on 30/07/2019 for Heritage Emm for the following area at Datum :GDA, Zone : 56, Eastings : 359462 - 369462, Northings : 6328206 - 6334206 with a Buffer of 1000 meters. Additional Info : As part of a report. Number of Aboriginal sites and Aboriginal objects found is 82

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : H190358_KA+JB

Client Service ID : 438293

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	Mr.Aaron Fogel					**Permits**		
45-7-0343	Nords Wharf 4	GDA	56	369861	6331731	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Aaron Fogel					**Permits**	4341,4417	
45-7-0349	NWR NORDS WHARF ROAD 01	GDA	56	369760	6331962	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Miss.Philippa Sokol					**Permits**		
45-7-0363	Woods Point Repatriation site	GDA	56	362530	6333367	Open site	Valid	Burial : 1, Modified Tree (Carved or Scarred) : 1		
	Contact Doctor.User Test	**Recorders**	Ms.Mary Temple (nee Ghosn)					**Permits**		

Report generated by AHIMS Web Service on 30/07/2019 for Heritage Emm for the following area at Datum :GDA, Zone : 56, Eastings : 359462 - 369462, Northings : 6328206 - 6334206 with a Buffer of 1000 meters. Additional Info : As part of a report. Number of Aboriginal sites and Aboriginal objects found is 82

Appendix 10 Built Features Management Plan

Delta coal	□□□ □□er□ **Environment and Community Coordinator** □□□ □□□

CHAIN VALLEY COLLIERY

Built Features Management Plan

S4 Miniwall Panel

ENVIRONMENTAL MANAGEMENT PLAN

Reviewers	□□ie □ ee□e□ □MM □□□u□i□g □□□ □□d
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Contents

1 Introduction

1.1 Purpose and Scope

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1.2 Background

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[illegible] to acquire BHP Billiton's 80% share in the Wallarah Coal Joint Venture (WCJV), [illegible]

[illegible] Preparation Plant, all located at the southern end of Lake Macquarie. At the time of LakeCoal's acquisition by [illegible]

[illegible]

[illegible]

[illegible]

1.3 Consultation

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Table 1: Consultation Summary

Stakeholder	Comments	Response/Action
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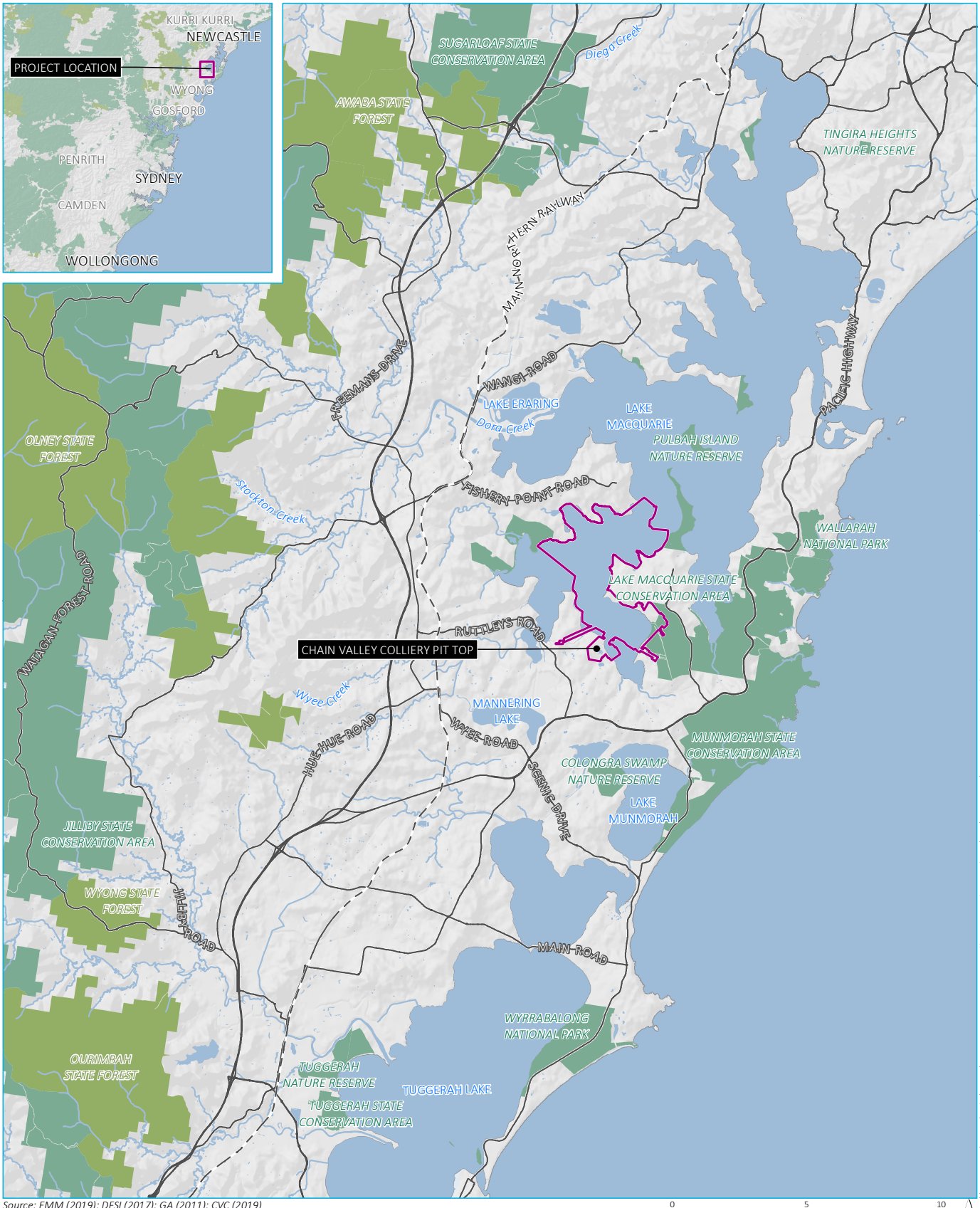

Source: EMM (2019); DFSI (2017); GA (2011); CVC (2019)

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GDA 1994 MGA Zone 56

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KEY

- Chain Valley Colliery development consent boundary
- Rail line
- Main road
- Watercourse/drainage line
- Waterbody
- NPWS reserve
- State forest

CVC regional context

Chain Valley Colliery
Figure 1

EMM
creating opportunities

2 Statutory Requirements

2.1 Key Legislation, Policy and Guidelines

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- *Environment Protection and Biodiversity Conservation Act 1999* □□□□□ □□□□□
- *Protection of the Environment Operations Act 1997* □□□ □□ □□□□□
- *Environmental Planning and Assessment Act 1979* □□□□□ □□□□□
- *Mining Act 1992*□
- *National Parks and Wildlife Act 1974*□
- *Biodiversity Conservation Act 2016*□
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2.2 Development Consent SSD-5465 Requirements

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3 Built Features Management

3.1 Identification

A □ur□□e ie□d mapp ing e□er i□e ha□ □ee□ u□der□□e□ by DC a □ov ə the S2, S 3 and S □ Min¡walls w ¡th the i□e□□ of ide□i□i□g all □ur□□e- □ui□□e□ure□ which □□u□d □e po□en¡ally □□e□ed by □□e comp □e¡on of th e u□dergr□u□d dri□□ge and m¡n¡wa l ə□r□□i□□. Th e follow ing s ə c¡ons i□□the ide□i□ied built □e□ure□ as w e ll as a de□ri□i□□ of each. A □re- □i□i□g ass ə ssm en t of th e □e i□□□ Rock Nav ˈga¡onal M□r□er i□ □r□□ided i□ **Appendix 3**.

3.2 Pelican Rock Navigational Marker NLM045

□□e □e i□□□ Rock □□□ig□i□□□□M□r□er NL M045 (□□□□ed □□□ger) i□ □□□□ed abo □e □□ig□□e S2 (TGS2) as □er □□e attach ed p□an an d i□ phys ˈcall □u□ □ered 045 w ¡th dim e ns ˈons as □er **Figure 2**.

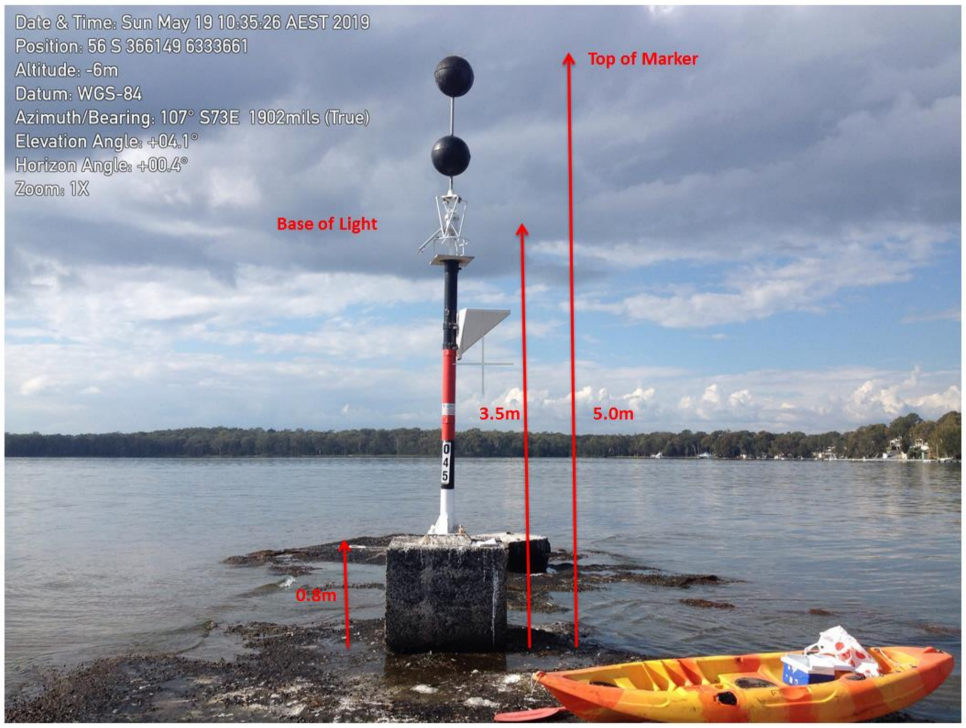

Figure 2: Pelican Rock Navigational Marker NLM045

Th e nav ˈga¡onal □ □r□er on □e i□□□ Rock falls into th ə □□eg□r□ of 'Oth ə r bu oy □ an d s ˈg ns – Isola □ed d□□ger' (□ee **Figure 3**). □□e Isola □ed □□□ger □ig□i□di□□e□ □□e i¡i□d□□ger□ with ge□er□□□ □□□e □□□er□ all □r□u□d □eg a wreck). It i□ □d¡□ed to sa¡lors □□ pass th e m □□ any □ide bu t not □□ pass too clo □e. If i□, i□shows a □□i□e ig□□ flash i□g i□ gr□u□□ of two (R MS, 2019).

Figure 3: Other Buoys and Signs – Isolated Danger

3.3 Houses, other associated structures, Jetties, moorings, roads and services along the Summerland Point Foreshore

M□□□ □□□e □ui□□e□ure□ □□□g □□e □re□□□re □□□ □e □ee□ i□ **Figure 4** □□□□□□□ **Figure 5** □□□□□□□□e□e i□□ude □□u□e□ □□er □□□□i□ed □ru□ure□□ e□ie□□ □ □□ri□g□r□□d□ □□d □eri□e□□ □□ere □re □□r□i□g□ □d□□e□i□ □□e □r□igr□□i□□□ □□er□i□g □ □□□r□□ □e□□ □□ □□□□□ □i□ **Figure 6** □□□□□□

Figure 4: Aerial Photography of the Built Features along the Foreshore at Summerland Point

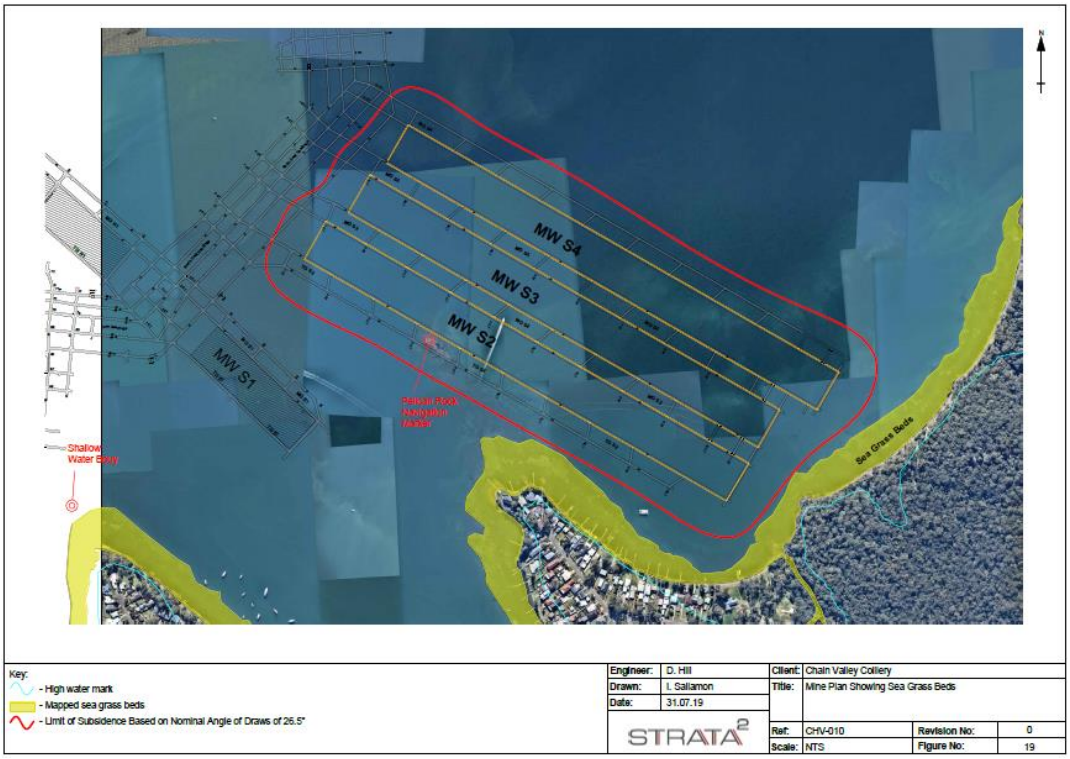

Figure 5: S2, S3 and S4 Miniwall (MWS2, MWS3 and MWS4) Surface Features (Strata2, 2019)

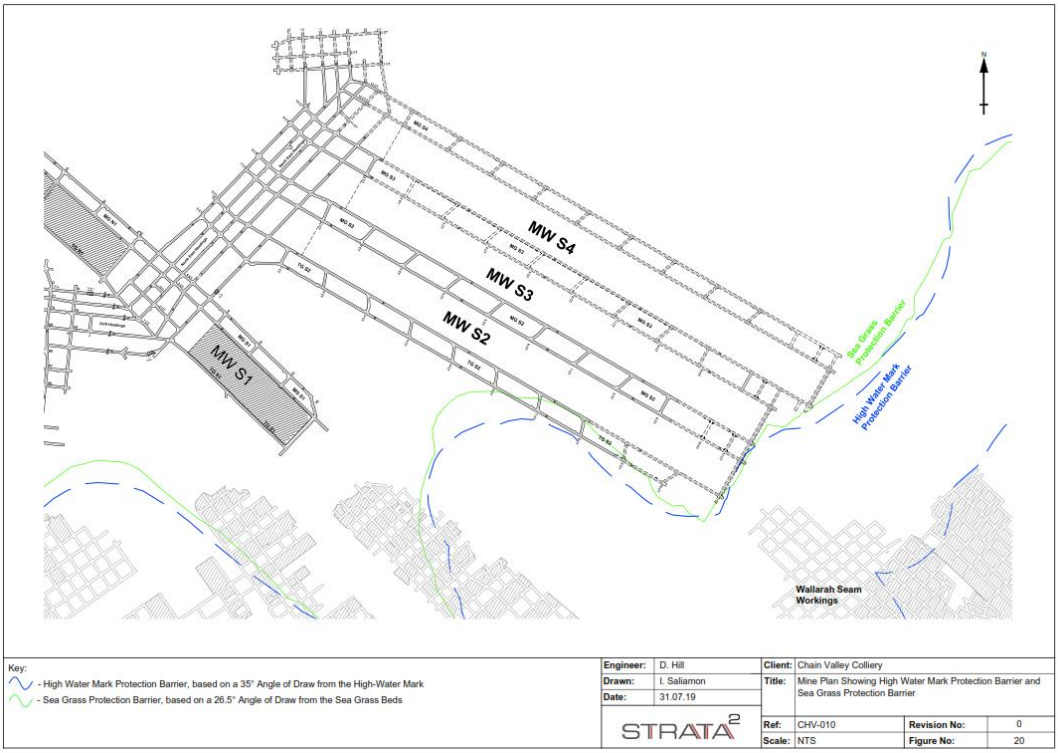

Figure 6: S2, S3 and S4 Miniwall (MWS2, MWS3 and MWS4) Protection Barriers and Wallarah seam workings location (Strata2, 2019)

4 Subsidence Predictions and Management Procedures

4.1 Subsidence Predictions

[illegible]

[illegible]

4.1.1 Pelican Rock Navigational Marker

[illegible]

4.1.1 Houses, other associated structures, Jetties, moorings, roads and services along the Summerland Point Foreshore

[illegible]

[illegible]

4.2 Subsidence Management

[illegible]

5 Subsidence Monitoring

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5.1 Pre and post mining inspections of the Pelican Rock Navigational Marker

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5.2 Pre and post mining surveying of the Pelican Rock Navigational Marker

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6 Subsidence Remediation

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7 Reporting

7.1 Regular Reporting

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7.2 Annual Review

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7.3 Incident or Non-Compliance Reporting

[illegible]

[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible]

8 Stakeholder Management, Response and Training

8.1 Complaint Protocol

[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]
- [illegible]

8.2 Independent Review

[illegible] who “*considers the development to be exceeding the relevant criteria in Schedule 3*”.

[illegible] independent review is warranted, then within 2 months of the Secretary's [illegible]

(a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the 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 Secretary and landowner a copy of the independent review.

8.3 Dispute Resolution

[illegible]

[illegible]

[illegible]

8.4 Training, Awareness and Competence

[illegible]

[illegible] and ongoing “toolbox” training for all permanent [illegible]

[illegible]

9 Audit and Review

9.1 Review and Improvement

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9.2 Auditing

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10 Records and Document Control

10.1 Records

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10.2 Document Control

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Table 2: Document Revision Details

Version	Date	Details of Revision	Company	Reviewed by/ Authorised by
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11 Roles and Responsibilities

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Table 3: Built Features Management Plan Roles and Responsibilities

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12 References

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Table 4: References

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13 Definitions

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EP&A Act *Environmental Planning and Assessment Act 1979*

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Appendix 1: Consultation

From: Chris Armit
To: 'Nathan Koch'; 'Ray Ramage'; 'Karen Mason'
Cc: 'Sonia Mckay'; 'Mike Baldwin'; 'Brett Boehm'; 'Fazal Khan'; 'Margaret MacDonald-Hill'; Katie Weekes; 'Colin Phillips'
Subject: CVC MWS4 Built Features Management Plan - Lake Macquarie (NLM045)
Sent: Wed 20/11/2019 6:15

Message | Draft Miniwall S4 Built Features Manangement Plan 191120.pdf (5 MB)

Open PDFs in Adobe Acrobat

Hi All,

Please find attached the draft Chain Valley Colliery Miniwall S4 Built features management plan for your review and comment.

It is an extension and update of the S2/S3 Built features management plan which had the Pelican Rock Navigational Marker as the main nearby built feature. This S4 miniwall is further away again from the navigational marker and is adjacent to the S3 Miniwall panel (See management plan for reference drawing).

By ways of an update development mining has occurred under the Pelican Rock navigation marker with no impact to nav marker serviceability. The S2 miniwall (miniwall closest to the NLM045) is planned to extract past the marker towards the end of December to early January. Miniwall S3 is currently planned for extraction in Feb 2020 and Miniwall S4 is currently planned for extraction in June 2020.

If you have any questions please don't hesitate to call.

Regards,
Chris

Delta coal

Chris Armit
Environmental and Community Coordinator
Phone: 02 4358 0800
Mobile: 0409 070 233

Chain Valley Colliery
Off Construction Rd (Off Ruttleys Rd)
Mannering Park NSW 2259

From: Chris Armit
To: 'Ray Ramage'
Cc: Phil Steuart; Gang Li; Tim Chisholm; David Hill; Chris Nicholas; 'Colin Phillips'
Subject: RE: CVC MWS4 Built Features Management Plan - Lake Macquarie (NLM045)
Sent: Mon 25/11/2019 11:00

Thanks for your feedback Ray, appreciate it.
I'll get Tim to include the Wallarah workings in the BFMP figure.
The S4 EP will also include Dave Hill's subsidence prediction report.
Cheers,
Chris

From: Ray Ramage [mailto:ray.ramage@planning.nsw.gov.au]
Sent: Monday, 25 November 2019 10:19 AM
To: Chris Armit
Cc: Phil Steuart; Gang Li
Subject: RE: CVC MWS4 Built Features Management Plan - Lake Macquarie (NLM045)

Chris,

Thanks for the update, particularly the info on tiltmeters.

I have reviewed the built features management plan for the purposes of consultation under SSD-5465.

The only comment I would make is that as houses & moorings along the shoreline have been identified and the critical control for these is mine layout and associated predicted angle of draw it would be beneficial to include the Wallarah Seam workings (refer in Fig 5 of the BFMP). It has been discussed at length in the past that the overlying workings have the potential to create subsidence outside the angle of draw.

Regards

Ray Ramage
Senior Mine Safety Officer (Subsidence Engineering)
Resources Regulator| Department of Planning, Industry and Environment
T 02 40636485 | **M** 0422 551 293 | **E** ray.ramage@planning.nsw.gov.au
8 Hartley Drive, Thornton NSW 2322

Transport for NSW

8 December 2019

Chris Armit
Environmental and Community Coordinator
Chain Valley Colliery
Off Construction Rd (Off Ruttleys Rd)
Mannering Park NSW 2259

email: CArmit@deltacoal.com.au

Dear Mr Armit

CVC MWS4 Built Features Management Plan - Lake Macquarie (NLM045)

Thank you for your correspondence dated 20 November 2019 requesting comment on the draft Chain Valley Colliery Miniwall S4 Built features management plan and specifically the Pelican Rock Navigational Marker as the main nearby built feature.

Transport for NSW (TfNSW) Maritime is responsible for the ongoing maintenance of safe navigation throughout NSW under the Marine Safety Act 1998. As such, proposals like this are reviewed to ensure that any disruption to navigation for vessels is minimised as much as is practical.

The project documentation provided has been assessed as having minimal impact on the safety of navigation to vessels operating in this area and Maritime has no objections to the proposed works nor any concerns with the built features management plan.

TfNSW Maritime advises the following for your reference:

1. Any works impacting on navigation during the construction phase must seek TfNSW Maritime support 21 days prior to works commencing. A full scope of works including dates is to be provided to navigationadvicenorth@rms.nsw.gov.au.
2. All associated work boats to comply with the relevant NSW Marine Legislation for survey, registration and safety equipment, and comply with the Marine Safety (Domestic Commercial Vessels) National Law Act 2012.
3. Vessels must exhibit lights and shapes in accordance with International Regulations for Preventing Collisions at Sea.

For more information, please contact me at navigationadvicenorth@rms.nsw.gov.au or my contact details below.

Yours sincerely

Lynda Hourigan
Project Officer North
Maritime

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Appendix 2: Development Consent Summary

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Table A2: Requirements from Chain Valley Colliery Development consent SSD-5465

Condition No.	Requirement	Relevant section of this document
	Schedule 2 Administrative Conditions	
18	***Updating and Staging Strategies, Plans or Programs*** *The Applicant must regularly review the strategies, plans and programs required under this consent and ensure that these documents are updated to incorporate measures to improve the environmental performance of the development and reflect current best practice in the mining industry. To facilitate these updates, the Applicant may at any time submit revised strategies, plans or programs for the approval of the Secretary.* *With the agreement of the Secretary, the Applicant may also submit any strategy, plan or program required by this consent on a staged basis. With the agreement of the Secretary, the Applicant may prepare a revision or stage of any strategy, plan or program required under this consent without undertaking consultation with all parties nominated under the applicable condition in this consent.* *Notes:* • *While any strategy, plan or program may be submitted on a staged basis, the Applicant must ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times.* • *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program.*	**Section 8**
	Schedule 3 Environmental Conditions – Underground Mining	
25	*The Applicant shall rehabilitate the site to the satisfaction of the DRE. This rehabilitation must be general consistent with the proposed rehabilitation strategy described in the EIS, and comply with the objectives in Table 7.* *Table 7: Rehabilitation Objectives* ***Feature*** / ***Objective*** Built features damaged by mining operations — • Repair to pre-mining condition or equivalent unless: – the owner agrees otherwise; or – the damage is fully restored, repaired or compensated under the *Mine Subsidence Compensation Act 1961*.	**Section 4 and 6**
	Schedule 4 Specific Environmental Conditions	
4	***Performance Measures- Built Features***	**This document**

	The Applicant shall ensure that the development does not cause any exceedance of the performance measures in Table 9 to the satisfaction of the Secretary. *Table 9: 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 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 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.*	
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 9 is to be settled by the Secretary, following consultation with the MSB and the DRE. Any decision by the Secretary shall be final and not subject to further dispute resolution under this consent.*	**Noted**
7	***Extraction Plan*** *(g) include a Built Features Management Plan, which has been prepared in consultation with DRE 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 other 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.* *The Applicant shall implement the approved management plan as approved from time to time by the Secretary.* *Notes:* • *To identify the underground mining areas approved under this consent referred to in this condition, see Appendix 3.* • *This condition does not limit secondary extraction under a Subsidence Management Plan approved as at the date of this consent.*	**This document**

8	*The Applicant shall 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*	**Section 4 and 6**

Appendix 3: Pre-mining Assessment - Pelican Rock Navigational Marker (NLM045)

21 May 2019

Dave McLean
Mine Manager
Chain Valley Colliery
Mannering Park, NSW

Re: Pre-mining assessment of Pelican Rock and associated Navigational Marker

Dear Dave,

1 Introduction

This letter has been prepared to inform the mine manager of the pre-mining assessment of the Pelican Rock Navigational Marker which was undertaken on 19th May 2019 and provides a brief description of the location and built feature details of the existing Pelican Rock navigational marker, the subsidence predictions and public safety impact.

2 Location

The Pelican Rock Navigational Marker (Isolated Danger) is located above Tailgate S2 (TGS2) as per the attached plan and is physically numbered 045 with dimensions as per Photo 1.

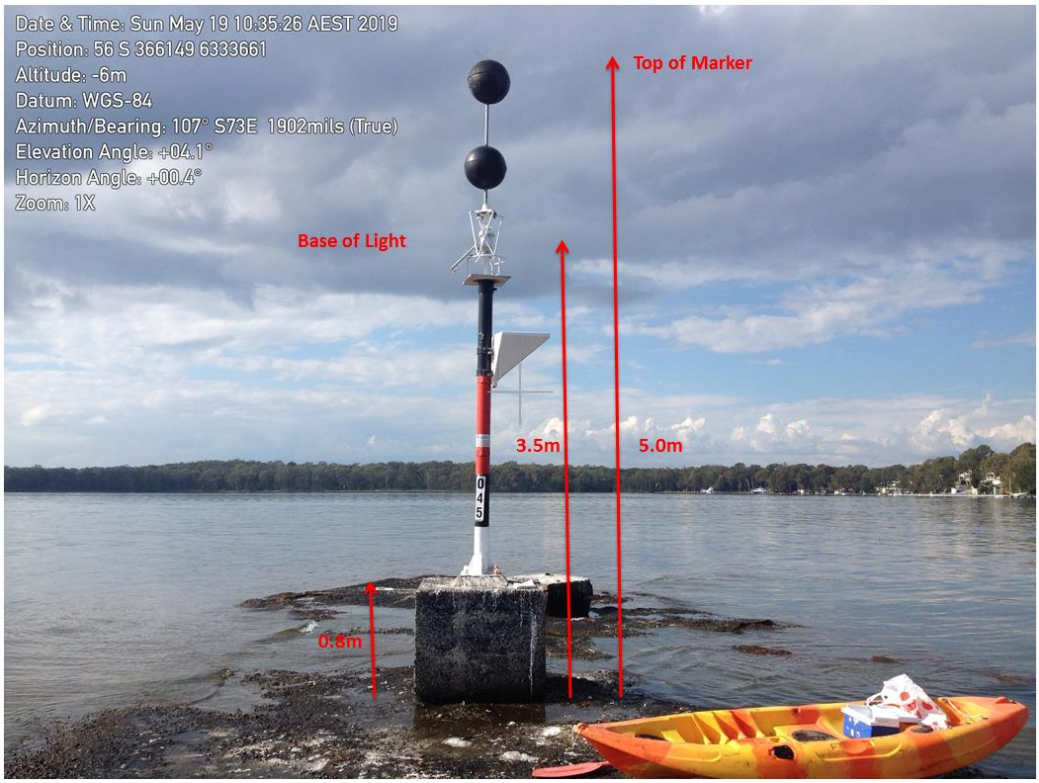
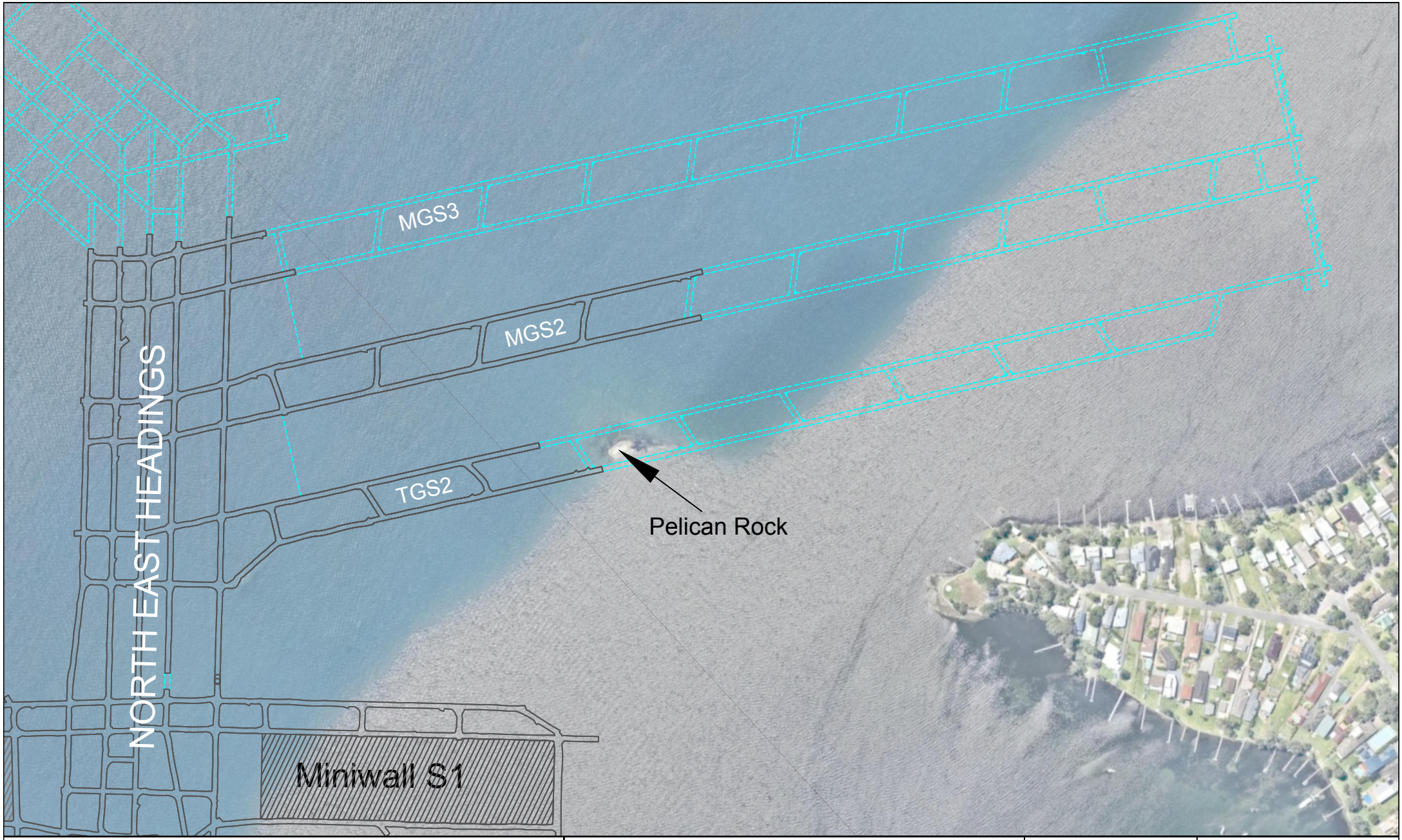


Photo 1. Pelican Rock Navigational Marker



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In terms of geological setting, the navigational marker and concrete block sit on a relatively flat, pebbly conglomerate outcrop which forms the navigational hazard (Photo 2). There were no signs of fresh cracking or deterioration on the outcrop or built feature which was inspected during high tide on the 19th May 2019. The Pelican rock outcrop extents seem to be more controlled by jointing on the northern side. During the High tide inspection the feature appeared generally flat and oval in general shape.

Photo 2. Pebbly Conglomerate outcrop which forms Pelican Rock

3 Built Feature Details

The New South Wales Transport Department – Roads Maritime Services (RMS) maintains a system of buoys, poles and lights is used to assist safe navigation on water. Each type of mark has a unique combination of colour, shape, topmark and light. The navigational marker on Pelican Rock falls into the category of **Other buoys and signs – Isolated danger**. The Isolated danger sign indicates specific dangers with generally safe waters all around (eg a wreck). It is advised to sailors to pass them on any side but not to pass too close. If lit, it shows a white light flashing in groups of two.

Figure 1. Other buoys and signs – Isolated danger

Photo 3. Current condition of the marker fixing to the concrete block

It appears as there was a previous marker to the south east of the current marker as there is a 500mm high concrete block remaining with a steel pipe in it. The current marker appears in a stable and fit state. The navigational lights were not observed due to the daytime inspection.

4 Subsidence predictions

Mine Subsidence Engineering Consultants (MSEC) prepared the Subsidence Prediction and Impact Assessment report for Miniwall Panels S2 and S3 in 2019. The following excerpt is taken from the subsidence prediction and impact assessment report.

> The Pelican Rock Navigation Marker is located on the rock outcrop that extends into Lake Macquarie from Summerland Point. The marker is outside but immediately adjacent to the tailgate of MWS2. The predicted vertical subsidence for the navigation marker is 90 mm. The predicted subsidence should be provided to Roads and Maritime Services so that management strategies can be developed for the marker, if required.

5 Public Safety impact

The isolated danger, navigational marker is an important safety sign for people travelling by boat near the Pelican Rock outcrop, especially whilst travelling during the night time. RMS has been provided the Extraction Plan for S2/S3 Miniwalls and subsidence monitoring program. As of the 19th May 2019 there has been no correspondence back from RMS. Given the above subsidence predictions <90mm there is little risk of vertical subsidence being an issue given the heights of the navigational markers (Photo 1).

6 Conclusion

In conclusion this memo is a completed record of the pre-mining assessment of Pelican Rock Navigational Marker. It is recommended that a post mining assessment is conducted after S2 and S3 Mini wall Panels are extracted to close out the impact to this feature.

Yours sincerely,

Chris Armit
Environment and Community Coordinator

7 References

https://www.rms.nsw.gov.au/maritime/safety-rules/rules-regulations/navigation-marks-and-signs.html

James Barbato (2019) S2 and S3 Miniwall Panel Extraction Plan Subsidence Assessment

Appendix 11 Public Safety Management Plan

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CHAIN VALLEY COLLIERY

Public Safety Management Plan
S4 Miniwall Panel
ENVIRONMENTAL MANAGEMENT PLAN

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Contents

1 Introduction

1.1 Purpose and Scope

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1.2 Background

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LakeCoal was formed in 2001 to acquire BHP Billiton's 80% share in the Wallarah Coal Joint Venture (WCJV), □□e re□ □i□i□g □□□□ □□□re □□□ □□□□d □□ □□i□□□□ □ □□□□er □□□□□□e□□□d □ □□erg□□ □□ i□□ed □□□□ □□□□□ □□□uired □□□e□ □□□□□□□□ i□ i□□ed□

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1.3 Consultation

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Table 1: Consultation Summary

Stakeholder	Comments	Response/Action
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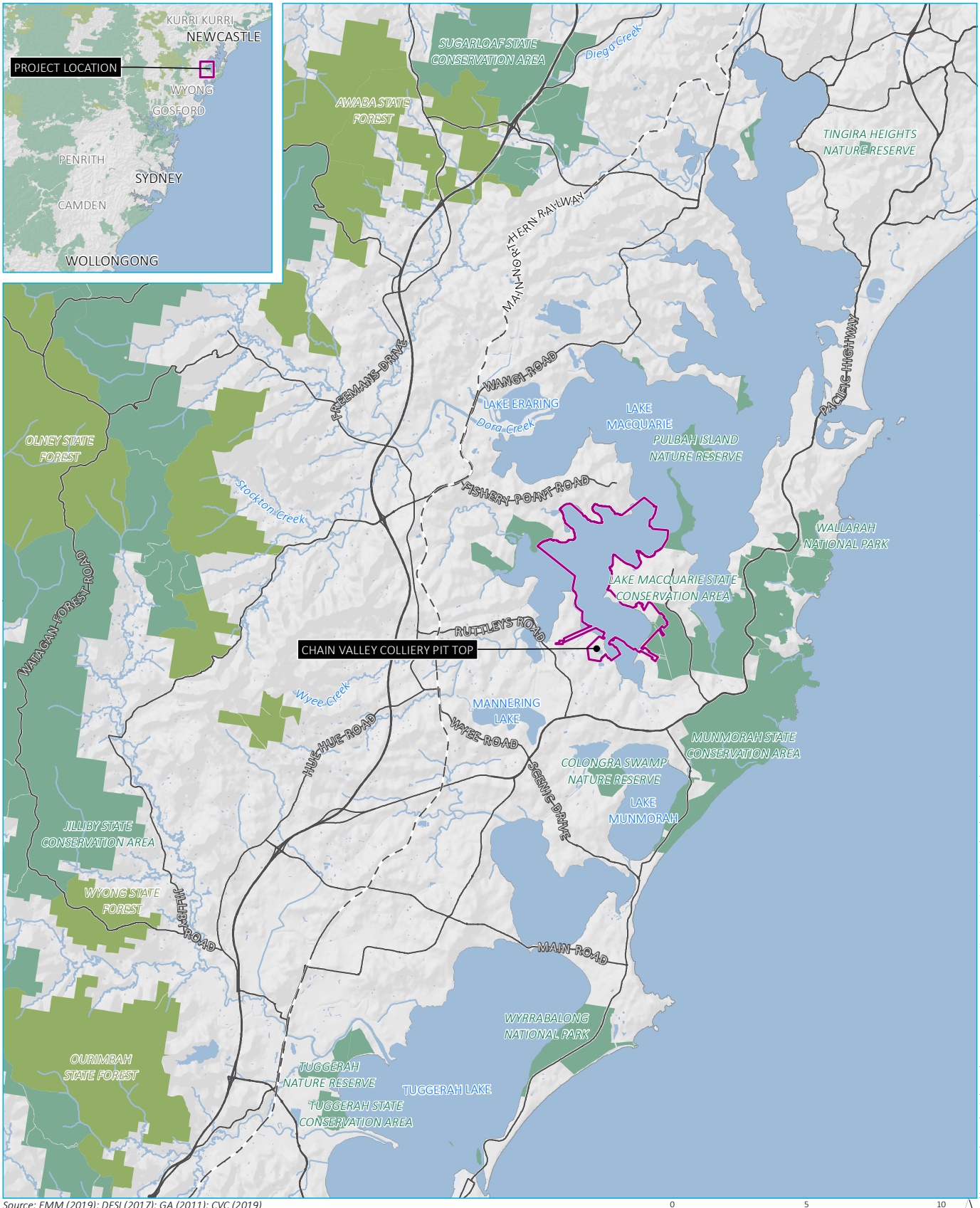

Source: EMM (2019); DFSI (2017); GA (2011); CVC (2019)

0 5 10 km

GDA 1994 MGA Zone 56

N

\\emmsvr1\EMMJobs\2019\H190358 - Mannering Colliery Mgt Plan Updates\GIS\02_Maps\MCMP001_RegionalLocation_20191021_02.mxd 21/10/2019

KEY

- Chain Valley Colliery development consent boundary
- Rail line
- Main road
- Watercourse/drainage line
- Waterbody
- NPWS reserve
- State forest

CVC regional context

Chain Valley Colliery
Figure 1

EMM
creating opportunities

2 Statutory Requirements

2.1 Key Legislation, Policy and Guidelines

[illegible]'s operation and activities. A number [illegible]

- *Protection of the Environment Operations Act 1997* [illegible]
- *Environmental Planning and Assessment Act 1979* [illegible]
- *Mining Act 1992* [illegible]

[illegible]

2.2 Development Consent SSD-5465 Requirements

[illegible]

[illegible]

[illegible] **Appendix 2** [illegible]

3 Background

3.1 Operations

[illegible]

[illegible]

[illegible]

[illegible]

3.2 Subsidence Predictions

[illegible] **Figure 2** [illegible]

[illegible]

[illegible]

- [illegible]
- [illegible]

[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
- [illegible]

[illegible]

- [illegible]
- [illegible]

3.3 Public Safety Management – Scope

3.3.1 Identified Features

[illegible]

[illegible] Figure 3 [illegible]

[illegible]

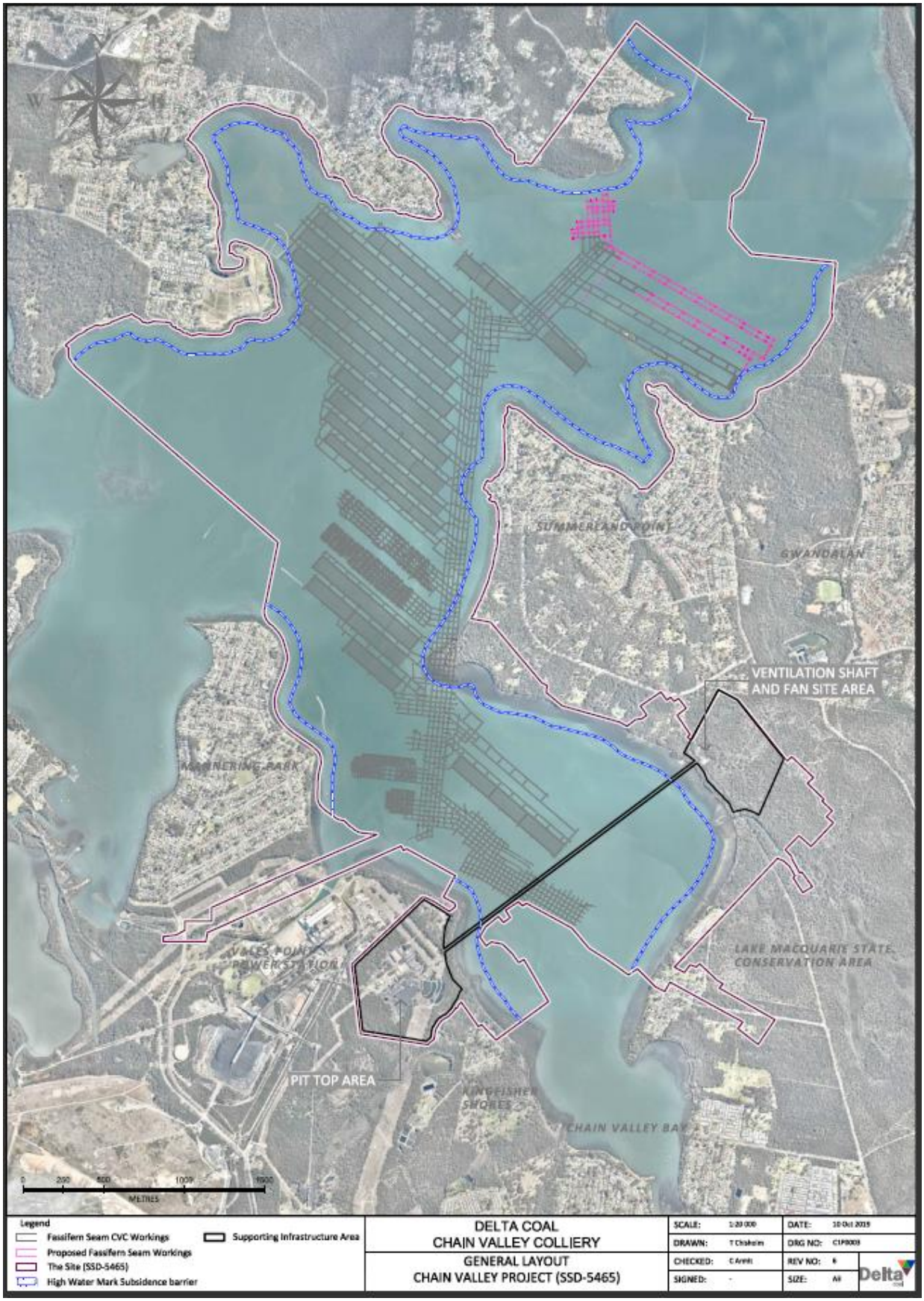
VENTILATION SHAFT AND FAN SITE AREA
PIT TOP AREA
LAKE MACQUARIE STATE CONSERVATION AREA
CHAIN VALLEY BAY
SUMMERLAND POINT
GWANDALAN
MARINERS PARK
VALES POINT POWER STATION
KINGFISHER SHORES
0 200 600 1000 1600
METRES
Legend
Fassifern Seam CVC Workings
Proposed Fassifern Seam Workings
The Site (SSD-5465)
High Water Mark Subsidence barrier
Supporting Infrastructure Area
DELTA COAL
CHAIN VALLEY COLLIERY
GENERAL LAYOUT
CHAIN VALLEY PROJECT (SSD-5465)
SCALE: 1:20 000
DRAWN: T Chisholm
CHECKED: C Arnni
SIGNED: -
DATE: 10 Oct 2019
DRG NO: C1P9009
REV NO: B
SIZE: A0

Figure 2: General underground mine layout

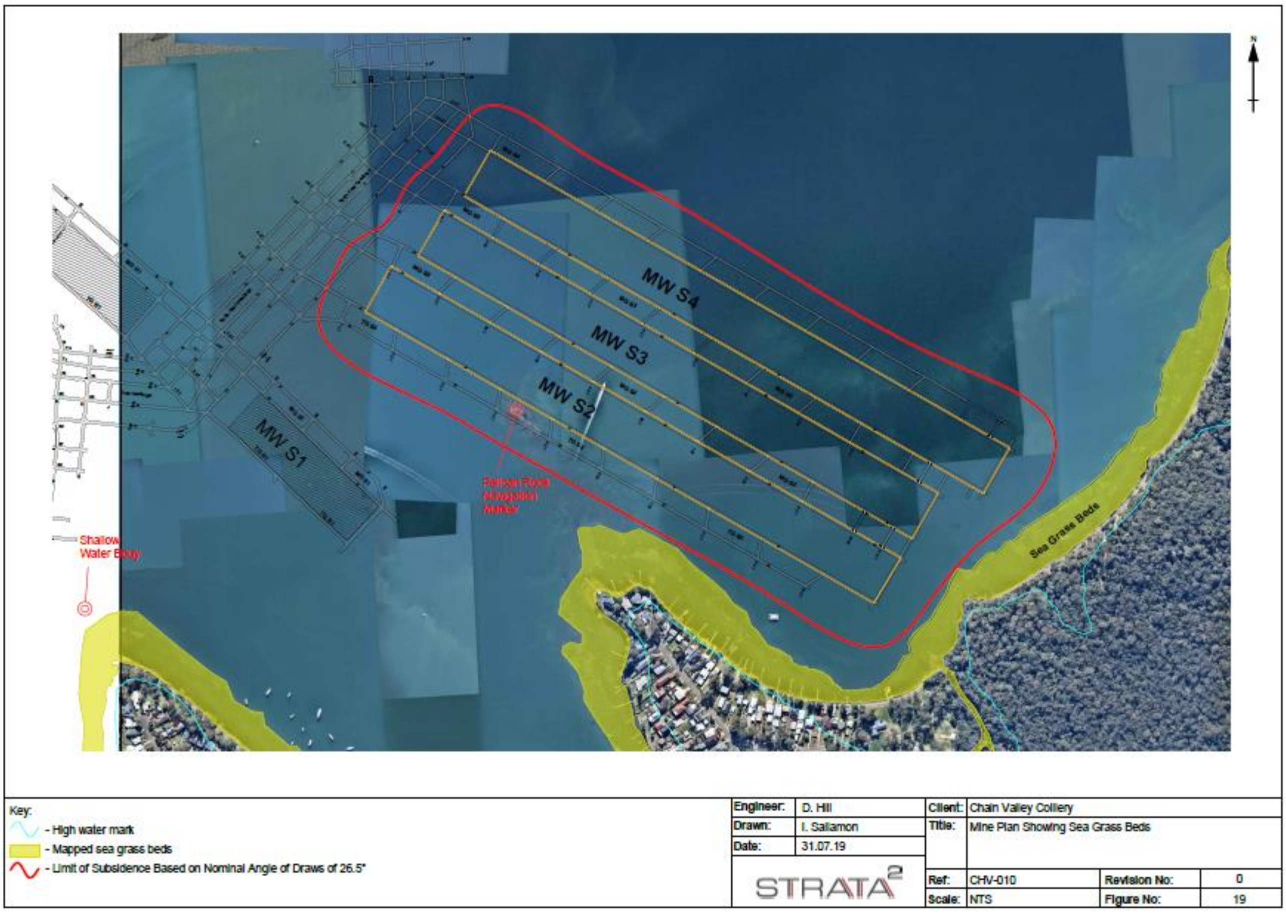

Figure 3: Predicted Limit of Subsidence Associated with Panels S2, S3 and S4

4 Public Safety Monitoring

4.1 Subsidence Monitoring Methods

4.1.1 Bathymetric Surveys

[illegible]

4.1.2 Foreshore Monitoring

[illegible] **Figure 3** [illegible]

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Figure 3: Example of subsidence monitoring point with safety cap

5 Public Safety Management

5.1 Management Practices

Survey pegs installed for monitoring will be clearly identified and as appropriate have ‘safety caps’ placed on □□e□ □□ □er **Figure 3**□ □ur□e□ □i□□ □i□□e □□e □ □i□ □□□e □□□□ □r□□i□□□□□ed i□ □□e □□□□e □□□□er□□i□□ □re□ □□d □re □□ □□er □□□□ □□e i□□e□□ □□d e□□ □□□□ □u□i□ □e□□□ □□d □□e□□ri□□□

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6 Reporting

6.1 Regular Reporting

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6.2 Annual Review

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6.3 Incident or Non-Compliance Reporting

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7 Stakeholder Management, Response and Training

7.1 Complaint Protocol

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7.2 Independent Review

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(a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the 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 Secretary and landowner a copy of the independent review.

7.3 Dispute Resolution

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7.4 Training, Awareness and Competence

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8 Audit and Review

8.1 Review and Improvement

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8.2 Auditing

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9 Records and Document Control

9.1 Records

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9.2 Document Control

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Table 3: Document Revision Details

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10 Roles and Responsibilities

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Table 4: Public Safety Management Roles and Responsibilities

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11 References

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Table 5: References and Associated Documents

Reference type	Document
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EP&A Act *Environmental Planning and Assessment Act 1979*

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POEO Act *Protection of the Environment Operations Act 1997*

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Appendix 1: Consultation

From: Chris Armit <CArmit@deltacoal.com.au>
Sent: Monday, 25 November 2019 1:53 PM
To: Andrew Hampstead <Andrew.Hampstead@environment.nsw.gov.au>; Nathan Koch <Nathan.Koch@rms.nsw.gov.au>; Margaret MacDonald-Hill <mmacdonald-hill@bigpond.com>; Karen Mason <kmason@lakemac.nsw.gov.au>; ben.fullagar@centralcoast.nsw.gov.au; Ray Ramage <ray.ramage@planning.nsw.gov.au>
Cc: Colin Phillips <Colin.Phillips@planning.nsw.gov.au>; Katie Weekes <KWeekes@deltacoal.com.au>
Subject: Miniwall S4 Draft Public Safety Management Plan

Hi All,

Please find attached the draft Miniwall S4 public safety management plan for your comment and review.

Margaret, if you can pass onto the Community Consultative committee members for their comment and review would be greatly appreciated.

Regards,
Chris

From: Tim Chisholm Sent: Mon 16/12/2019 2:43
To: Chris Armit
Cc: Chris Nicholas; Katie Weekes
Subject: RE: Miniwall S4 Draft Public Safety Management Plan

From: Chris Armit
Sent: Monday, 16 December 2019 2:20 PM
To: Ray Ramage <ray.ramage@planning.nsw.gov.au>
Cc: Phil Steuart <phil.steuart@planning.nsw.gov.au>; Tim Chisholm <TChisholm@deltacoal.com.au>; Chris Nicholas <CNicholas@deltacoal.com.au>; Katie Weekes <KWeekes@deltacoal.com.au>
Subject: RE: Miniwall S4 Draft Public Safety Management Plan

Hi Ray,
Thanks for your email, please find below my responses.
Hope you guys have a good Chrissie break.
Regards,
Chris

From: Ray Ramage [mailto:ray.ramage@planning.nsw.gov.au]
Sent: Wednesday, 27 November 2019 9:55 AM
To: Chris Armit
Cc: Phil Steuart
Subject: RE: Miniwall S4 Draft Public Safety Management Plan

Chris,

I have reviewed the draft Public Safety Management Plan (PSMP). I believe my comments in relation to the navigational marker also apply to the PSMP.

1. Potential subsidence outside the angle of draw could occur should there be any interaction with overlying workings, therefore the location of such workings should be considered. This has been considered in the Geotechnical assessments for S2/S3 by MSEC and S4 by Strata2 to be included in S4 EP.

2. Another issue, which I failed to mention previously in relation to the marker, is that should CVC elect to use components of the extraction plan in the HRA notification there should therefore be consistency with the WHS laws. Most importantly selection of risk controls (management plans) should be based on hazard identification and risk assessment. It is not clear from the two management plans I have reviewed that a risk assessment has been undertaken. Comment on the S4 extraction risk assessment details will be included in the MPs and will be included in the S4 EP as an appendix.

3. Related to the point above if the PSMP (or any other management plan from the EP) are to be used in a HRA notification then references to "Statutory Requirements" should also include WHS law. Planning law does not modify obligations under WHS law and consequently should the PSMP fail in its purpose regulatory action would be undertaken by RR under WHS law regardless of any planning approval. HRA usually completed by Tim so have let them know to amend MPs on WHS law as appropriate in consultation the RR.

Regards

Ray Ramage
Senior Mine Safety Officer (Subsidence Engineering)
Resources Regulator| Department of Planning, Industry and Environment
T 02 40636485 | M 0422 551 293 | E ray.ramage@planning.nsw.gov.au

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DPIE Resource Assessments - Benthic Communities Management plan related comments	**Response**
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Appendix 2: Development Consent Summary

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Table A2: Requirements from Chain Valley Colliery Development consent SSD-5465

Condition No.	Requirement	Relevant section of this document
	Schedule 2 Administrative Conditions	
18	***Updating and Staging Strategies, Plans or Programs*** *The Applicant must regularly review the strategies, plans and programs required under this consent and ensure that these documents are updated to incorporate measures to improve the environmental performance of the development and reflect current best practice in the mining industry. To facilitate these updates, the Applicant may at any time submit revised strategies, plans or programs for the approval of the Secretary.* *With the agreement of the Secretary, the Applicant may also submit any strategy, plan or program required by this consent on a staged basis. With the agreement of the Secretary, the Applicant may prepare a revision or stage of any strategy, plan or program required under this consent without undertaking consultation with all parties nominated under the applicable condition in this consent.* *Notes:* • *While any strategy, plan or program may be submitted on a staged basis, the Applicant must ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times.* • *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program.*	**Section 8**
	Schedule 4 Specific Environmental Conditions	
4	***Performance Measures- Built Features*** *The Applicant shall ensure that the development does not cause any exceedance of the performance measures in Table 9 to the satisfaction of the Secretary.* *Table 9: 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:*	**This document**

	• *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 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 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.*	
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 9 is to be settled by the Secretary, following consultation with the MSB and the DRE. Any decision by the Secretary shall be final and not subject to further dispute resolution under this consent.*	**Noted**
7	***Extraction Plan*** *(j) include a Public Safety Management Plan, which has been prepared in consultation with DRE, to ensure public safety;* *The Applicant shall implement the approved management plan as approved from time to time by the Secretary.* *Notes:* • *To identify the underground mining areas approved under this consent referred to in this condition, see Appendix 3.* • *This condition does not limit secondary extraction under a Subsidence Management Plan approved as at the date of this consent.*	**This document**
8	*The Applicant shall 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*	**Section 4 and 6**

Appendix 12 Rehabilitation Management Plan

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CHAIN VALLEY COLLIERY

Rehabilitation Management Plan

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Table of Contents

1 Introduction

1.1 Purpose

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- [illegible]
- [illegible] requirements [illegible]
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[illegible]

1.2 Background

[illegible] **Figure 1** [illegible]

[illegible] with the first delivery to the adjacent Delta Electricity's Vales Point Power Station [illegible]

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[illegible] Preparation Plant, all located at the southern end of Lake Macquarie. At the time of LakeCoal's [illegible]

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1.3 Operation

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1.4 Consultation

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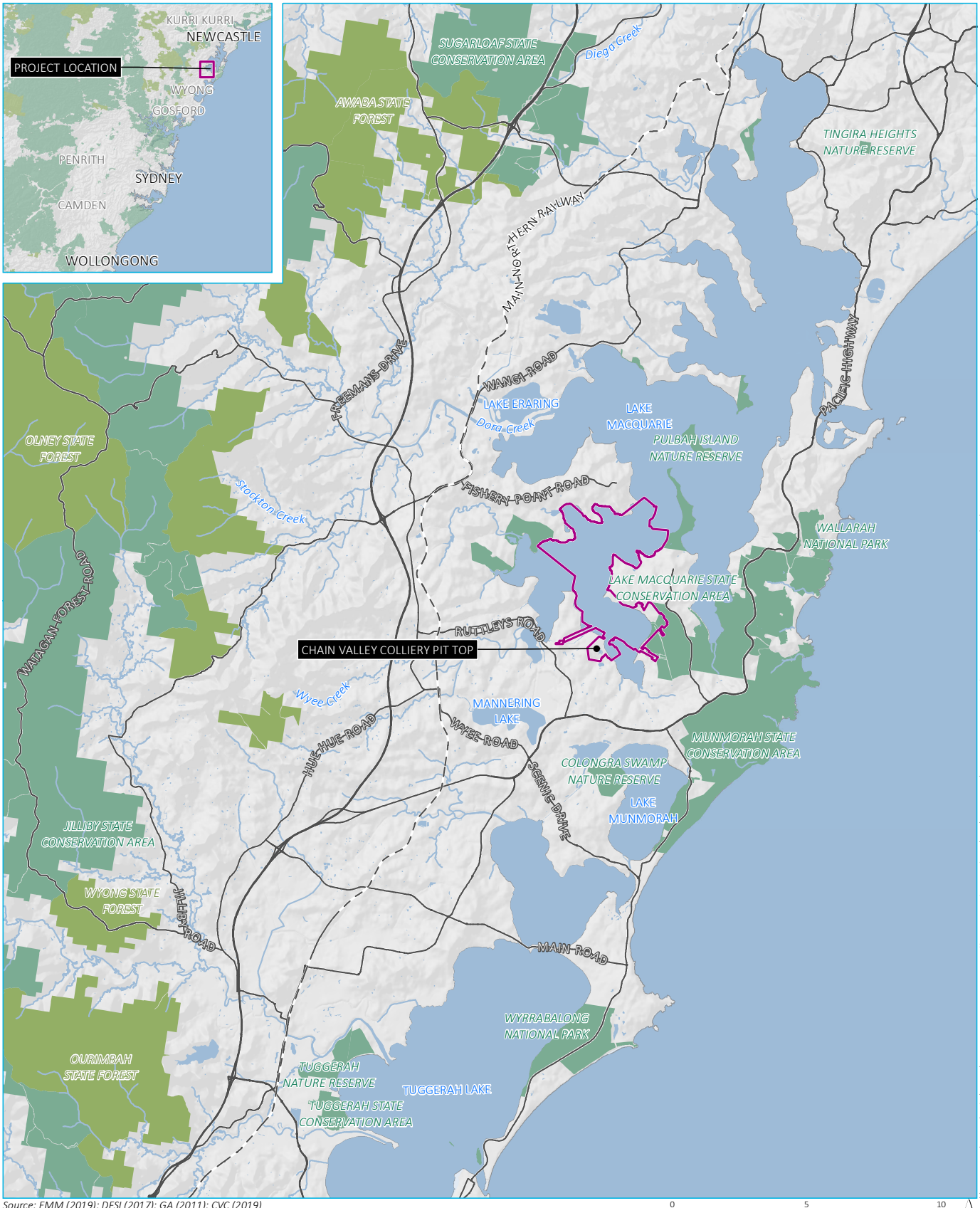
Table 1: Consultation Summary

Stakeholder	Comments	Response/Action
[illegible] e [illegible] ur [illegible] e [illegible] e [illegible] e [illegible]	• [illegible] e [illegible] re [illegible] ei [illegible] ed [illegible] – [illegible] e [illegible] di [illegible] • Mi [illegible] e [illegible] ure [illegible] i [illegible] i [illegible] g re [illegible] uire [illegible] e [illegible] ri [illegible] i [illegible] • [illegible] d [illegible] e [illegible] Mi [illegible] e [illegible] u [illegible] ide [illegible] e [illegible] egi [illegible] i [illegible] • F [illegible] re [illegible] ere [illegible] e [illegible] ri [illegible] i [illegible]	• [illegible] ee [illegible] e [illegible] di [illegible] • [illegible] ee [illegible] e [illegible] i [illegible] • [illegible] ee [illegible] e [illegible] i [illegible] 3 [illegible] e 3 • [illegible] ee [illegible] e [illegible] i [illegible]

Figure 1 Regional and local context



Source: EMM (2019); DFSI (2017); GA (2011); CVC (2019)

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GDA 1994 MGA Zone 56

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\\emmsvr1\EMMJobs\2019\H190358 - Mannering Colliery Mgt Plan Updates\GIS\02_Maps\MCMP001_RegionalLocation_20191021_02.mxd 21/10/2019

KEY

- Chain Valley Colliery development consent boundary
- Rail line
- Main road
- Watercourse/drainage line
- Waterbody
- NPWS reserve
- State forest

CVC regional context

Chain Valley Colliery
Figure 1

EMM
creating opportunities

2 Statutory Requirements

2.1 Key Legislation, Policy and Guidelines

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- *Environment Protection and Biodiversity Conservation Act 1999* □□□□□ □□□□□
- *Protection of the Environment Operations Act 1997* □□□ □□ □□□□□
- *Environmental Planning and Assessment Act 1979* □□□□□ □□□□□
- *Mining Act 1992*□
- *Biosecurity Act 2015* □□d □i□□e□uri□□ □egu□□i□□ □□□□□□
- *Local Land Services Act 2013*□
- *National Parks and Wildlife Act 1974*□
- *Biodiversity Conservation Act 2016*□□□d
- *Rural Fires Act 1997*□

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2.2 Development Consent (SSD-5465) Requirements

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3 Existing Environment

3.1 Physical Environment

[illegible]

[illegible]

[illegible]

3.2 Land Tenure and Use

[illegible] **Table 2**[illegible]

Table 2: Land Ownership Details

Site	Owner	Lot	Deposited Plan
[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]
		[illegible]	[illegible]
		[illegible]	[illegible]
		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

3.3 Coal processing

[illegible]

3.4 Waste management

[illegible]

3.5 Hydrocarbon Management

[illegible]

3.6 Hydrology

3.6.1 Surface water

[illegible] **Figure 3** [illegible]

[illegible]

3.6.2 Groundwater

[illegible]

The groundwater is naturally saline and migrates into the Colliery's underground workings in the Wallarah, [illegible]

[illegible]

3.7 Geology

[illegible]

[illegible] **Figure 2** [illegible]

3.8 Aquatic Ecology

[illegible] from the Lake's entrance such as Chain Valley Bay [illegible]

[illegible]

[illegible]

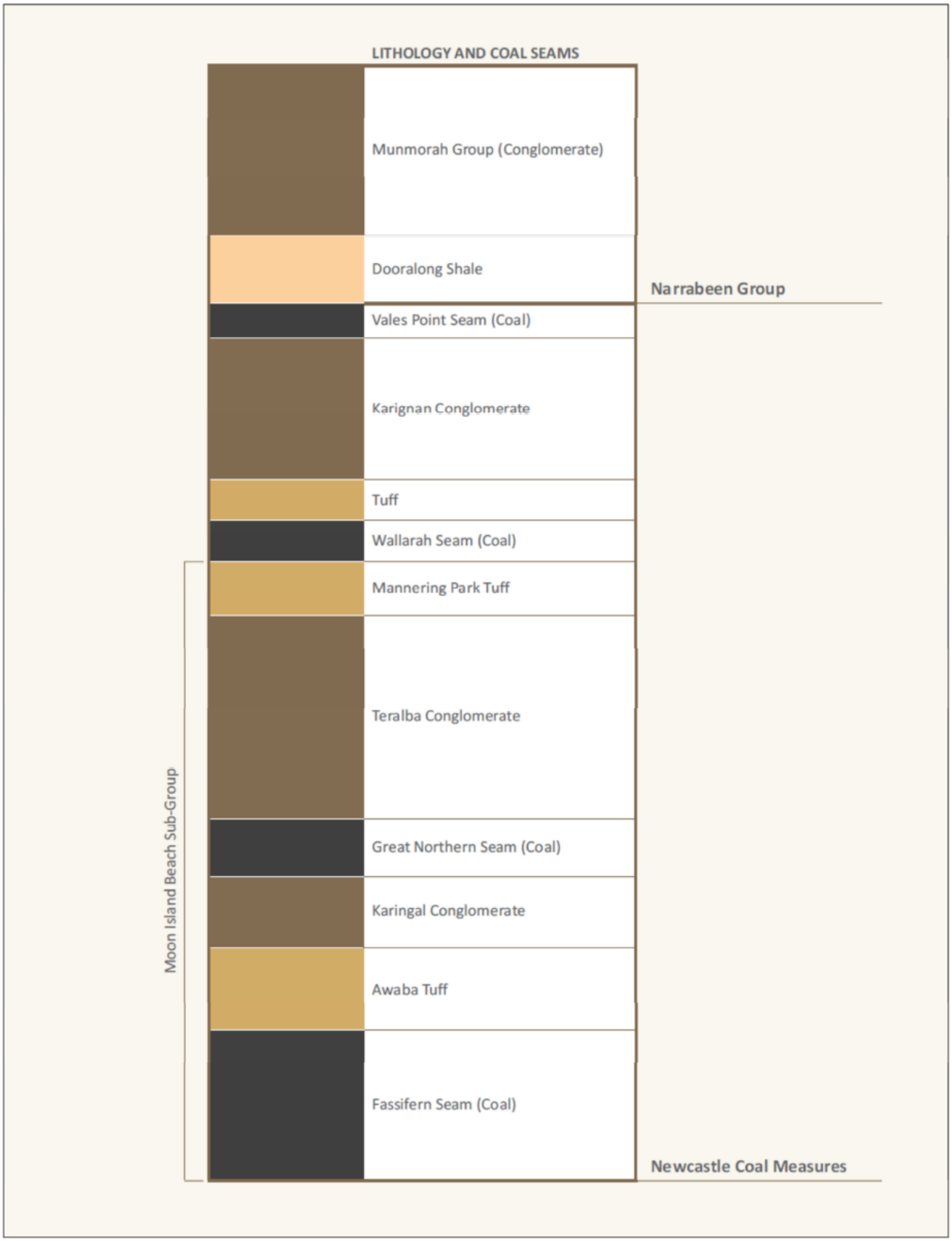

Figure 2: Typical Stratigraphy at Chain Valley Colliery

3.9 Terrestrial Ecology

[illegible] during [illegible] identified [illegible] M[illegible] [illegible] identified [illegible] M[illegible]

Fr[illegible] *Biodiversity Conservation Act 2016*[illegible]

[illegible] (*Petaurus norfolcensis*) [illegible] (*Anthochaera phrygia*) [illegible] (*Lathamus discolor*) [illegible] F[illegible] (*Pteropus poliocephalus*) [illegible]

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3.10 Socio-economic and Cultural Environment

[illegible]

[illegible] M[illegible]

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3.11 Cultural Heritage

[illegible] M[illegible] (M[illegible]) [illegible]

3.11.1 Aboriginal Cultural Heritage

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3.11.2 Non-indigenous Cultural Heritage

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4 Rehabilitation Management

4.1 Proposed Rehabilitation During Life of the Current MOP

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4.2 Mine Closure Planning

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4.3 Mine Closure and Final Rehabilitation Objectives

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Table 3: Rehabilitation Objectives

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Feature	Objective
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Notes:

- *These rehabilitation objectives apply to all subsidence impacts and environmental consequences caused by mining taking place after the granting of project approval MP 10_0161, and to all development surface infrastructure 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).*

4.4 Final Rehabilitation Planning Criteria & Performance Measures

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Table 4: Rehabilitation Completion Criteria and Performance Measures

Phase	Objective	Completion criteria	Performance measures
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Phase	Objective	Completion criteria	Performance measures
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4.5 Interaction with Other Environmental Management Plans

[illegible] **Section 1** [illegible] ’s EMS. As the time [illegible]

4.6 Progressive Rehabilitation

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4.7 Final Rehabilitation Proposals

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4.7.1 Disturbed Land

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4.7.2 Water Management

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4.7.3 Rehabilitation Trials and Research

The □r□□□□ed □inal re□□□ii□□□i□□ □r□gr□□ will □e bas□d on e□□e□i□e e□□erie□□e of re□□□ii□□□i□□ i□ coastal are□s u□der□□e□ □re□i□u□□ by DC, i□ □ddi□i□□ □□ □□□□u□der□□e□ by □□u□i□□ □□d □i□er□□□□□d □i□i□g compan□es an□ re□e□r□□ on □i□e re□□□ii□□□i□□ i□ the □u□er Val□ey. G□ven □i□, and the i□i□ed amo□nt of □re□ di□□ur□ed, majo□ re□□□ii□□□i□□ ri□□□ □r re□e□r□□ programs □re not e□□e□□ed to □e ne□□ssa□y.

4.7.4 Community

The a□ms of th□ RMP with re□□e□□ to □□□ □u□i□□e□ □re □u□i□ sa□□ty an□ the □i□i□i□□i□□ of □d□er□e soc□o-□conom□c e□□e□□□ r□□ □i□e □□□□ure. □□□e□er, the □i□e i□ not e□□e□□ed □□ □e □□□□i□g for a □u□ □er of y□ars. As the soc□o□conom□c env□ronm□nt of the local □re□, the regi□□ and i□deed □u□r□i□ will □□□□ge i□ this □eri□d, i□i□ □ot □e□i□e □□ □ddre□□ □□□i□e□□□□□ i□i□ue□ i□ de□i□i□ this RMP. Rath□r, they □i□□□ddre□□ed i□ de□i□ clos□r to the i□□ of □i□e □□□□ure i□ the □i□e □□□□ure plan. It i□ e□□e□□ed thou□h that the follow□ng □ri□i□e□ □□u□d □e □□□□idered:

- the estab□ishm□nt of CVC has □r□u□□ □ig□i□□□□ i□r□□ru□ture □□ the □i□e □i□e and the local comm□nity. Plann□ng for □i□e □□□□ure □□u□d ass□st □□ □i□g□i□g the cons□quent redu□i□□ i□ acc□ss to u□e□u□ i□r□□ru□ture. W□th □d□□□□ed □□d □□re□u□ plann□ng, i□may □e poss□b□e to de□e□□ capa□□y to ma□ntain □er□i□ i□r□□ru□ture □□i□i□e□ and □er□i□e□ for □u□ure comm□nity □r local gov□rnm□nt own□rship □r as pa□t of □u□ure bus□ness dev□lopm□nt □□□□ru□i□e□;
- an e□r□ and e□e□i□e comm□nity e□g□ge□e□□ r□□eg□ □□□u□d □e e□□□i□□ed and □□e comm□nity e□g□ged. Th□s □□□u□d occ□r as e□rly as poss□b□e duri□g the plann□ng and de□ig□ pha□e of the □□□□ure. Th□ plann□ng □□□u□d □□□□ider how to □i□i□i□e □□e □d□er□e impacts of □i□e □□□□ure and to □□i□i□e the □□□□ru□i□e□ for the comm□□ity; and
- □□□□i□g □r □i□e □□□□ure □□□u□d e□□ure □□□□□□e □u□ure □u□i□ □e□□□ □□d □□e□□ of □□e □□□ □u□□□i□ not □□□ □r□□i□ed. □he community's resilience to the adverse impacts of mine closure □□□u□d □e □re□g□□e□ed so that □□e comm□□ity can max□m□se □□□□ru□i□e□ for s□bs□quent land u□e and re□i□ □i□i□g i□r□□ru□ture of □□ue to the comm□nity.

4.7.5 Remaining Features

□e□di□g u□ to □□d duri□g □i□e □□□□ure the follow□ng ac□ions w□ll □e tak□n with re□□e□□ to the □uildi□g□ and □ru□ture□ assoc□a□ed with □□e □i□i□g, re□□r□i□□ and r□□□□□□r of the coa□:

- □re□ere□i□□□ any plant, □ru□ture□, □uildi□g□ r conv□yors □□u□d □e □□d and/or re□□□□ed for reu□e at □□□□□er □i□i□g □□er□i□□;
- the re□ □i□i□g coal b□ns, □ur□□e conv□□or plant, □uildi□g□ and □uild □ru□ture□ □i□□e de□ □i□□ed □r re□ □□ed. All de□ □i□i□□ i□ to occ□r i□ acco□danc□ with AS 2601-2001: Th□ □e□ □i□i□□ of □ru□ture□ (□r its □□e□□□er□i□□) □
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- roadways not re□uired for ac□ess to th□ □i□e □i□e □r oth□r purpos□s s□ch as □u□□ire mana□□m□nt will □e re□□i□□□ed; and
- □e□□□gr□de □ru□ture□ s□ch as □□□□re□e s□mps w□ll □e □□ed □□d □□□ered with gr□□□□ □ediu□.

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4.7.6 Other Infrastructure and Services

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4.8 Conceptual Site Land Works

Figure 3 □□□□□ □ □□e □□□□e□u□□□□□d □□r□□ □□□□□□ed □□r □□□□□□e□er□□□ □□e □e□er□ □□ □ □ird□ □□□□e □□□ier□ □□d □□e □e□i□□i□□ □□□□□□□□ie □i□□e □□e□red □□□□□i□r□□□ru□ture i□e□ □ □□□□□□re □□□re□uired □□□□□□ i□e □□□□ure □□d □□e □□□d □e□e□ed□□□e e□□er□ □□e □ird □i□□e □u□□□d i□ed ge□er□□□□□ □□e □rigi□□□□□□d □e□e□□□□dee□ed □□□r□□ri□e □□ □ □□□□ □i□□ □□e □urr□u□di□g □e□e□□ □□□□□□i□□ed □□□i□e □ree□ □i□□e re□□i□ed □□ere□er □□□□i□e□

Oil / Water Separator
Wash down sump
Oxy - acetalene storage compounds
Cable shed
Workshop and Store
Hazardous Substances & Dangerous Goods
Fire Station
Hard Stand Storage
Aerated Water Treatment System
Mine Dewatering Lines
Compressors
Main Office
Training Centre
Operations Office
Bathhouse
Septic Tanks
132000 litre Water Tanks
80000 litre Water Tank
Haulage Room
Switch Room
Sub Station
ROM Bin
Cable Belt Switch room
Cable belt Drive
Switch room
250 tonne bin
Entry Gate to Colliery
Weighbridge
Final Products Bin
Coal Stockpile Area
SEAL SHAFT
Down cast Shaft
SEAL DRIFTS
CUT & FILL TO MATCH SURROUNDING RL's
D11
D12
D13
HT 13.5m
HT 14.9m
HT 14.2m
HT 13.1m
D8
D7
D9
D10
Sediment Dams
HT 12.1m
D6
HT 12.6m
HT 12.7m
D5
D1
D4
D3
D2
HT 17.2m
HT 16.2m
330kV HV Transmission Lines
330kV HV Transmission Lines
REMOVE STRUCTURES AND LEVEL GROUND TO SUIT
PIT TOP FACILITIES
CHAIN VALLEY COLLIERY
Tidal Creek

VENTILATION FAN SITE
Switch room
SEAL SHAFT
Ventilation Fans
Old switch room
REMOVE STRUCTURES AND LEVEL GROUND TO SUIT
SEAL SERVICE BOREHOLE
Services Borehole

Rehabilitation - Bushland
Rehabilitation -Grassland
Rehabilitation - Surface Water Flow
Rehabilitation - Proposed Dams

DELTA COAL CHAIN VALLEY COLLIERY

SITE SURFACE FACILITIES
CONCEPTUAL FINAL REHABILITATION

SCALE:	1:2000	DATE:	1 October 2019
DRAWN:	T Chisholm	DRG NO:	C1S0154
CHECKED:	K Weekes	REV NO:	2
		SIZE:	A3

Delta coal

5 Rehabilitation Monitoring

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6 Financial Provisioning

[illegible]

[illegible]

[illegible]

6.1 Planned Mine Closure

[illegible]

[illegible]

[illegible]

6.2 Unplanned Closure

[illegible]

A security deposit must cover the Government's full costs in undertaking rehabilitation in the event of default [illegible] **Figure 4**.

6.3 Temporary Closure (care and maintenance)

[illegible]

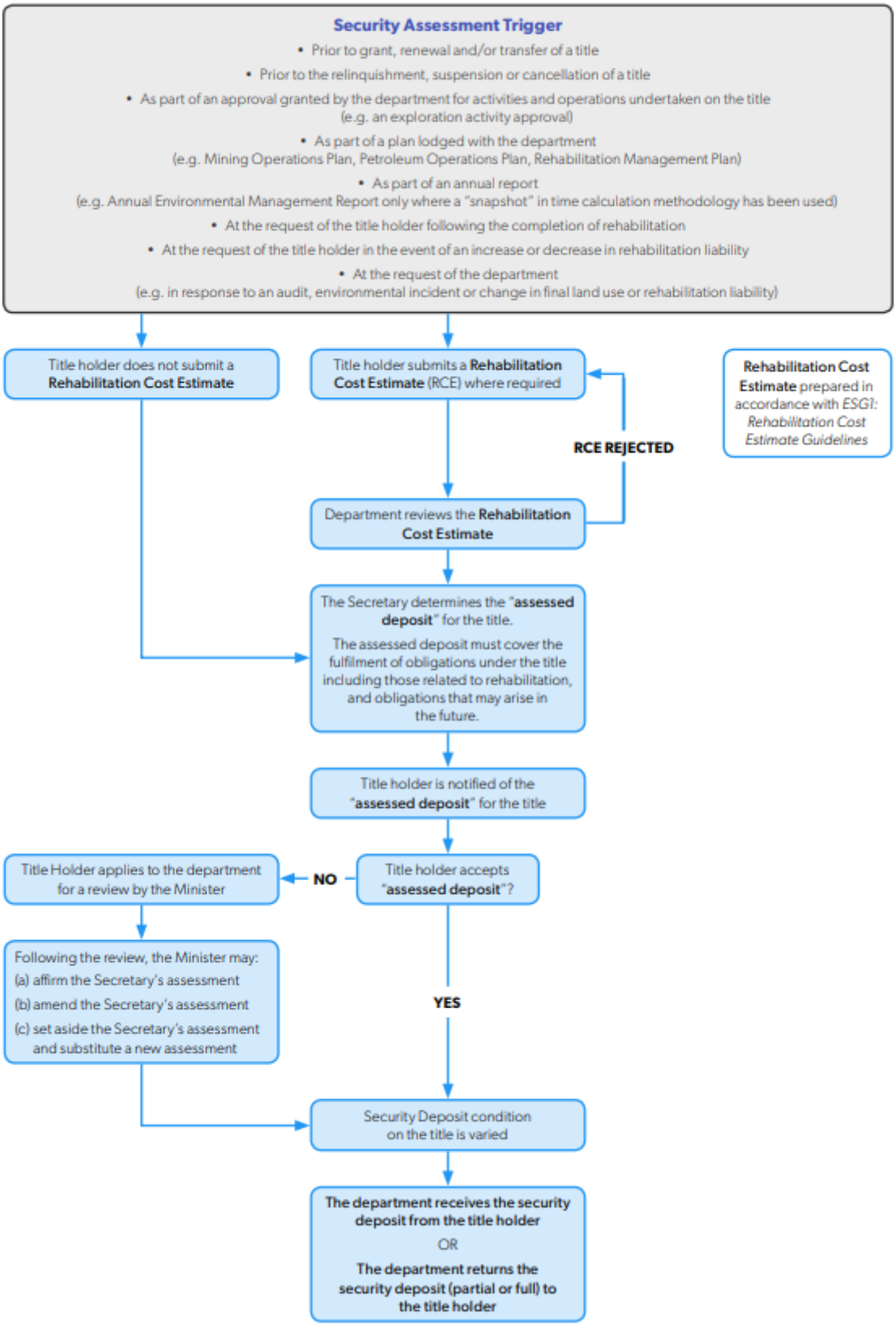

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Figure 4: Security Review Process

7 Risk Management

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7.1 Residual Risk Register

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8 Reporting

8.1 Annual Review

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8.2 Incident or Non-compliance Reporting

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9 Stakeholder Management and Response

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9.1 Mine Closure and Rehabilitation

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9.2 Complaints Handling

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9.3 Independent Review

[illegible] who “*considers the development to be exceeding the relevant criteria in Schedule 3”.*

If the Secretary is satisfied that an independent review is warranted, then within 2 months of the Secretary’s [illegible]

(a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the 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 Secretary and landowner a copy of the independent review

9.4 Dispute Resolution

[illegible]

[illegible]

[illegible]

10 Audit and Review

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10.1 Review

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10.2 Auditing

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11 Records and Document Control

11.1 Records

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11.2 Document Control

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Table 5: Document Revision Details

Version	Date	Details of Revision	Company	Reviewed by/ Authorised by
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12 Roles and Responsibilities

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Table 6: Roles and responsibilities for rehabilitation management

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13 References

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14 Definitions

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EP&A Act *Environmental Planning and Assessment Act 1979*

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POEO Act *Protection of the Environment Operations Act 1997*

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Appendix 1: Consultation

From: Chris Armit <CArmit@deltacoal.com.au>
Sent: Tuesday, 19 November 2019 5:35 AM
To: Ray Ramage <ray.ramage@planning.nsw.gov.au>; Karen Mason <kmason@lakemac.nsw.gov.au>; OEH ROD Hunter Central Coast Mailbox <rog.hcc@environment.nsw.gov.au>; Margaret MacDonald-Hill <mmacdonald-hill@bigpond.com>
Cc: DPE PSVC Compliance Mailbox <compliance@planning.nsw.gov.au>; Katie Weekes <KWeekes@deltacoal.com.au>; Colin Phillips <Colin.Phillips@planning.nsw.gov.au>; Chris Nicholas <CNicholas@deltacoal.com.au>
Subject: Chain Valley Colliery - Rehabilitation Management Plan for comment

Hi All,
Please find attached a review of the Chain Valley Colliery Rehabilitation Management Plan for your comment.

Margaret,
If you could email through this management plan revision to the Community Consultative Committee members for their comment it would be greatly appreciated.
You can email it together with last week's minutes when I send them through today.

regards,
Chris

Delta coal

Chris Armit
Environmental and Community Coordinator
Phone: 02 4358 0800
Mobile: 0409 070 233
Chain Valley Colliery

From: Geoffrey Keech [mailto:gkeech@lakemac.nsw.gov.au]
Sent: Thursday, 12 December 2019 3:41 PM
To: Chris Armit
Cc: Melissa Sawatske
Subject: LMCC response to Delta Coal Mannering Colliery and Chain Valley Colliery management plans consultation

Hi Chris,

Thankyou for providing Council the opportunity to comment on your management plans. I provide the following feedback:

CVC Rehabilitation Management Plan	Any infrastructure (slabs, pits, pipes, etc.) that is to be abandoned and covered over should be mapped and this map made available to any future user or purchaser of the site. Spelling mistake "mircobat"

For future iterations of these plans, could you please send the plans to Council@lakemac.nsw.gov.au addressed to "Development Assessment and Certification officer." The plans will be allocated to a DAC officer to coordinate comments from the relevant sections of Council. It would help us if you can include a note about the purpose of the consultation (as per the "Audit and Review" section of the management plans), and ideally send a copy that has been marked up with the changes that have occurred, as this allows us to focus quickly on the relevant changes.

Geoffrey Keech
Development Planner

LAKE MACQUARIE CITY
T 02 4921 0025 **M** 0429 124 904
E gkeech@lakemac.nsw.gov.au
lakemac.com.au

Our ref: DOC19/1013209-1
Your ref: SSD-5465 (MOD 2)

Chris Armit

Environmental and Community Coordinator
Chain Valley Colliery
Delta Coal
Off Construction Road (Off Ruttleys Road)
MANNERING PARK NSW 2259
CArmit@deltacoal.com.au

Dear Mr Armit

Chain Valley Colliery (SSD-5465 MOD 2) – review of the Benthic Communities Management Plan, Seagrass Management Plan and Rehabilitation Management Plan

I refer to your e-mails dated 14, 17, and 19 November 2019 in which the Delta Coal provided the Biodiversity and Conservation Division (BCD) of Department of Planning, Industry and Environment (The Department) with copies of three updated management plans for the Chain Valley Colliery. These management plans must be prepared '...in consultation with...' BCD to meet Schedule 3, Condition 27; Schedule 4, Condition 7(h & i); and Table 8 of the current consent for the mine (SSD-5465 MOD 2). The management plans are the:

- *Chain Valley Colliery Benthic Communities Management Plan: Environmental Management Plan* (dated 14 November 2019)
- *Chain Valley Colliery Seagrass Management Plan: Environmental Management Plan* (dated 17 November 2019), and
- *Chain Valley Colliery Rehabilitation Management Plan* (dated 19 November 2019)

BCD makes no comment on the *Chain Valley Colliery Benthic Communities Management Plan* or the *Chain Valley Colliery Seagrass Management Plan*. However, in relation to the *Chain Valley Colliery Rehabilitation Management Plan* BCD makes one recommendation: that the bushland rehabilitation is targeted to create recognisable Plant Community Types from the local or adjoining Interim Biogeographical Regionalisation of Australia region. This will further refine the completion criteria for species diversity, plant density and plant cover; contained in Table 4 of the plan.

If you require any further information regarding this matter, please contact Robert Gibson, Regional Biodiversity Conservation Officer, on 4927 3154 or via email at rog.hcc@environment.nsw.gov.au

Yours sincerely

NICOLE DAVIS
A/Senior Team Leader Planning
Hunter Central Coast Branch
Biodiversity and Conservation Division
3 December 2019

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DPIE Rehabilitation Management plan related comments	Response
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Appendix 2: Development Consent Summary

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Table A1: Requirements from Chain Valley Colliery Development Consent (SSD-5465)

Condition No.	Requirements	Relevant section of this document
	Schedule 2 Administrative Conditions	
18	***Updating and Staging Strategies, Plans or Programs*** *The Applicant must regularly review the strategies, plans and programs required under this consent and ensure that these documents are updated to incorporate measures to improve the environmental performance of the development and reflect current best practice in the mining industry. To facilitate these updates, the Applicant may at any time submit revised strategies, plans or programs for the approval of the Secretary. With the agreement of the Secretary, the Applicant may also submit any strategy, plan or program required by this consent on a staged basis.* *With the agreement of the Secretary, the Applicant must prepare a revision or stage of any strategy, plan or program required under this consent without undertaking consultation with all parties nominated under the applicable condition in this approval.* *Notes:* • *While any strategy, plan or program may be submitted on a staged basis, the Applicant must ensure that the existing operations on site are covered by suitable strategies, plans or programs at all times.* • *If the submission of any strategy, plan or program is to be staged, then the relevant strategy, plan or program must clearly describe the specific stage to which the strategy, plan or program applies, the relationship of this stage to any future stages, and the trigger for updating the strategy, plan or program.*	**Section 10.1**

<table>
<tr><th>Condition No.</th><th>Requirements</th><th>Relevant section of this document</th></tr>
<tr><td></td><td>Schedule 3 Specific Environmental Conditions</td><td></td></tr>
<tr><td>25</td><td>REHABILITATION

Rehabilitation Objectives

The Applicant shall rehabilitate the site to the satisfaction of the DRE. This rehabilitation must be generally consistent with the proposed rehabilitation strategy described in the EIS, and comply with the objectives in Table 7.

Table 7: Rehabilitation Objectives
<table>
<tr><th>Feature</th><th>Objective</th></tr>
<tr><td>Mine site (as a whole)</td><td>• Safe, stable and non-polluting.
• Final land use compatible with surrounding land uses.</td></tr>
<tr><td>Rehabilitation materials</td><td>• Materials (including topsoils, substrates and seeds of the disturbed area) are recovered, appropriately managed and used effectively as resources in rehabilitation.</td></tr>
<tr><td>Surface infrastructure</td><td>• To be decommissioned and removed, unless the DRE agrees otherwise.</td></tr>
<tr><td>Portals and ventilation shafts</td><td>• To be decommissioned and made safe and stable.
• Retain habitat for threatened species (eg bats), where practicable.</td></tr>
<tr><td>Other land affected by the development</td><td>• Restore ecosystem function, including maintaining or establishing self-sustaining ecosystems comprised of:
– local native plant species (unless the DRE agrees otherwise); and
– a landform consistent with the surrounding environment.</td></tr>
<tr><td>Built features damaged by mining operations</td><td>• Repair to pre-mining condition or equivalent unless:
– the owner agrees otherwise; or
– the damage is fully restored, repaired or compensated under the Mine Subsidence Compensation Act 1961.</td></tr>
<tr><td>Community</td><td>• Ensure public safety.
• Minimise the adverse socio-economic effects associated with mine closure.</td></tr>
</table>
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).</td><td>Section 4</td></tr>
<tr><td>26</td><td>Progressive Rehabilitation

The Applicant shall carry out the rehabilitation of the site progressively, that is, as soon as reasonably practicable following disturbance to the satisfaction of the Secretary and DRE.</td><td>Section 4</td></tr>
<tr><td>27</td><td>Rehabilitation Management Plan

The Applicant shall prepare a Rehabilitation Management Plan for the development, in consultation with OEH, DPI Water, WSC, LMCC, and the CCC, and to the satisfaction of the DRE.

This plan must:</td><td>This document</td></tr>
<tr><td></td><td>(a) be submitted to the Secretary and the DRE for approval within 12 months of the date of approval of this development consent;</td><td>Original version submitted for approval 6 March 2013</td></tr>
<tr><td></td><td>(b) be prepared in accordance with any relevant DRE guideline and be consistent with the rehabilitation objectives in the EIS and in Table 7;</td><td>Section 4</td></tr>
</table>

Condition No.	Requirements	Relevant section of this document
	(c) describe how the performance of the rehabilitation would be monitored and assessed against the objectives in Table 7;	**Section 4, 5**
	(d) describe the process whereby additional measures would be identified and implemented to ensure the rehabilitation objectives are achieved;	**Section 5**
	(e) 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	**Section 4, 5**
	(f) be integrated with the other management plans required under this consent.	**Section 4.5**
	The Applicant shall implement the approved management plan as approved from time to time by the Secretary. *Note: The Rehabilitation Management Plan should address all land impacted by the development whether prior to, or following, the date of this consent.*	**This Document**
	Statement of Commitments	
Rehabilitation and mine closure	*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.*	**Noted**

Appendix 13 Subsidence Monitoring Program

	Mine Surveyor

CHAIN VALLEY COLLIERY

Subsidence Monitoring Program

MINIWALL S4

1 Table of Contents

List of Figures / Tables

LAST REVIEW DATE	NEXT REVIEW DATE		REVISION NO	DOCUMENT OWNER
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2 Introduction

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“7. The Applicant shall prepare and implement an Extraction Plan for all second worki□g□ □□ □i□e□□□ □□e □□i□□□□□i□□ □□□□e □ire□□□r□□e□er□□□□□ □□□□□□i□□ □□□□□ □ u□□□

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Table 1 - Subsidence Impact Performance Measures - Natural and Heritage Features

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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 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

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Table 2 - Subsidence Impact Performance Measures – Built Features

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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 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.*
- *Requirement's 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.*
- *Requirement's under this condition may be met by measures undertaken in accordance with the Mine Subsidence Compensation Act 1961.*

3 Purpose

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4 Background

4.1 Operations

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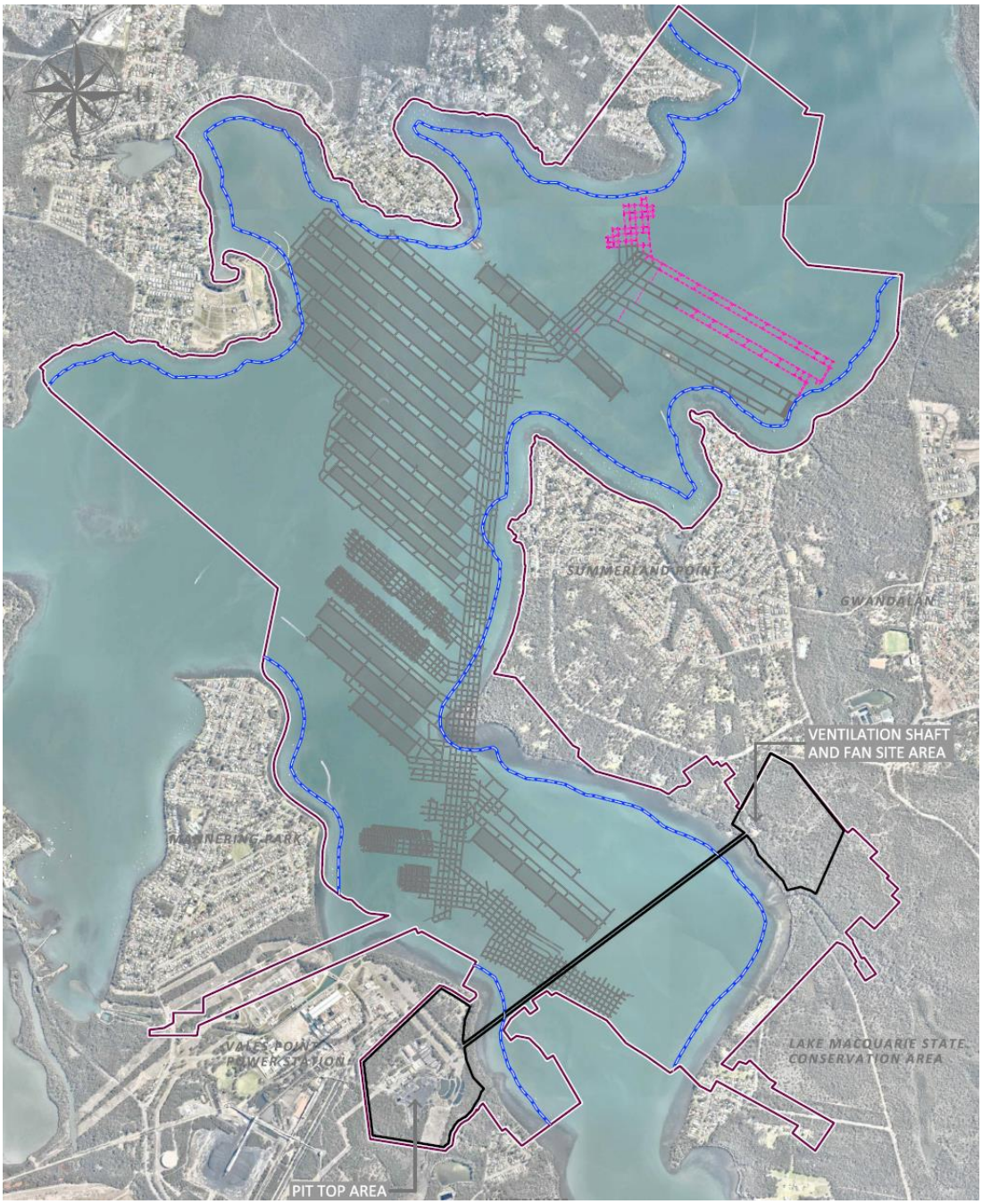

Figure 1: General Layout of the Chain Valley Northern Mining Domain (DC Plan C1P0003_rev6)

4.2 Subsidence Predictions

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Figure 2 - Predicted Subsidence after extraction of S2, S3 and S4 panels (Hill, 2019)

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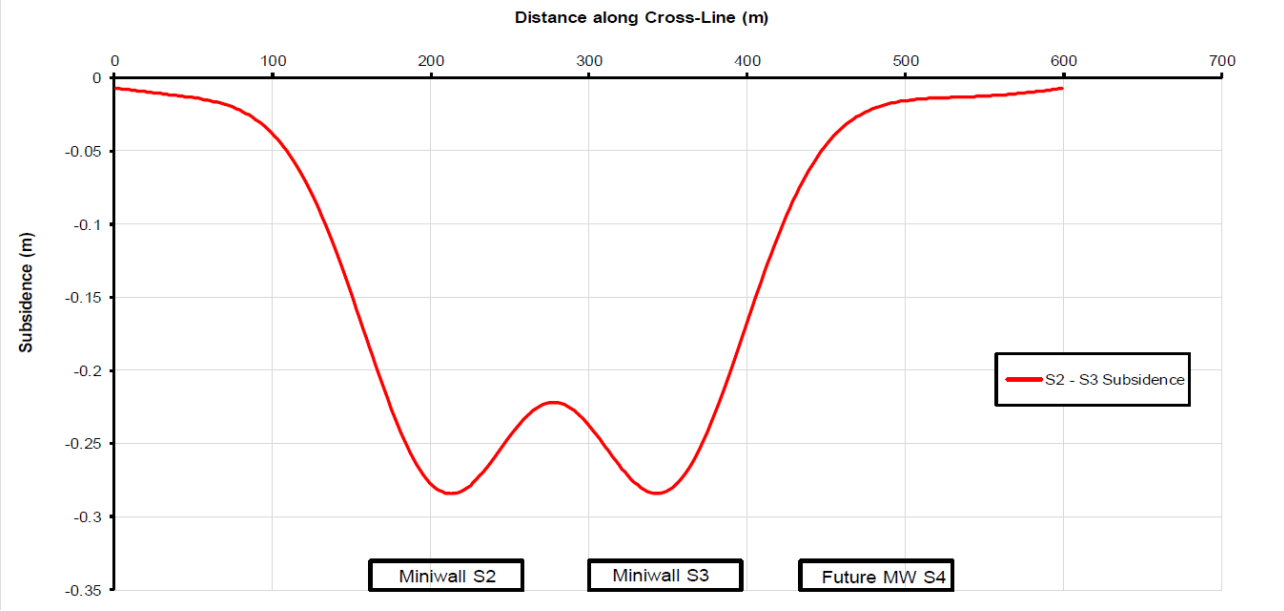

Figure 3 - Estimated Subsidence after Miniwall S2 and S3 panels (Hill, 2019)

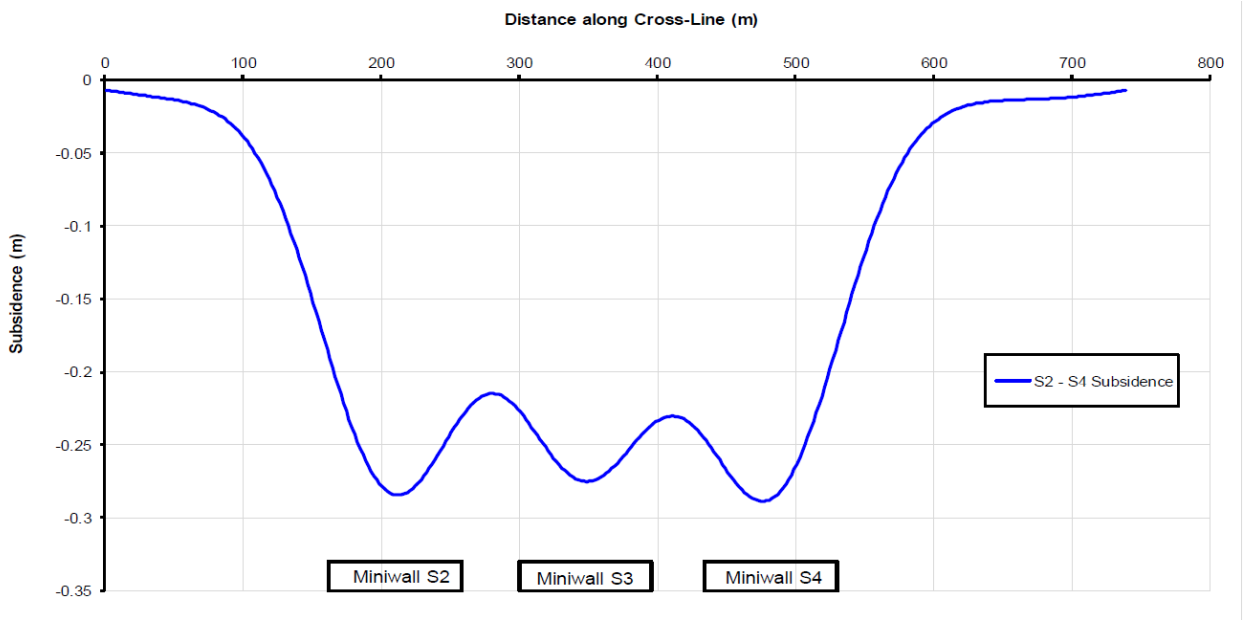

Figure 4 - Estimated Subsidence after MIniwalls S2, S3 and S4 Panels (Hill, 2019)

4.3 Subsidence Monitoring - Scope

4.3.1 Shoreline (High Water Mark)

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“The Proponent shall ensure that vertical subsidence within the High Water Mark Subsidence Barrier and □i□i□ □e□gr□□□ □ed□i□ i□ i□ed □□ □ □ □□i□u□ □□□□□ □i□□ e□re□(mm)….”

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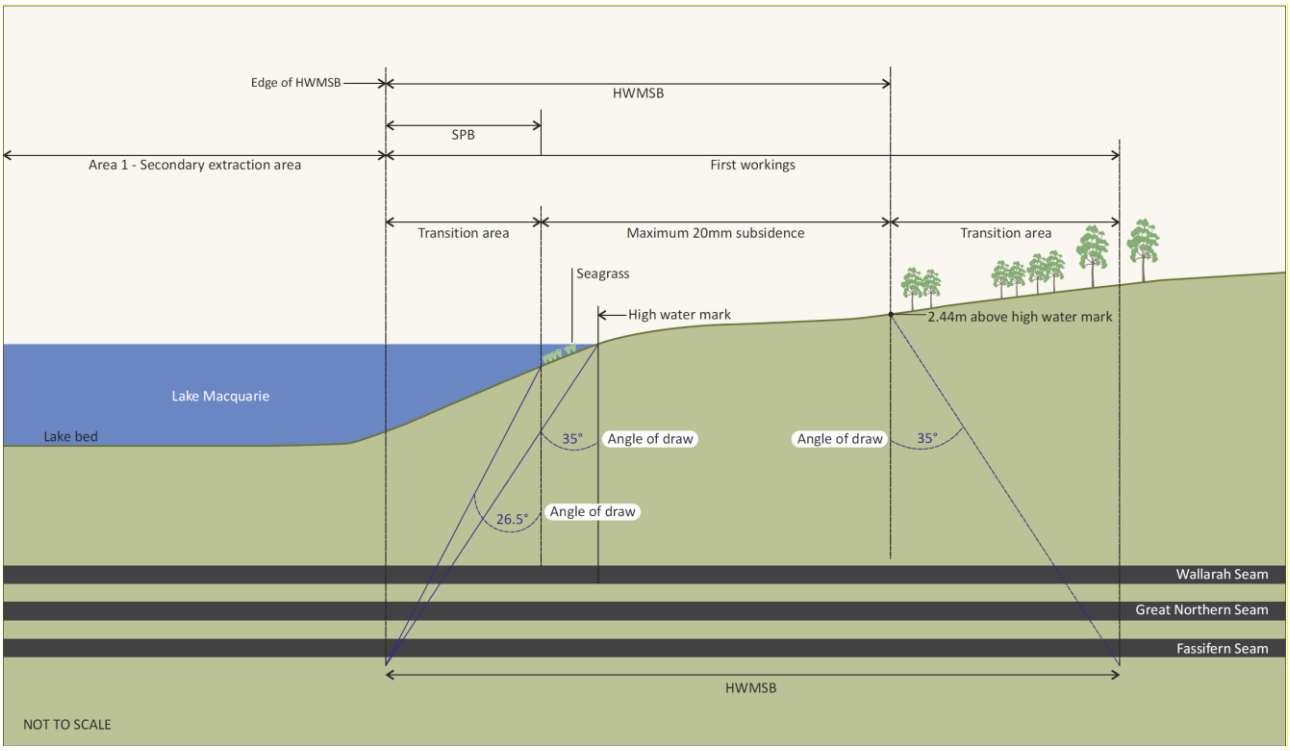

Figure □ - High Water Mark Subsidence Barrier Typical Diagram

4.3.2 Seagrass

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4.3.3 Benthic Communities

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5 Subsidence Monitoring

5.1 Subsidence Monitoring Methods

5.1.1 Bathymetric Surveys

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5.1.2 Foreshore Monitoring

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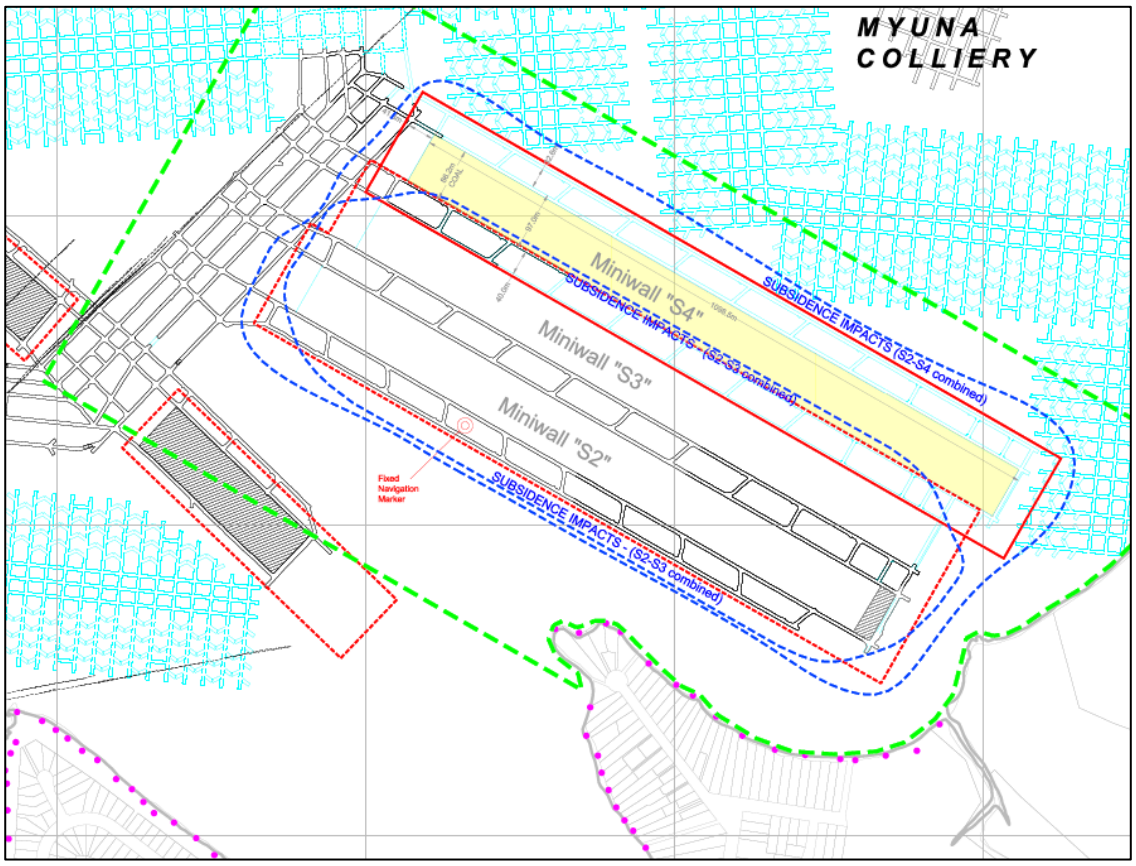

Figure 6 - Proposed Shoreline Subsidence Monitoring Locations, Summerland Point (Delta Coal Plan C4A0094_7)

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5.2 Subsidence Monitoring Frequency Requirements

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Table 3 - Subsidence Monitoring Frequencies (S2, S3 and S4 Panels)

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5.3 Subsidence Monitoring Review

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5.4 Consultation

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6 Roles and Responsibilities

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Table 4: Subsidence Monitoring Program Roles and Responsibilities

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Appendix 14 Graphical Plans

MYUNA
COLLIERY

LAKE MACQUARIE

LAKE MACQUARIE

SIGNED DATE

MANAGER OF MINING ENGINEERING

SIGNED DATE

REGISTERED MINE SURVEYOR

PLAN 1 - EXISTING & PROPOSED WORKINGS

Delta

WEST LAKE MINE SUBSIDENCE DISTRICT

WEST LAKE MINE SUBSIDENCE DISTRICT

MYUNA COLLIERY

SWANSEA NORTH ENTRANCE MINE SUBSIDENCE DISTRICT

SIGNED DATE

REGISTERED MINE SURVEYOR

PLAN 2 - SURFACE FEATURES

Delta

MYUNA
COLLIERY

SIGNED DATE

REGISTERED MINE SURVEYOR

PLAN 3 - GEOLOGICAL FEATURES

Delta

MYUNA
COLLIERY

SIGNED DATE

REGISTERED MINE SURVEYOR

PLAN 4 - OVERLYING WORKINGS

MYUNA
COLLIERY

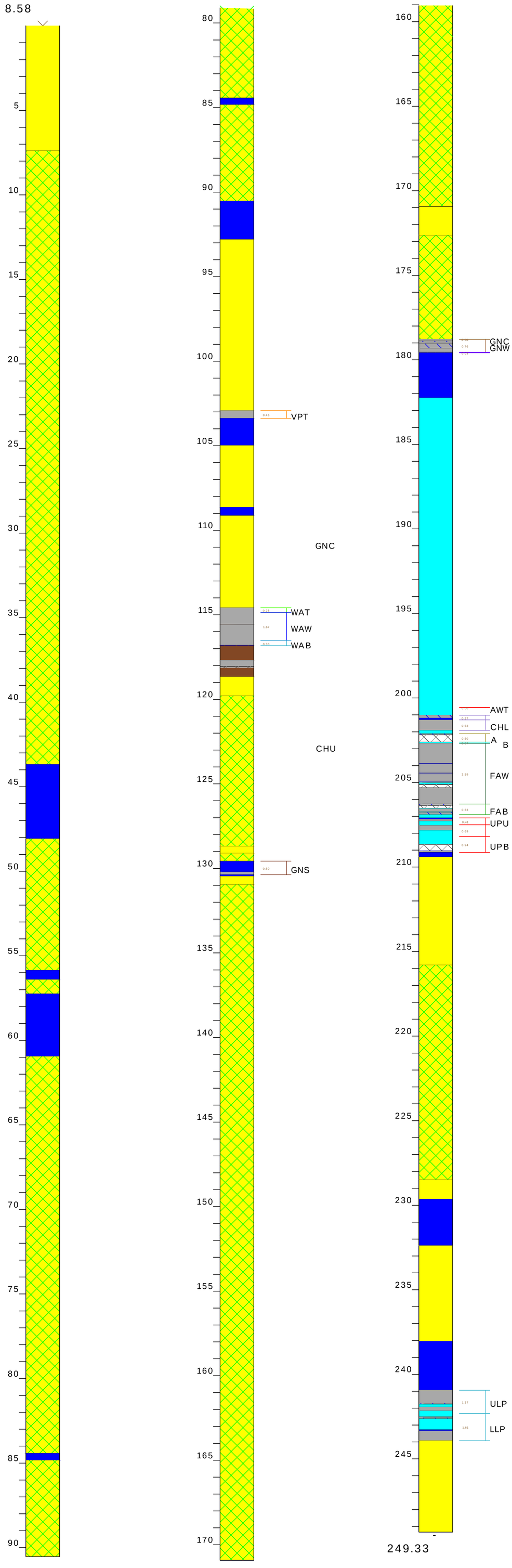
Lease No	Area (total)	Particulars
CCL 721 (Sublease	2405.9ha	Expires 30/06/2022
ML 1051	259ha	Expires 07/07/2022
ML1370 (Sublease)	112.7ha	Expires 30/06/2022
ML1632 (Sublease)	494.9ha	Expires 30/06/2022

PLAN 5 - TITLES

SIGNED DATE

REGISTERED MINE SURVEYOR

JCV3



Legend

Lithology Reference

- SOIL
- GRAVEL
- SANDSTONE
- Pebble Conglomerate
- CLAYSTONE
- NO RECOVERY
- CONGLOMERATE
- SIDERITE
- SILTSTONE
- AIR
- COAL Stony
- WATER
- COAL
- ALLUVIUM
- MUDSTONE
- SILT
- CORE - LOSS / NOT RECOVERED
- COAL Heat altered
- SHALE
- Rock Mass Boundary
- COAL Shaly
- CLAY
- CARB. SHALE
- COAL Smutty
- CALCITE
- NON - CORED
- CHERT
- COAL Weathered
- IGNEOUS
- COAL Undifferentiated
- COAL Cindered
- COAL Shaly
- SAND
- Siltshale

Seam Legend

Seam Expansion Reference

VPT	- Vales Point
WAT	- Wallarah - tops
WAW	- Wallarah - working secti
WAB	- Wallarah - bottoms
LWA	- Wallarah Lower / Toukley
TBC	- Great Northern - conglom
GNN	- Great Northern - non - con
GNS	- Great Northern - Split
GNC	- Claystone
GNT	- Great Northern - Tops
GNW	- Great Northern - Working
GNB	- Great Northern - Bottoms
AWT	- Awaba Tuff
CHU	- Chain Valley Upper
CHL	- Chain Valley Lower
FAT	- Fassifern - Tops
A	- Fassifern - A ply
B	- Fassifern - B ply Clayst
FAW	- Fassifern - Working Sect
FAB	- Fassifern - Bottoms
UPU	- Upper Pilot Upper
UPM	- Upper Pilot Middle
UPB	- Upper Pilot Lower
ULP	- Lower Pilot Upper
LLP	- Lower Pilot Lower

PLAN 6 - GEOLOGICAL INFORMATION

Delta coal

MYUNA COLLIERY

PLAN 7 - SUBSIDENCE MONITORING PLAN

SIGNED

DATE

REGISTERED MINE SURVEYOR

Delta

MYUNA
COLLIERY

LAKE MACQUARIE

SIGNED DATE

MANAGER OF MINING ENGINEERING

SIGNED DATE

REGISTERED MINE SURVEYOR

PLAN 8 - EXTRACTION AREA PLAN

Delta

Appendix 15 Subsidence Prediction Report

STRATA2
Ground Control Consulting

LAKE COAL
CHAIN VALLEY COLLIERY

S4 Panel : Geotechnical Environment, Subsidence Estimates and Impacts

MAY 2020

Report No: CHV-010-Rev2

ABN 19 622 292 460
First Floor, Building B, Edgeworth Town Square
720 Main Road
Edgeworth NSW 2285

REPORT TO : Mr. D. McLean
Manager
Chain Valley Colliery

REPORT ON : S4 Panel: Geotechnical Environment, Subsidence Estimates and Impacts

REPORT NO : CHV-010-Rev2

REFERENCE : PO D101622

Rev	Date	Prepared	Status	Signature
A	03.07.2019	D. Hill	Draft	
B	25.07.2019	D. Hill	Draft	
0	09.08.2019	D. Hill	Final	
1	05.05.2020	D. Hill	Final, amended	
2	12.05.2020	D. Hill	Final, amended	

TABLE OF CONTENTS

1. INTRODUCTION

This report addresses key geotechnical aspects of the design of the S4 miniwall panel (MW S4) in the Fassifern Seam workings at Chain Valley Colliery ("CVC"), including estimates of subsidence effects and impacts. The panel location is shown in **Figure 1**. Key aspects of the layout are as follows:

i) As per S2 and S3 Panels, S4 Panel is orientated at 119º, rather than the 134º of earlier miniwalls. This orientation is more favourable with respect to the dominant 131º structural direction.

ii) The panel void width is 97m, consistent with recent CVC practice.

iii) Twin heading gate roads with typically 100m long (centres) pillars.

iv) 5.4m wide by 3.2m high roadways.

v) The S4 chain pillars (both maingate and tailgate) have been increased in width to 40m (solid) to limit (a) subsidence over S2 to S4 Panels and (b) abutment load transfer to future workings to the north. It is emphasised, however, that future workings will require detailed planning to address the full range of relevant issues, including pillar stability and subsidence.

vi) Seam thickness varies slightly, from 4.8m inbye to 5.0m outbye. The nominal extraction height will be 3.5m, leaving around 1.4m of top coal during extraction.

vii) Depth of cover varies narrowly between 160m and 171m.

The issues addressed herein are as follows:

A. The role of the geological and geotechnical environment.
B. Chain pillar stability on development and subsequent to miniwall extraction.
C. Heights of connective fracturing.
D. Subsidence estimates.
E. Subsidence impacts.

2. KEY ASPECTS OF THE GEOLOGICAL / GEOTECHNICAL ENVIRONMENT

The overburden consists of Triassic and Permian strata, comprising massive conglomerate beds (the Munmorah, Karignan, Teralba and Karingal Members), sandstone, carbonaceous shale, coal and claystone (**DGS, 2018a**). From a geotechnical / subsidence perspective, the units of particular interest are the massive conglomerate beds in the overburden and the claystone in the floor of the Fassifern Seam, as both will tend to influence subsidence development. The closest boreholes to the area of interest, **Figure 1**, are JCV13 in the south-east and JCV3 in the south (**Figures 2a** and **2b** respectively).

The significance of the major conglomerates is that voussoir beam analysis suggests they are generally capable of spanning the miniwall void width of 97m at thicknesses of >15m. This spanning ability begins to break down if the chain pillars yield and the effective span increases over multiple panels, resulting in increased subsidence.

Important features of the S4 Panel area are:

- the Karingal Conglomerate, beneath the Great Northern Seam, thins from 15-20m in the far north-west to zero in the south-east,
- the Teralba Conglomerate thickens to around 40m in the south and south-east and is around 25m thick above MW S4,
- the interburden from the Teralba Conglomerate to the Fassifern Seam extraction horizon (the working section) reduces to 25m to 30m and
- the second major unit in the overburden is the Munmorah Conglomerate, which is around 50-55m thick and 70-80m above the Fassifern Seam.

Everything else being equal, the associated increase in overburden stiffness is expected to result in reduced subsidence and overburden fracturing, in comparison to the southern (MW1-12) area.

The Fassifern Seam floor includes interbedded coal / carbonaceous shale beds, plus moisture sensitive claystone. The individual claystone beds are 50mm to 300mm thick and the cumulative thickness of claystone in the first 2m of floor in the S2 to S4 Panel area is 1.1m to 1.2m, similar to that encountered in the MW7-12 area. The claystone typically has a strength of <5MPa and is considered weak.

The significance of the weak claystone floor is that:

a) It can be associated with pillar bearing failure and increased subsidence, if chain pillar stresses are high (critical average stresses are in the 15 to 20MPa range, depending on the pillar geometry).

b) Uncertainties with regard to the long-term mechanical properties and behaviour of weak claystone favours the utilisation of empirical design methods based on equivalent mining environments.

3. CHAIN PILLAR DESIGN

3.1 Pillar Strength

The methodology adopted herein builds on the outcomes of previous design studies for the mine (in particular, **Strata2 Report CHV-005**). The design approach is calibrated to a data-base of 62 Lake Macquarie "weak floor" pillar case studies, focusing on the subsidence outcomes. The case studies encompass the Great Northern, Wallarah and Fassifern Seams, covering four decades of local experience. This database incorporates the CVC miniwall subsidence experience.

The empirical coal pillar design formulae applied were developed at the UNSW (**Salamon *et al*, 1996**). The UNSW formulae are founded on extensively researched and broadly-based databases of mining experience. These formulae represent the culmination to-date of work commenced almost 60 years ago in South Africa after the 1960 Coalbrook disaster (**Salamon and Munro, 1967**). A combined Australian and South African database has been applied to the derivation of formulae that are considered widely applicable (**Hill, 2010).**

The range of parameters in the UNSW failed and intact pillar database can be summarised as follows:

- Depth: 20m to 510m
- Mining Height: 1.0m to 9.2m
- Smallest Pillar Dimension: 2m to 32m
- Bord Width: 3.7m to 15.0m
- Percentage Extraction: 30% to 90%
- Width to Height (w/h) Ratio: 0.9 to 11.2
- Time to Failure: 0 to >80 years

The strength formula for Australian coal pillars with w/h ratios of >5 is as follows:

$$\text{Strength, } \sigma_s = 27.63^{0.51}(0.29*((w_m/5h)^{2.5} - 1) + 1)/(w^{0.22} \times h^{0.11})$$

where:

w_m = minimum pillar width (m)
h = roadway height (m)
Θ = a dimensionless 'aspect ratio' factor for rectangular pillars (**Salamon *et al,* 1996**).

For pillars with w/h ratios of ≤ 5, the strength formula is as follows:

$$\sigma_s = 8.6(w_m\Theta)^{0.51}/h^{0.84}$$

FoS can be related to the nominal probability of failure of a panel of pillars. A probability of stability of 99.9% is attained at a Factor of Safety of 1.63, see **Figure 3**, and further increases in FoS have little

effect, as the probability of stability curve approaches 100% asymptotically. From a risk management perspective, increasing the FoS beyond 1.63 can only reduce the failure probability by <0.1%.

The consequences of collapse are a key consideration, as these determine the acceptable probability of failure, which in turn allows an appropriate FoS to be determined. For example, risk management suggests that the probability of failure for long-term workings under sensitive surface structures should be negligible. In Australia, long-life critical pillars (e.g. in main headings and for the protection of surface infrastructure) are often designed to an FoS of ≥ 2.11, which equates to a nominal failure probability of one panel in a million. This reduces the failure probability to a level that would be considered acceptable in other key fields of public interest.

It should be understood that the nominal probability of failure is related to the life-time of the pillar data-base underpinning the design methodology; currently the average is around 60 years (i.e. of the order of 120 years of history is available). The annualised probability of failure (a concept more commonly applied in engineering practice) is therefore about one-fiftieth of the nominal failure probability.

The South African and Australian databases from which the UNSW formulae were derived cover a broad range of roof and floor materials, including mudrocks, coal, siltstones and sandstones. Therefore, these materials and the variability in strength that may be associated with them are implicitly recognised and largely catered for in the FoS approach. Uncertainty associated with the natural variability in coal measures strata often prohibits design to low FoS values. Geological variability partly accounts for the scatter in the population of failed pillar cases and usually necessitates design to FoS values of >1.5, equivalent to low failure probabilities. Back analysis indicates that incidences of instability traditionally associated with weak floor, for example, can very often be explained in terms of 'conventional' empirical design criteria.

Similarly, the database encompasses pillars in a significant number of seams in different geotechnical environments; consequently, the existence of pillar weaknesses is very largely reflected and implicit within the variability in the failed and intact pillar cases, such that these weaknesses are again very largely catered for by adopting appropriate FoS values.

Figure 4a/b illustrates several key relationships within the Lake Macquarie database. In **Figure 4a**:

i) The 62 Lake Macquarie weak floor cases have initially been divided into nominally stable and failed on the basis of the subsidence outcomes. The 39 cases associated with ≤ 200mm of subsidence have been classed as stable (i.e. strata deformation is largely due to elastic system compression), whereas the 23 cases resulting in >200mm of subsidence have been classed as failed (i.e. higher deformation, more typical of an overloaded system).

ii) The Lake Macquarie "failed" cases have Factors of Safety ranging from 0.91 to 2.66.

iii) The Lake Macquarie "stable" cases have Factors of Safety ranging from 1.45 to 25.0.

iv) The overlap between the failed and stable cases is largely a function of natural variability in the geotechnical properties of the strata (i.e. some failures are associated with particularly weak rock, whilst some of the stable cases are associated with relatively stronger strata).

v) The failed case with the highest FoS of 2.66 involved 220mm of subsidence (i.e. marginal in terms of the 200mm failed / stable criterion). The associated data point is from Chain Valley MG4 (Fassifern Seam).

vi) The failed cases involving high width to height (w/h) ratio pillars have high pillar stresses (e.g. miniwall chain pillars).

In **Figure 4b**, those cases involving average pillar stresses of >15MPa have been excluded and the data is presented in FoS versus subsidence form. The trendline for the failed cases crosses the CVC 780mm approval limit at a Factor of Safety of around 1.7.

Figure 5 reproduces the entire database in histogram form. At a Factor of Safety of ≥ 2.11, but <2.7, subsidence averages 93mm, with a maximum value of 220mm. These limited subsidence

values are indicative of deformation due almost entirely to elastic system compression. At Factors of Safety of ≥ 2.7 subsidence is negligible, at ≤ 20mm.

Therefore, a Factor of Safety of ≥ 2.11 is considered appropriate for the design of miniwall chain pillars in situations requiring limited and predictable subsidence, associated almost entirely with elastic system compression (i.e. such pillars are considered long-term stable).

3.2 Pillar Loading

The key aspects of the chain pillar loading environment are as follows:

i) On development, tributary area loading provides a conservative estimate of pillar loading for a twin heading panel (**Salamon and Oravecz, 1976**).

ii) On extraction, caving is likely to be capped at the base of the Teralba Conglomerate (30-50m thick), some 20m to 30m above the extraction horizon (just above the Great Northern Seam). The goaf stress is therefore lower than normal, at ≤ 0.7MPa. Conversely, pillar abutment loading is higher than normal.

iii) Final chain pillar loading can therefore be estimated by ignoring the benefits of caving, except for the deduction of around 0.5MPa.

iv) In the case of Maingate S4, there may be minor load transfer to the adjacent area of solid. This component can be estimated using the Stress Reduction Factor, R (**Peng and Chiang, 1984, Mark, 1990**).

3.3 Pillar Design Outcomes

The design outcomes for the pillars are summarised in **Table 1**.

Table 1: Design Outcomes for the Chain Pillars of S4 Panel

Location	Loading Condition	Depth (m)	Pillar						Pillar FoS (Salamon)	R Value
			Height (m)	Width (m)	Length (m)	w/h Ratio	Stress	Strength (MPa)		
TG S4 (I/B)	Double Abutment	168	3.2	40.0	94.6	12.5	14.2	45.9	3.2	N/A
TG S4 (O/B)		165					13.9		3.3	
MG S4 (I/B)	Single Abutment	170					9.6		4.8	0.97
MG S4 (O/B)		162					9.1		5.0	

The chain pillars are long-term stable in their final condition, with FoS values of ≥ 3.2 and ≤ 20mm of subsidence expected. Stress transfer from the MG S4 chain pillar to the adjacent area of solid / future workings would be negligible.

4. HEIGHT OF CONNECTIVE FRACTURING

4.1 Connective Fracturing Theory

The strata above an extracted area forms a goaf made of a number of zones, as presented in the **Forster and Enever (1992)** longwall model, which is shown in **Figure 6a**; the approximate location of the overlying Great Northern Seam, Teralba and Munmorah Conglomerates within the overburden profile are shown in **Figure 6b**. Note that there are no overlying workings in this case.

Commencing at the extraction horizon, the first zone is the “Caved Zone”, which comprises loose blocks of detached rock occupying the cavity created by mining. This typically extends to a height above the seam of 5 to 10 times the extraction height, or between 17.5m and 35m for a Fassifern Seam mining height of 3.5m. In this case, the Caved Zone is expected to be arrested at the base of the Teralba Conglomerate, 20m to 30m above the extraction horizon (see **Section 4.3**).

Above this is the “Fractured Zone”, in which the rock sags, with significant bending, fracturing, joint dilation and bed separation. **Forster’s** model suggests that the combined height of the caved and fractured zones extends to between 21 and 33 times the extracted height for super-critical longwall panels (or between 73.5 and 115.5m for an extraction height of 3.5m). A similar outcome is predicted by the **Kendorski (1993)** longwall model. Within this combined caved and fractured zone, very large increases in bulk horizontal and vertical permeability are expected (termed “connective cracking”).

Above the Fractured Zone is the Constrained Zone (**Forster**) or Dilated Zone (**Kendorski**). This zone is characterised by bedding dilation and discontinuous fracturing. This results in an increase in the horizontal permeability and associated drawdown in groundwater levels, which recover over time. Based on the Wyee experience, **Forster (1995)** suggests the minimum thickness of the Constrained Zone should equate to “12T”, assuming no significant geological structures within the zone. At an extraction height of 3.5m, this equals 42m.

Other Australian workers (e.g. **MSEC, 2005**) have related the height of the combined Caved plus Fractured Zones solely to the mined panel width. Such approximations are probably appropriate for longwall mining at typical Australian extraction heights of around 3m to 3.5m. Other workers have also noted that the upward extent of fracturing is a function of the extracted span (**Mills and O’Grady, 1998**).

British researchers (**Whittaker and Reddish, 1989; Follington and Isaac, 1990**) considered the influence of both panel span and mining height on sub-surface fracture heights. Physical modelling suggested that sub-surface fracture heights could be estimated from the predicted maximum surface tensile strain ($+E_{max}$) values (**Whittaker and Reddish, 1989**); thereby linking sub-surface fracturing to the overall geometry. **Follington and Isaac** found that the failure height increased relative to the mining height, as panel width increased, see **Figure 7**. As panel width increased from 80m to 120m, the failure height increased from 18 to 25 times the mining height (i.e. close to **Forster’s** lower bound value of 21 times the mining height).

More recently, Australian workers have sought to assess the combined effect of panel width and mining height on sub-surface fracturing (**Tammetta, 2013**; **Ditton and Merrick, 2014**).

The **Tammetta (2013)** method appears to relate to the height of the Constrained / Dilated Zone (i.e. all appreciable fracturing and bedding / joint dilation). The **Tammetta** equation defines H, the “Complete Height of Groundwater Drainage” (CHGD) as follows:

$$H = 1{,}438\ l_n(4.315 \times 10^{-5}u + 0.9818) + 26$$

where $u = wt^{1.4}d^{0.2}$
and w = void width (97m in the CVC case)
t = extraction height (3.5m)
d = depth (162m to 170m)

The **Tammetta** equation generates a “CHGD” value of 94 to 95m for the S4 Panel inputs (i.e. the equivalent of ~27T). **Tammetta** also suggests that an Upper 95% Confidence Limit can be defined by adding 37m to the mean value (i.e. producing a U95%CL value of 132m in the case of S4, the equivalent of ~38T). It should be noted that it is not rational for the U95%CL to be defined by adding a constant 37m; this value should bear some relationship to the geometry and the mean value (otherwise, in the extreme, a panel width of 0m would have an associated U95%CL value of 37m, which is nonsense).

The **Ditton and Merrick** equations aim to define the height of the “A Zone”, a term originally proposed by **Whittaker and Reddish** and analogous to the Fractured Zone. **Ditton and Merrick** derived two equations, one solely based on geometry and a second intended to reflect the positive impact (i.e. reduction in “A Zone” height) of a massive spanning bed within the overburden. The latter is considered by **Ditton** to be more relevant to the CVC geotechnical environment and the associated equation was applied successfully for the MW1-12 area, as well as more recently for MWs CVB1, S1 and N1.

The **Ditton and Merrick** geology equation is as follows:

$$A = 1.52W'^{0.4} H^{0.535}T^{0.464}t^{0.4} \quad +aW'$$

Where W' = the minimum of actual panel void width and "critical" panel width (taken as 1.4H)
H = depth
T = extraction height
t = effective thickness of the massive unit (19m according to **Ditton** in this case)

The +aW' term defines an Upper 95% Confidence Limit or "U95%CL". For sub-critical panels, 'a' is 0.15.

The following comments are made regarding the results obtained with this equation, see also **Figure 8**:

The average fracture height varies between 79m and 81m (i.e. ~23T) and the upper bound fracture height varies between 94m and 96m (i.e. ~27T and practically the same as the mean value from the **Tammetta** equation).

i) The **Ditton and Merrick** equation is less conservative than the **Tammetta** equation, at a void width of 97m. It can be shown that the two equations converge at reduced panel widths (as would be expected), but continue to diverge as panel width increases, with the **Tammetta** equation increasingly producing the more conservative result.

4.2 Local Experience

Table 2 summarises the key geometrical parameters and subsidence outcomes for the local (Wyee and CVC) database of 8 longwall and 16 miniwall panels on the Fassifern Seam.

Table 2: Wyee and Chain Valley Collieries - Panel and Subsidence Database

Case	Void Width (m)	Depth (m)	Mining Height (m)	Inter-Panel Chain Pillar Width (m)	Subsidence (m)	Comment
Wyee LW1	216	212	3.44	N/A	2.20	Multi-seam workings
Wyee LW17	130	174	3.2	45	0.45	3 adjacent panels
Wyee LW18	130	172	3.2		0.55	3 adjacent panels
Wyee LW19	130	170	3.2		0.65	3 adjacent panels
Wyee LW20	140	180	3.2	N/A	0.4	Isolated panel
Wyee LW21	140	175	3.2	N/A	0.45	Isolated panel
Wyee LW22	150	185	3.2	45	N/A	2 adjacent panels
Wyee LW23	150	195	3.2		0.50	2 adjacent panels
CVC MW4	97	196	3.4	40	0.22	3 adjacent panels
CVC MW5	97	200	3.4	30.6	0.46	3 adjacent panels
CVC MW5a	97	200	3.4		0.46	3 adjacent panels
CVC MW1	72	200	3.4	30.6	0.20	10 adjacent panels
CVC MW2	72	200	3.4	30.4	0.40	10 adjacent panels
CVC MW3	97	200	3.4	32.6	0.70	10 adjacent panels
CVC MW6	97	198	3.4		0.80	10 adjacent panels
CVC MW7	97	195	3.4		0.90	10 adjacent panels
CVC MW8	97	193	3.5		1.00	10 adjacent panels
CVC MW9	97	191	3.5		1.20	10 adjacent panels
CVC MW10	97	183	3.5		0.90	10 adjacent panels
CVC MW11	97	178	3.5		0.60	10 adjacent panels
CVC MW12	97	173	3.5		0.30	10 adjacent panels
CVC CVB1	97	225	3.5	N/A	0.45	Multi-seam workings
CVC MW S1	97	195	3.5	N/A	<0.1	Isolated panel
CVC MW N1	97	170	3.5	N/A	<0.1	Isolated panel

The following comments are made regarding this local database:

i) The panel void width range of 72m to 216m is large.

ii) The depth range of 170m to 225m is quite narrow. The planned S4 Panel is at / marginally below the bottom of this range (i.e. depths of 162m to 170m).

iii) The extraction height range of 3.2m to 3.5m is narrow and consistent with S4 Panel (i.e. 3.5m).

iv) The Wyee panels were the subject of detailed geotechnical investigation, focusing on subsidence and the development and extent of sub-surface fracturing (**Holla, 1989; Li *et al*, 2006**).

v) The 45m (solid width) Wyee chain pillars all meet the criteria for long-term stability with minimal subsidence discussed in **Section 1** (i.e. Factors of Safety of >2.11).

vi) The 40m chain pillar between CVC MWs 4 and 5 is long-term stable (FoS of 2.66) and a controlling influence with regard to the very limited subsidence over MW4 (i.e. 0.22m).

vii) The remaining 30.4m to 32.6m wide CVC chain pillars do not meet the stipulated criteria for long-term stability (i.e. Factors of Safety of <2.11). Even then, subsidence only increases to >0.5m when >3 adjacent panels are mined (and spanning / bridging of the overburden reduces).

viii) Multi-seam workings at both mines have been associated with increased subsidence magnitudes (Wyee LW1 and CVC CVB1).

ix) No appreciable subsidence has been measured by bathometric survey above CVC MWs S1 and N1 to-date, noting that survey accuracy is considered to be approximately 100mm.

Table 3 overleaf summarises the local database in the context of the theoretical outcomes of the **Ditton and Merrick (2014)** and **Tammetta (2013)** equations. Also included are the results for planned MW S4.

The following comments are made regarding the outcomes:

i) **Tammetta's** equation is much less sensitive to depth than that of **Ditton and Merrick**.

ii) **Tammetta's** average values correlate very closely to the void width.

iii) The Wyee LW1 data point was the subject of detailed research **(Holla, 1989; Holla and Buizen, 1990)**, from which a Fractured Zone height of 126m was derived. **Ditton and Merrick** used this a calibration point for their model. The **Tammetta** equation suggests a CHGD of 208m to 245m (average and U95%CL), which is effectively to surface (i.e. H = 212m).

iv) The Wyee LW1 data point is also interesting in that it represents a multi-seam case, with remnant pillars in the overlying Great Northern Seam.

v) The **Tammetta** U95%CL results for Wyee LWs 17 to 23 range from 149m to 169m and would have been a cause for concern if they had been available at the time of mining, given that they suggest only 17m to 26m of super-incumbent cover to the lake floor (including <10m of rock). This was the area investigated by **Li *et al* (2006)**; no inflow / seepage issues were reported.

It is concluded, on the basis of the local experience, that:

- the **Ditton and Merrick** values (average and U95%CL) are credible and
- the **Tammetta** average values are credible at panel widths of ≤150m.

Table 3: Theoretical Fractured Zone Heights for the Local Database

Case	Void Width	Depth	Mining Height	Ditton & Merrick 'A' Zone Height		Tametta 'CHGD'	
	(m)	(m)	(m)	Average (m)	U95%CL (m)	Average (m)	U95%CL (m)
Wyee LW1	216	212	3.44	125	158	208	245
Wyee LW17	130	174	3.2	89	108	113	150
Wyee LW18	130	172	3.2	88	108	112	149
Wyee LW19	130	170	3.2	88	107	112	149
Wyee LW20	140	180	3.2	93	114	122	159
Wyee LW21	140	175	3.2	92	113	121	158
Wyee LW22	150	185	3.2	97	120	131	168
Wyee LW23	150	195	3.2	100	123	132	169
CVC MW1	72	200	3.4	78	89	71	108
CVC MW2	72	200	3.4	78	89	71	108
CVC MW3	97	200	3.4	88	102	95	132
CVC MW4	97	196	3.4	87	101	94	131
CVC MW5	97	200	3.4	88	102	95	132
CVC MW5a	97	200	3.4	88	102	95	132
CVC MW6	97	198	3.4	87	102	94	131
CVC MW7	97	195	3.4	86	101	94	131
CVC MW8	97	193	3.5	87	102	98	135
CVC MW9	97	191	3.5	87	101	97	134
CVC MW10	97	183	3.5	85	99	97	134
CVC MW11	97	178	3.5	83	98	96	133
CVC MW12	97	173	3.5	82	97	96	133
CVC MW CVB1	97	225	3.5	94	109	101	138
CVC MW S1	97	195	3.5	88	102	98	135
CVC MW N1	97	170	3.5	81	96	95	132
CVC S2	97	170	3.5	81	96	95	132
CVC S3	97	167	3.5	81	95	95	132
CVC S4 Inbye	97	170	3.5	81	96	95	132
CVC S4 Outbye	97	162	3.5	79	94	95	132

4.3 SCT Surface Tensile Strain Approach

SCT (2008) used 2d numerical (FLAC) modelling and field studies of overburden strata conductivity to compliment the historical database. They studied the relationships between surface tensile strain, subsidence, depth and groundwater inflow (consistent with the concept put forward by **Whittaker and Reddish, 1989**). SCT stated that no issues were associated with systematic strains of <4mm/m and that inflow became problematical at strains of >10mm/m (consistent with UK experience).

Table 4 summarises the tensile strain results for the Wyee and CVC database, including the planned S2, S3 and S4 Panels, based on the standard equation:

Strain, E = 1000k(Subsidence/Depth)

Where:

k is a constant dependent on coalfield geology (k = 0.4 for the Newcastle Coalfield).

Table 4: Systematic Tensile Strain Results for the Local Database

Panel	Subsidence Smax (m)	Depth H (m)	Tensile Strain (mm/m)	
			E/k	E (k = 0.4)
Wyee LW1	2.20	212	10.4	4.2
Wyee LW17	0.45	175	2.6	1.0
Wyee LW18	0.55	175	3.1	1.3
Wyee LW19	0.65	175	3.7	1.5
Wyee LW20	0.4	180	2.2	0.9
Wyee LW21	0.45	175	2.6	1.0
Wyee LW23	0.5	185	2.7	1.1
CVC MW7-12	1.15	190	6.1	2.4
CVC MW4-5	0.22	200	1.1	0.4
CVC MW5-5A	0.46	210	2.2	0.9
CVC MW CVB1	0.45	225	2.0	0.8
CVC MW S1	0.1	195	0.5	0.2
CVC MW N1	0.1	170	0.6	0.2
CVC MW S2	0.2	175	1.1	0.5
CVC MW S3	0.2	164	1.2	0.5
CVC MW S4	0.2	162	1.2	0.5

For the purpose of simple local comparison, it is not necessary to know the 'k' value; it is enough to compare the E/k ratios, viz:

- Wyee LW1: 10.4
- Wyee LWs 17 to 23: 2.2 to 3.7
- Previous CVC Miniwalls: 1.1 to 6.1
- Planned CVC Miniwall S4: 1.2 (i.e. at the bottom end of the database)

Figure 9 is adapted from the **SCT ACARP** report; with respect to strain, it is noted that the local values generally plot in the range indicated as benign by **SCT**, with CVC MWs 7-12 plotting just below the "No Observed Water Inflow Issues" line. In particular, S4 Panel plots well inside the "No Issues" zone. Also shown in the figure is the 7.5mm/m strain limit derived from the **Wardell Guidelines (1975)** and **Holla's** k value of 0.4 for the Newcastle Coalfield. This limit line is practically the same as the SCT 10mm/m line, which is based on a k value of 0.6.

4.4 Spanning of the Teralba Conglomerate

A two-dimensional analytical beam model has been utilised to assess the spanning ability of the Teralba Conglomerate. The model assesses potential modes of beam failure involving both linear elastic and voussoir arch (i.e. jointed rock mass) properties. A major advantage is that it allows the sensitivity of an outcome to various input parameters to be rapidly tested; this parametric analysis provides insight of roof behaviour. The model has been applied by Strata^2 geotechnical engineers in a variety of mining environments and situations for over 20 years.

For the purpose of this study, there are two key units of interest, namely:

- the Teralba Conglomerate and
- the 25-30m of interburden from the Fassifern Seam working section to the Teralba Conglomerate.

A review of previous Chain Valley studies, laboratory tests, rock mass characterisation and *in situ* stress testing results indicates that the properties summarised in **Table 5** are appropriate inputs.

Table 5: Beam Analysis Inputs

Parameter	Interburden	Teralba Conglomerate
Depth (m)	170	145
$\sigma_1 : \sigma_V$ Ratio	2:1	
UCS (MPa)	30	50
E (GPa)	5	12
Beam Thickness (m)	2	20 to 30 (around 25m)
Joint Friction Angle (°)	35	45
Joint Dip Angle (°)	70 to 90 (70 conservatively selected)	

The important feature of the interburden is that it is expected to cave readily. For the purposes of this analysis, the main function of the interburden is to create a caving arch that reduces the effective span at the base of the Teralba Conglomerate beam. Assuming a moderately conservative 20° caving angle from the working horizon, it can be shown that over the 25m height, the span reduces from 97m to 75m.

The analytical outcomes are not sensitive to the cover depth range of the S4 panel; therefore, a single representative depth of 145m to the base of the Teralba Conglomerate has been applied.

It can be shown that the probable initial mode of beam failure would be abutment crushing, with the roof sagging and overstressing the rock material at its margins. This would tend to be manifested by guttering, accompanied by buckling. In the analysis, "failure" (i.e. caving) is expected to initiate at a Factor of Safety (FoS) of 1, whereas long-term stability would be expected at FoS values of ≥ 2.

For this analysis, the beam thickness has been varied, see **Figure 10**. The results are summarised as follows:

i) At the expected beam thickness of 25m, the FoS is 3. The Teralba Conglomerate beam is long-term stable.

ii) The FoS reduces to 1 at a beam thickness of 12m. This is not credible for the area of interest.

iii) At an average thickness of 25m, the theoretical failure span of the Teralba Conglomerate is around 150m, over 50m greater than the void width. Failure of the Teralba Conglomerate is not credible.

4.5 Conclusions Regarding the Theoretical Height of Connective Cracking

The following conclusions are drawn from the preceding analysis:

i) **Forster's** approach is for super-critical longwalls and is not applicable to the sub-critical MW S4.

ii) The **Tammetta** equation is inconsistent with local experience at panel widths of >150m.

iii) The values derived using the **Ditton and Merrick (2014)** geology equation are consistent with local experience and this equation has been successfully applied at CVC in recent years. This approach suggests heights of connective fracturing of 94 to 96m for MW S4.

iv) The **SCT (2008)** approach is considered the most rational, as it relates to the expected maximum values of strain, the latter being a key parameter for permeability. The approach suggests that the MWs S4 design is conservative, from a "potential inflow" perspective.

v) In practice, the height of connective cracking would almost certainly be capped at the base of the Teralba Conglomerate, only around 25m above the workings.

4.6 Geological Structure

Many of the panels in the local database encountered geological structures, see **Table 6**.

Table 6: Major Structures Encountered by Wyee and CVC Panels

Case	Void Width (m)	Depth (m)	Mining Height (m)	Subsidence Smax (m)	Major Geological Structure
Wyee LW1	216	212	3.44	2.20	Dyke parallel with T/G; 35-55m disturbance zone
Wyee LW17	130	174	3.2	0.45	0.3m fault at inbye end of M/G
Wyee LW18	130	172	3.2	0.55	No major geological structure
Wyee LW19	130	170	3.2	0.65	Fault zone with 0.6-1.4m throw, inbye half of block
Wyee LW20	140	180	3.2	0.4	Minor 0.1-0.4m faults in block
Wyee LW21	140	175	3.2	0.45	0.8m fault in block; 3m fault in T/G
Wyee LW22	150	185	3.2	N/A	4m normal fault zone at inbye end of panel
Wyee LW23	150	195	3.2	0.50	4m normal fault zone at inbye end of panel
CVC MW4	97	196	3.4	0.22	1-2m normal fault through the entire block
CVC MW5	97	200	3.4	0.46	Locallised 0.1-0.2m normal faults in block; normal faults up to 2.7m in chain pillars
CVC MW5a	97	200	3.4	0.46	Normal faults up to 2.7m throughout the block and chain pillars
CVC MW1	72	200	3.4	0.20	0.4m normal fault in inbye quarter of TG1
CVC MW2	72	200	3.4	0.40	No major geological structure
CVC MW3	97	200	3.4	0.70	No major geological structure
CVC MW6	97	198	3.4	0.80	Dyke ~3m thick in outbye half of block; 2m normal fault zone in inbye half of M/G and extending into block
CVC MW7	97	195	3.4	0.90	0.25m dyke in outbye half of block; 2m normal fault in inbye half of block
CVC MW8	97	193	3.5	1.00	0.25m dyke mid-block
CVC MW9	97	191	3.5	1.20	1.8m normal fault, inbye quarter of block, trending into M/G chain pillar
CVC MW10	97	183	3.5	0.90	1-1.5m normal faults through three-quarters of the block
CVC MW11	97	178	3.5	0.60	1-1.5m normal faults through outbye half of the block
CVC MW12	97	173	3.5	0.30	No major geological structure
CVC CVB1	97	225	3.5	0.45	0.5-1m normal faults through both gates and in the inbye third of the block
CVC MW S1	97	195	3.5	<0.1	Minor 0.1-0.4m faults in block and gate roads
CVC MW N1	97	170	3.5	<0.1	Minor 0.1-0.3m faults in block and gate roads

The following comments are made regarding **Table 6**:

i) Two-thirds of the panels in the local database were directly impacted by significant geological structures (defined for this purpose as faults with throws of >0.5m or dykes). A number of panels were also bounded by major (>2m) faults (e.g. MWs S1 and N1, see **Figures 1** and **11**).

ii) There is no obvious relationship between the subsidence magnitude and the presence or absence of major geological structure.

iii) One of the reasons why the faults do not impact on subsidence is that they are normal faults dipping at moderate to high angles (60° to 90°). As such, they have a reduced impact on beam stability and the spanning ability of the overburden, in comparison to low angle thrust faults, which have been associated with increased subsidence magnitudes elsewhere, such as Mandalong.

However, there is local evidence that structures can be associated with strain concentrations at surface. Over Wyee LW1, measured maximum strain values varied between 2.5mm/m on the MG side and 8.1mm/m on the TG side, versus the predicted maximum tensile strain of 4.2mm/m. The maximum measured value coincided with the dyke zone adjacent to the tailgate. This is consistent with the findings of **Ditton and Frith (2003)**, who suggested that surface strain concentrations of 2 to 3 times the systematic strain could be associated with fracturing. However, the surface strain concentration does not seem to have translated into a height of fracturing increase over Wyee LW1.

iv) Localised strain concentrations, due to geological structure or any other factor, must be implicitly incorporated in empirical strain limit guidelines based on “systematic” strains (i.e. empirical limits / impact guidelines are an outcome of actual experiences that incorporate and reflect the vagaries of

geology). Further, the presence of major geological structures is also implicit within the empirical models and equations for heights of fracturing, such as that of **Ditton and Merrick (2014)**.

v) Nonetheless, even a strain multiple of 2 to 3 would have no material consequences for MW S4.

vi) MW S4 is expected to extract through a ~2m normal fault dipping at 60° to the NE over the inbye two-thirds of the panel. The fault plane will almost certainly extend upwards through the Fractured and Constrained Zones. However, given that:

- voussoir beam analysis suggests that such a feature would not appreciably impact on the spanning ability of the Teralba Conglomerate and
- the favourable experiences from previous extraction panels with much greater exposure to major structures,

this fault is considered to be of no material consequence.

Figure 11 shows the major structural features, based on in-seam drilling, mapping in adjacent areas / seams and exploration drilling results. The MW S2 to S4 panels are orientated at 119°, rather than the 134° of earlier CVC panels. This orientation is much more favourable, with respect to the dominant 131° structural direction.

Overall, the structural environment is considered to have no significant adverse implications for S4 Panel subsidence and sub-surface fracturing.

4.7 Rock Cover Requirement for MW S4

Figure 12 shows the rock cover contours for the area of interest, based on the June 2018 detailed survey results. Rock cover varies from 138m at the outbye end of the panel to 158m inbye. Rock cover therefore meets the Fractured Zone (≤ 96m) plus 12T (42m) guideline.

5. SUBSIDENCE ESTIMATION

It was concluded in **Section 3 (Chain Pillar Design)** that subsidence due to MW S4 extraction was expected to be negligible in the long-term (≤ 20mm). To compliment this empirical subsidence estimate, numerical modelling has been conducted using the three-dimensional, displacement discontinuity code "LaModel" (**Heasley and Chekan, 1999**), which has been successfully applied by the author to a variety of situations at a number of NSW mines over the last decade.

5.1 Material Property Inputs and Assumptions

LaModel incorporates yielding elements in the coal seam properties enabling the yield zone, which is manifested in practice by rib spall and fracturing, to be simulated. The results of numerical codes are sensitive to the material parameters inputted and require calibration.

In LaModel, the following material input parameters are important:

- Young's Modulus of the coal and overburden,
- Poisson's Ratio of the coal and overburden,
- overburden lamination thickness,
- goaf loading height and
- mass strength of coal at a width to height (w/h) ratio of 1.

LaModel incorporates default values for material properties, developed from simulations of a large number of case histories. However, the adoption of site-specific values determined via a calibration process is recommended, where the data is available. Calibration involves adjusting the modelled, site-

specific mechanical properties to provide the best correlation between predicted and measured values of pillar stress and surface subsidence (**White and Hill, 2017**).

For this study, calibration has primarily involved reference to local geotechnical data and subsidence-related studies from Chain Valley and the adjacent Mannering Colliery.

The model outcomes are relatively insensitive to the Poissons Ratio of the coal and overburden. The default values of 0.33 for coal and 0.25 for the overburden have been applied, noting that these are consistent with previous studies for the mine **(DGS, 2017)**.

The default value for the overburden Young's Modulus is 20.7GPa, noting that modelled subsidence results are sensitive to this input value. Previous studies for the mine have simply applied this default value **(DGS, 2017)**, which is generally consistent with expected values of 15-20GPa for conglomerate material. However, experience indicates that lower values tend to calibrate better to actual subsidence behaviour. This is considered to reflect the influence of the weaker units within the overburden, as well as the role of discontinuities and the strength reduction typically associated with full-scale "rock mass" versus laboratory-scale "rock-material" mechanical behaviour.

Subsidence estimation with LaModel is also sensitive to the overburden lamination thickness. Previous studies for the mine have varied the lamination thickness from 20m to 46m **(DGS, 2017)**. However, for sub-critical panels, experience indicates that the most accurate subsidence predictions are attained by adopting lamination thicknesses of 10m to 15m for mining operations involving caving (e.g. miniwall systems). These more conservative input values are considered to implicitly reflect the weakening effect of major discontinuities, such as faults and dykes, on overburden behaviour.

Accordingly, a sensitivity analysis was conducted, involving progressive reductions in the overburden modulus and lamination thickness and associated increases in the calculated subsidence values, until the results most closely matched the measured subsidence behaviour over the previous Chain Valley miniwall panels and the Wyee (Mannering) longwall panels. The overburden properties that provided the most accurate calibration were:

- a Youngs Modulus of 10GPa and
- a lamination thickness of 10m.

The default value at a w/h ratio of 1.0 for coal mass strength is 6.2MPa. Geomechanical testing of the Fassifern Seam at Chain Valley indicates a moderate uniaxial compressive strength (UCS) of typically 25 to 40MPa for laboratory sized specimens, with an average of 34MPa. Empirical methods and rock mass classification schemes suggest a coal mass strength of 6 to 8MPa and, in particular, a value of 7MPa derived using the approach of **Protodiakanov (1964)**. **Gale (1999)** suggested that coal mass strength varies between 5MPa, for weak coal with weak coal / strata contacts, to 9MPa for strong coal with strong coal / strata contacts. The Fassifern Seam contacts are considered weak. The specific issue is the role of the claystone units in the floor, which has an average long-term strength of <5MPa. A second sensitivity analysis was therefore conducted, involving progressive reductions in the strength and stiffness properties of the seam and associated increases in the calculated subsidence magnitudes, until the results most closely matched long-term, measured subsidence behaviour. The seam properties that provided the most accurate calibration were:

- a seam strength of 3.5MPa and
- a Youngs Modulus of 1.05GPa.

Goaf properties are calculated using LaModel's "Gob Wizard" by inputting the maximum estimated goaf stress. In this case, the goaf stress is considered to be largely limited to the load due to the height of the caved material below the Teralba Conglomerate, with the majority of the load transferring to the chain pillars and adjacent abutments, refer to **Section 4.3**. Given a caving height of 20m to 30m from the Fassifern Seam working section to the base of the conglomerate, this suggests a goaf stress of around 0.7MPa.

The material inputs are accordingly summarised in **Table 7**.

Table 7: Modelling Parameters for the S2 to S4 Panel Area

Material Parameter	Values Modelled
Young's Modulus of Coal (GPa)	1.05
Poisson's Ratio of Coal	0.33
Young's Modulus of Overburden (GPa)	10
Poisson's Ratio of Overburden	0.25
Mass Strength of Coal (MPa)	3.5
Lamination Thickness (m)	10
Depth (m)	170
Mining Height (m)	3.5

The outcomes of the LaModel calibration exercises are summarised in **Figure 13**, which plots modelled (i.e. predicted) versus measured subsidence. The correlation coefficient of 0.7 is acceptable. Of note is the fact that the modelling results tend to become conservative, as the value of subsidence reduces

5.2 Modelling Steps

The model was simulated in two steps, as follows:

- **Mining Step 1**: Miniwall Panels S2 and S3 extracted.
- **Mining Step 2**: Miniwall Panel S4 extracted.

Mining Step 1 facilitates a comparison of the LaModel subsidence estimates with previous estimates of MW S2 and S3 subsidence obtained by MSEC using their Incremental Profile Method or "IPM" (**MSEC, 2018**).

5.3 Grid Geometry

A section of the model grid at Mining Step 1 is shown in **Figure 14**. A modelled element width of 2m was applied, so that the geometry approximated very closely to the actual at both the first workings and secondary extraction stages.

5.4 Modelling Results

The following comments are made regarding the results for Step 1, following the extraction of MWs S2 and S3, see **Figure 15**:

i) Maximum subsidence is 292mm. This is consistent with practical experiences from elsewhere and with the **MSEC (2018)** prediction of 290mm.

ii) Tilt values are < 4mm/m. This is marginally less than the **MSEC** prediction of a maximum of 6mm/m.

iii) Strain values are < 2mm/m. This is marginally greater than the **MSEC** prediction of a maximum tensile strain of 1mm/m.

iv) Angles of draw are <7°.

v) Subsidence at the Pelican Rock Navigation Marker, above Tailgate S2, is 130mm. This is marginally greater than the **MSEC** prediction of 90mm.

The following comments are made regarding the results for Step 2, following the extraction of MW S4, see **Figure 16**:

i) Maximum subsidence is 296mm. This is consistent with practical experiences from elsewhere.

ii) Tilt values remain < 4mm/m.

iii) Strain values remain < 2mm/m.

iv) Angles of draw remain <7°.

v) Subsidence at the Pelican Rock Navigation Marker, above Tailgate S2, remains 130mm.

vi) The minimal difference in the maximum subsidence values following the mining of MW S4 reflects the controlling influence of the 40m wide chain pillars.

5.5 Conclusions Regarding Subsidence Effects

It was found in **Section 3.2** that the pillar database suggests <20mm of subsidence, which is less than the numerical modelling outcomes. It is considered likely that the numerical model is conservative at small values of subsidence. The LaModel outcomes are considered an appropriate basis for planning.

Apart from these numerical and empirical estimates, it is also possible to draw directly on the actual experience from the MW1-12 area. The situation that corresponds most closely to the planned S4 geometry is that of MWs 4 and 5, where two 97m void width panels were also separated by a 40m (solid width) chain pillar, albeit at a greater depth of 196m to 200m. Six years after mining, the measured subsidence is of the order of 220mm, with no sign of ongoing movement / creep.

It is therefore concluded that maximum final subsidence associated with the extraction of S4 Panel will be of the order of 200mm to 300mm. Given that the resolution of bathometric survey techniques is understood to be of the order of 100mm, it is suggested that planning proceed on the basis of a nominal maximum of 400mm of long-term subsidence.

6. SUBSIDENCE IMPACTS

The potential subsidence impacts on the following natural and built features are considered in turn:

- The lake bed
- Sea grass beds
- The foreshore
- Built features

6.1 The Lake Bed

The lake bed contours, derived from bathometric surveys from 2012 onwards, are shown in **Figure 17**. Given that the water depth is ≥ 5m over MW S4 and the expected subsidence is ≤ 0.3m, it is considered very unlikely that there would be an adverse impact on the lake bed.

Further details on benthic communities are given in the Benthic Communities Management Plan, which is included as part of the Extraction Plan.

6.2 Sea Grass Beds

Sea grass beds exist along the foreshore, below the Low-Water Mark, see **Figures 18** to **20**. The Sea Grass Protection Barrier (SGPB) is defined by a 26.5° angle of draw from the mapped beds. It is evident from **Figure 20** that the commencing end of MW S4 is located an average of 30m outside the barrier, reducing to a minimum of 3m to 4m outside at the SE corner of the panel. Predicted vertical subsidence at the closest point (i.e. at the SE corner) of MW S4 to the SGPB is <150mm and predicted subsidence at the actual sea grass beds is <20mm. It is therefore considered practically impossible that there would be an adverse impact on the sea grass beds.

6.3 The Lake Foreshore

The foreshore to the east of MW S4 and the High-Water Mark, defined by the RL0.00m AHD contour, are shown in **Figure 20**. The High-Water Mark Protection Barrier (HWMPB) is defined by a 35° angle of draw from the High-Water Mark. It can be seen from **Figure 20** and also the long-section down the panel centre-line, **Figure 21**, that the commencing end of MW S4 is located an average of around 80m

outside the barrier, reducing to a minimum of around 40m at the closest point (i.e. at the SE corner of MW S4).

Predicted subsidence at the HWMPB is <70mm, adjacent to the SE corner of MW S4. It is therefore considered practically impossible that there would be any measurable change in the High-Water Mark due to the extraction of MW S4 (i.e. predicted subsidence at the High-Water Mark is <20mm).

6.4 Built Features

Built features near MW S4 are shown in **Figure 22**. The Pelican Rock Navigation Marker is located on a rock outcrop that extends into the lake from Summerland Point, see **Figures 19** and **23**. It has already been noted that no additional subsidence is expected at the navigation marker due to the extraction of MW S4.

The built features along the foreshore, including houses and jetties, do not extend beyond the mapped sea grass beds. Given that <20mm of subsidence is predicted, no measurable impacts are expected on the foreshore features.

Given the limited overburden caving and predicted vertical subsidence of <300mm, it is unlikely that measurable horizontal movements will be experienced beyond an angle of draw of 26.5°. However, NSW Spatial Services should be notified, so that any affected survey markers can be managed and re-established if necessary, post-MW S4 extraction.

7. CONCLUDING REMARKS

This report has addressed the key issues of chain pillar design, height of connective fracturing and initial subsidence estimation for planned CVC Panel MW S4. It is concluded that:

1. The layout is conservative from the perspective of subsidence and sub-surface fracturing effects.

2. No adverse surface impacts are expected, with any impacts to be within the consented subsidence limits.

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Appendix A: Glossary of Key Terms

Angle of Draw

The angle from the vertical of a line drawn between the limit of extraction at seam level (goaf edge) and the 20mm subsidence contour on surface, which is historically regarded as the practical limit of measurable subsidence.

Chain Pillar

The unmined block or pillar of coal left between extracted miniwall panels.

Cover Depth

The depth from surface to the top of the seam.

Critical Panel Width

The minimum width of extraction at which the maximum possible subsidence at a point on surface first occurs.

Far-Field Movements

Horizontal movements well beyond the panel boundaries, over solid unmined coal. Such movements tend to be *en masse* movements towards the extracted area, with very low levels of associated strain.

First Workings

Tunnels, roadways or “bords” driven by a continuous miner to provide access to extraction panels in a mine.

Goaf

The void created by the extraction of coal, into which the immediate roof layers collapse or “cave”.

Horizontal Displacement

The horizontal movement of a point on surface due to underlying coal extraction.

Mining Height

The height at which a coal seam is mined; this may not equal the seam thickness.

Panel

The plan area of coal extraction.

Panel Length

The longitudinal distance along a panel measured in the direction of mining, from the commencing rib to the finishing rib.

Panel Width

The transverse distance across a panel between chain pillars.

Secondary Extraction

The extraction of coal pillars or blocks, resulting in the formation of a goaf as the coal is removed.

Strain

The change in horizontal distance between two points, divided by the original horizontal distance between the points. Strain is dimensionless and can be expressed as a decimal or a percentage, but commonly as mm/m. **Tensile Strains** involve an increase in distance between two points, whereas **Compressive Strains** involve a reduction.

Sub-Critical Width

A panel width less than the critical width.

Subsidence

The difference between the pre and post-mining surface level at a point.

Subsidence Control

Reducing the impact of subsidence on a feature by reducing the amount of coal extracted.

Subsidence Effect

Vertical subsidence due to mining, including related parameters, such as horizontal displacement, tilt and strain.

Subsidence Impact

The change (most commonly damage) to a natural or built feature caused by subsidence effects.

Subsidence Mitigation / Amelioration

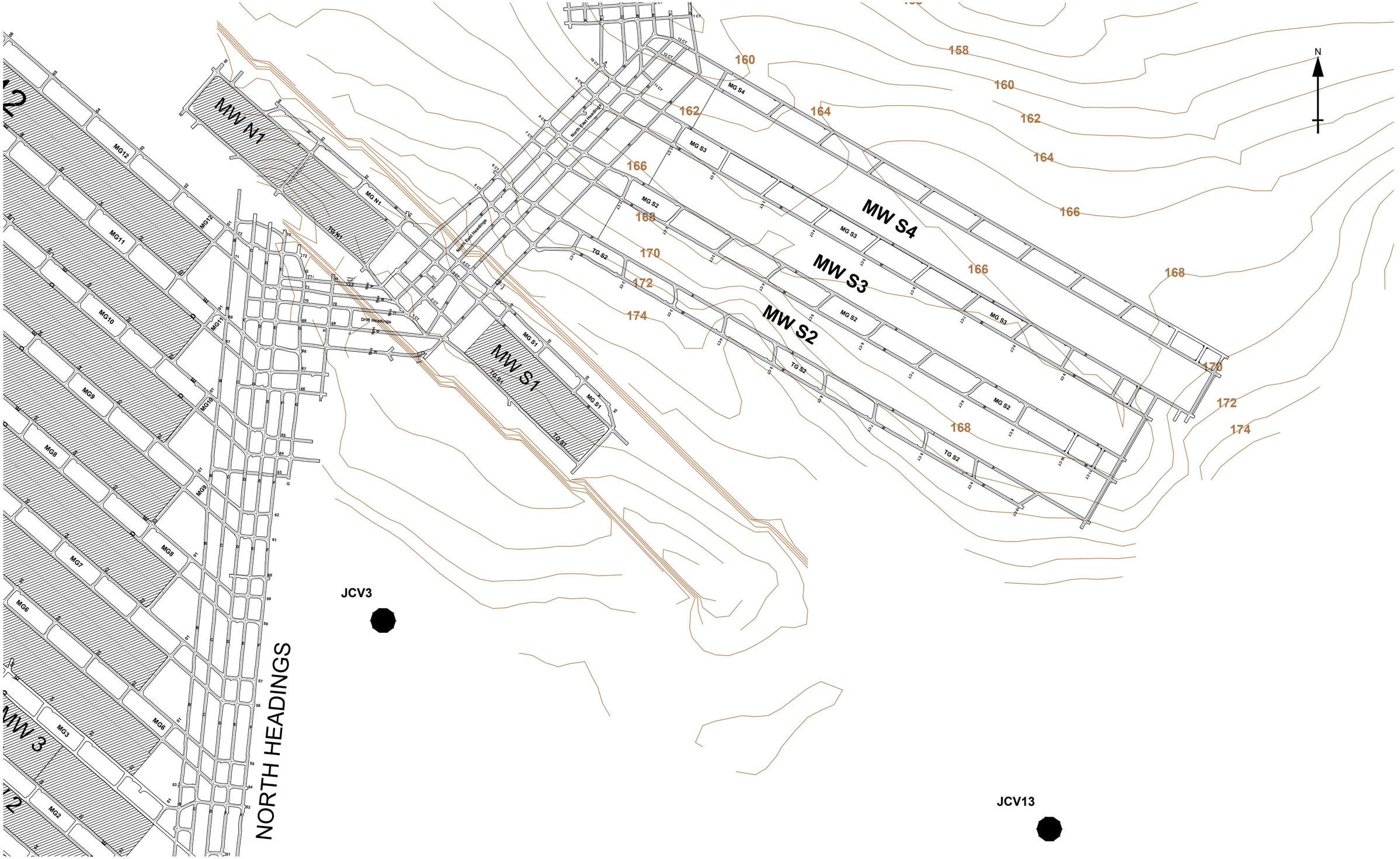
Modifying or reducing the impact of subsidence on a feature to within tolerable limits.

Super-Critical Area

A panel width greater than the critical width.

Tilt

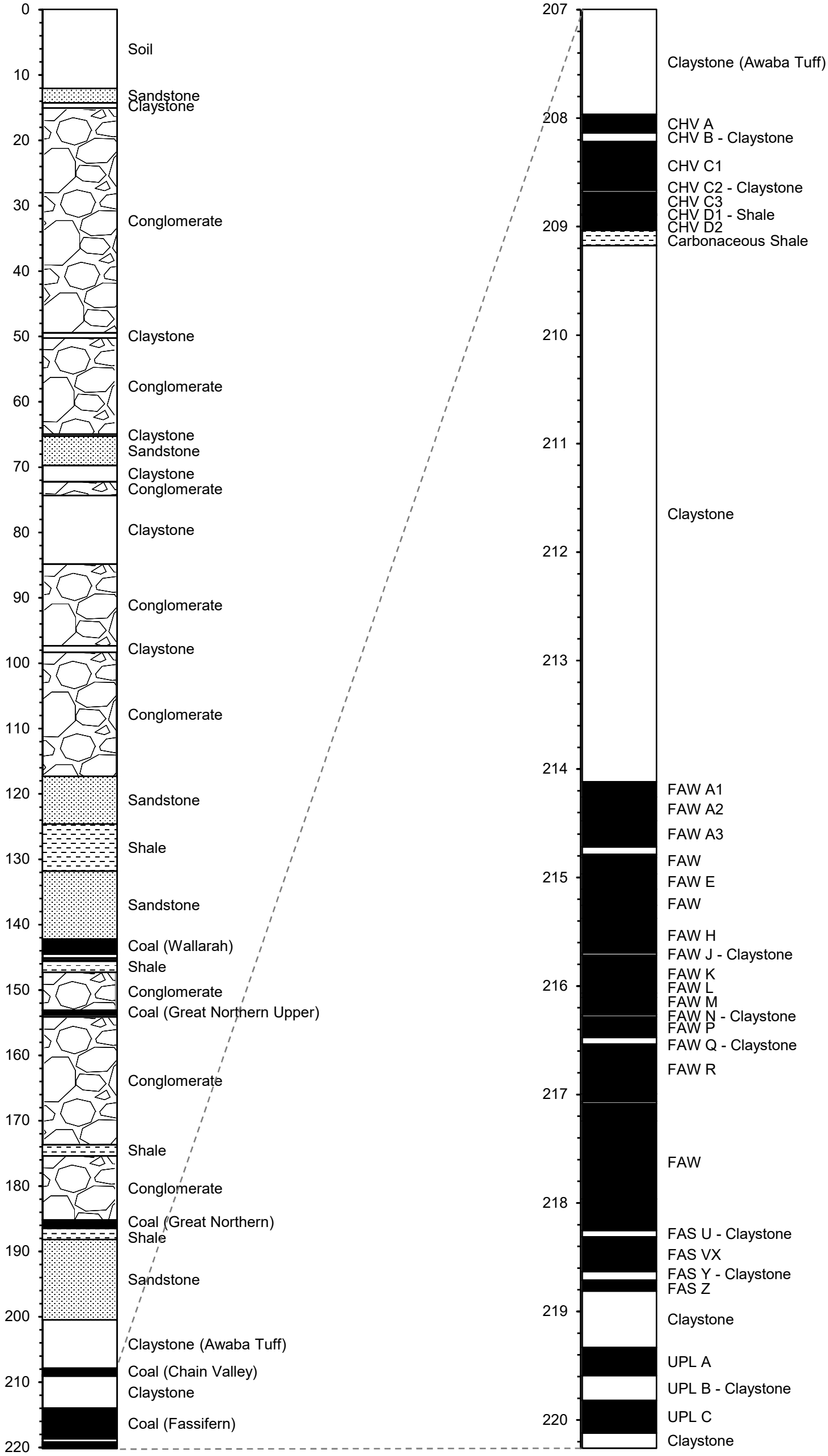
The rate of change of subsidence between two points a known distance apart, plotted at the mid-point and commonly expressed as mm/m.



Key:

~ - Depth of Cover (m)

Engineer:	D. Hill	**Client:**	Chain Valley Colliery
Drawn:	R. de Laubadere	**Title:**	Mine Plan Showing Location of Potential S4 Panel with Boreholes and Overburden Thickness Contours including Lake Bed Sediment to FAW Working Section Roof (C Ply)
Date:	31.07.19		
	STRATA²	**Ref:**	CHV-010
		Revision No:	2
		Scale:	NTS
		Figure No:	1



Engineer:	D. Hill	**Client:**	Chain Valley Colliery
Drawn:	R. de L.	**Title:**	JCV13 Lithology Log
Date:	24.07.19		
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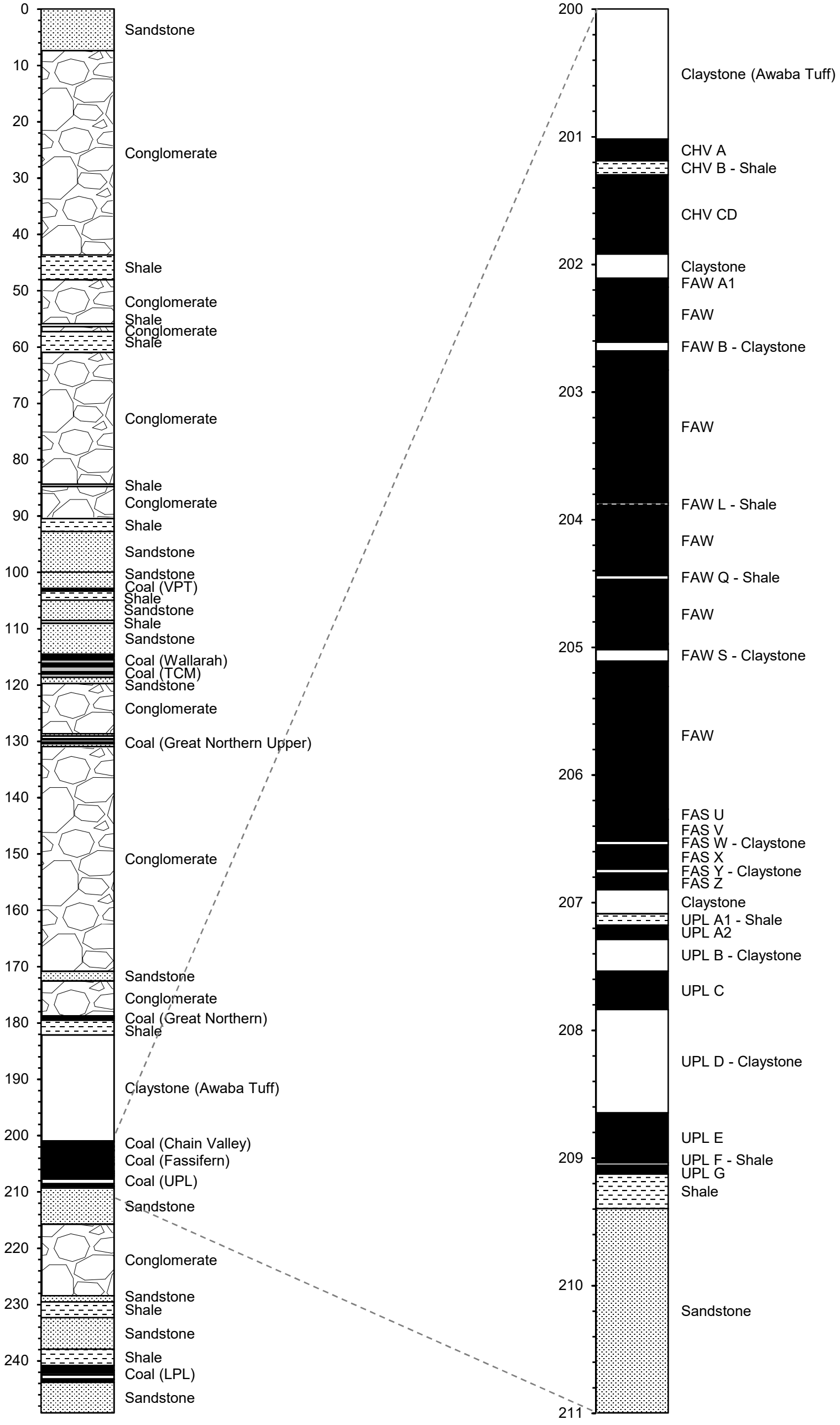
		Revision No:	2
		Scale:	N/A
		Figure No:	2a



Engineer:	D. Hill	**Client:**	Chain Valley Colliery
Drawn:	R. de L.	**Title:**	JCV3 Lithology Log
Date:	24.07.19		
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		Revision No:	2
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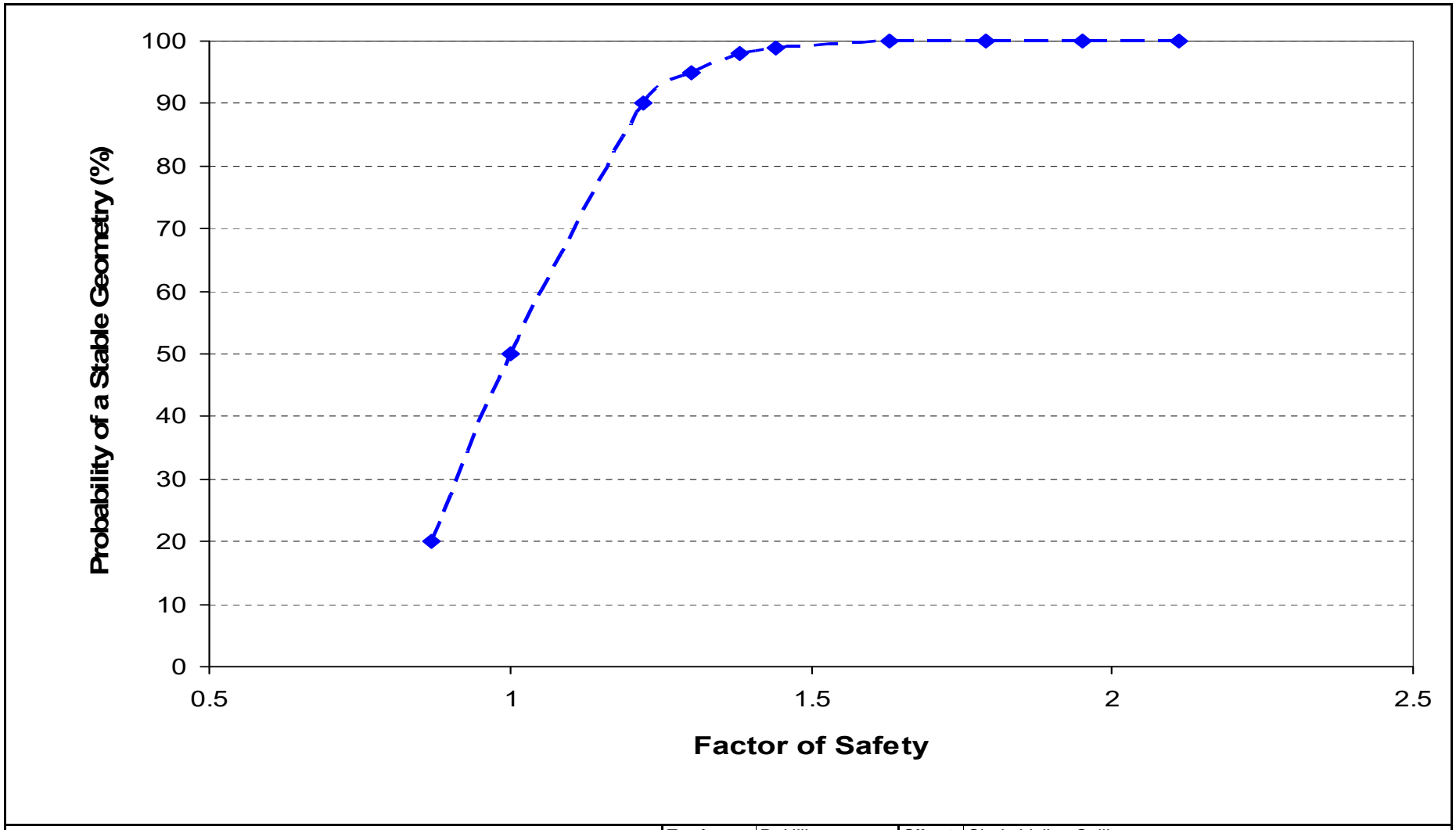
		Figure No:	2b



Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Salamon Factor of Safety versus Probability of Stability		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
		Scale:	N/A	**Figure No:**	3

Figure 4a: Successful and Failed Cases (Failure nominally defined by >200mm of Subsidence)

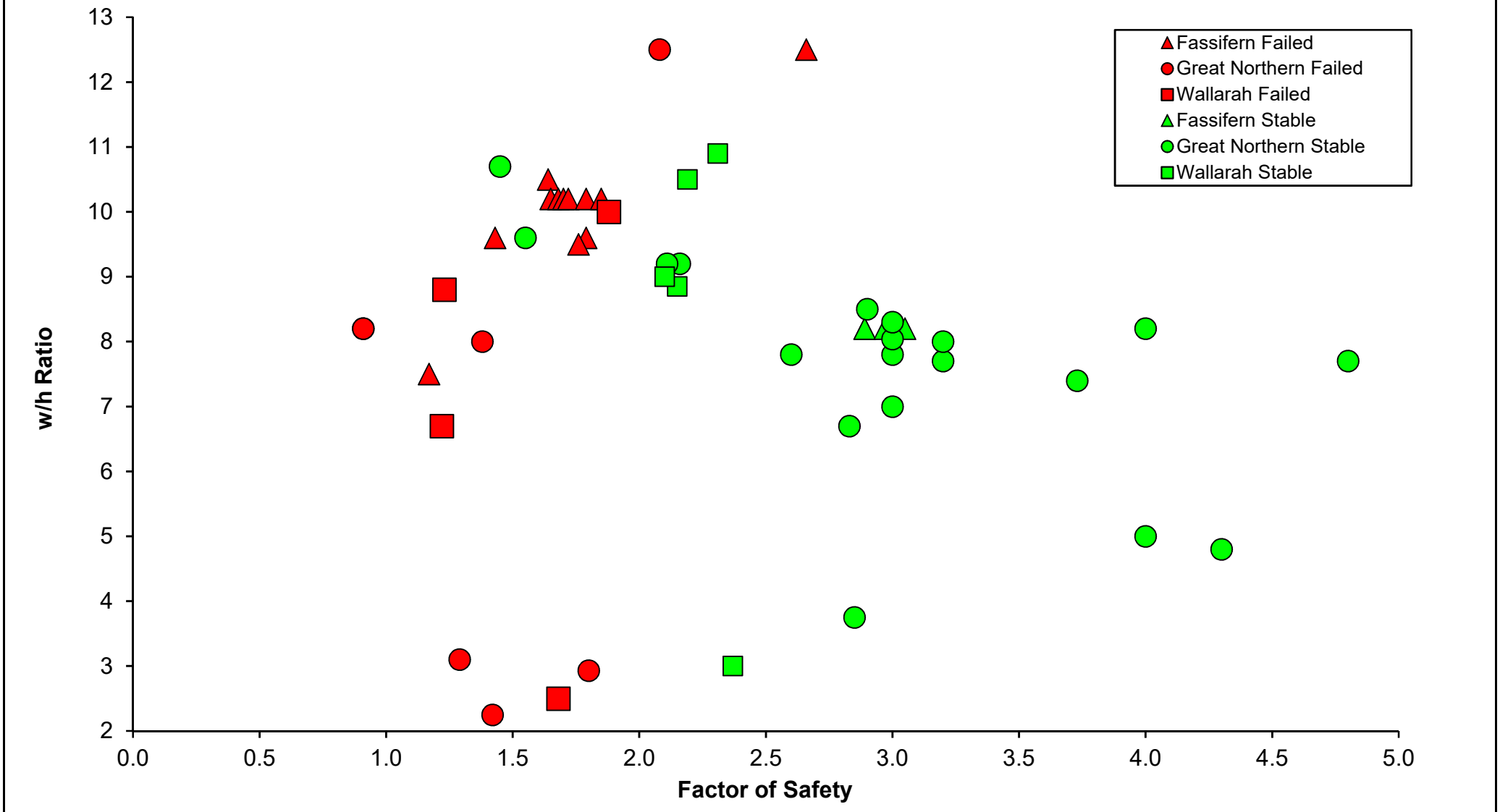
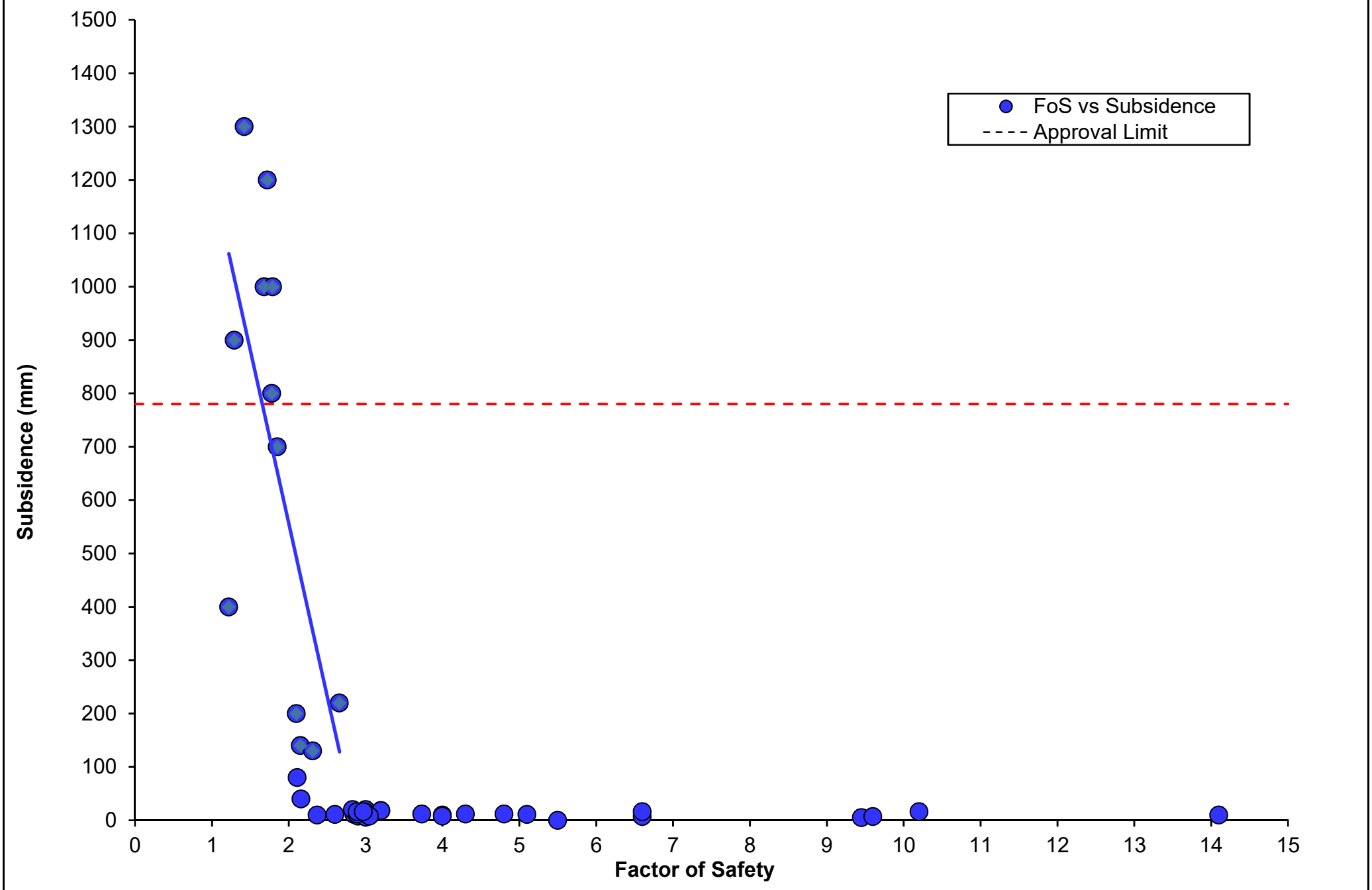


Figure 4b: Subsidence versus FoS, at Pillar Stress Values of <15MPa



Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Lake Macquarie Pillar Database		
Date:	25.07.2019				
STRATA²		**Ref:**	CHV-010	**Revision No:**	2
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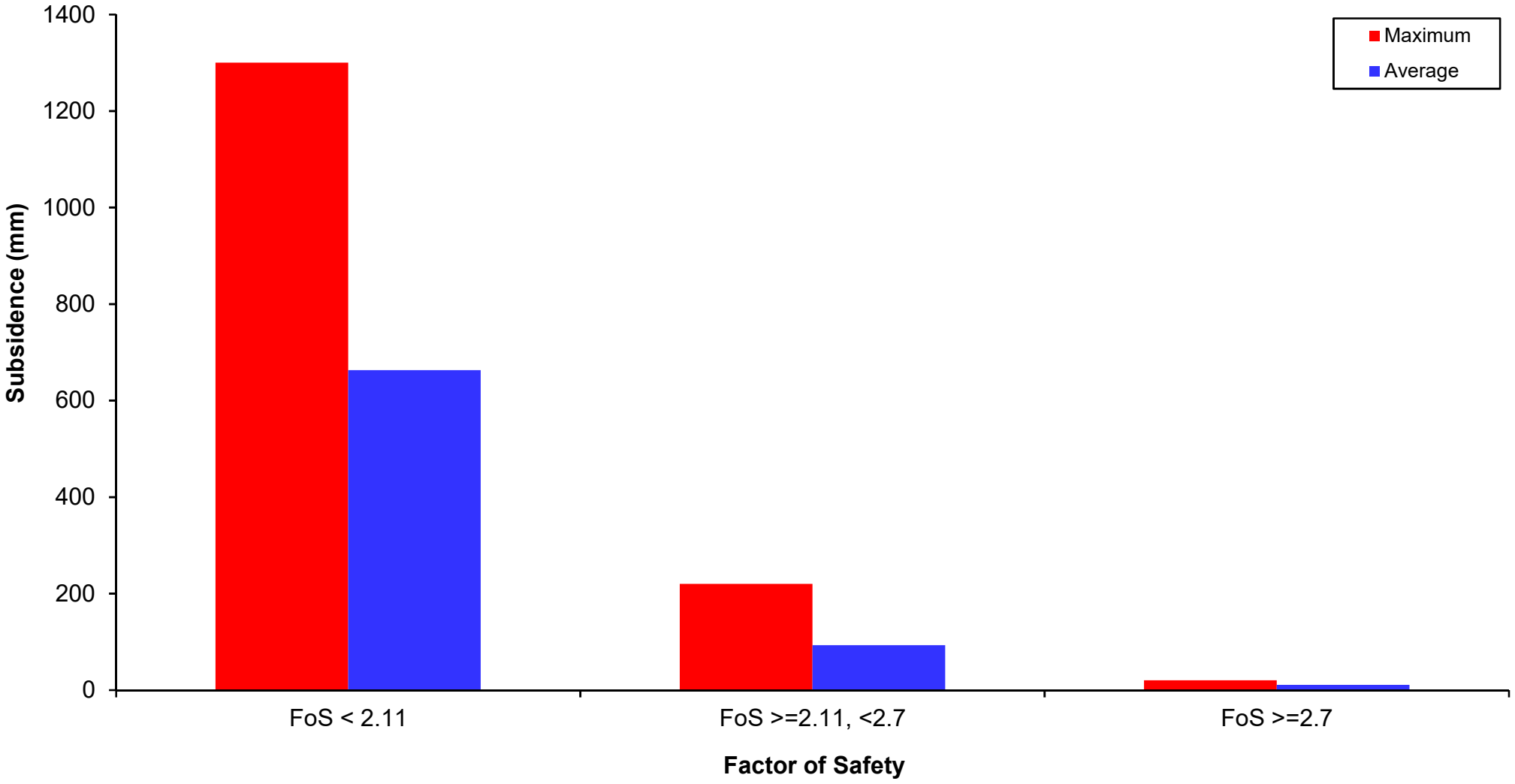

Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Lake Macquarie Case Histories - Subsidence versus Salamon Factor of Safety		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
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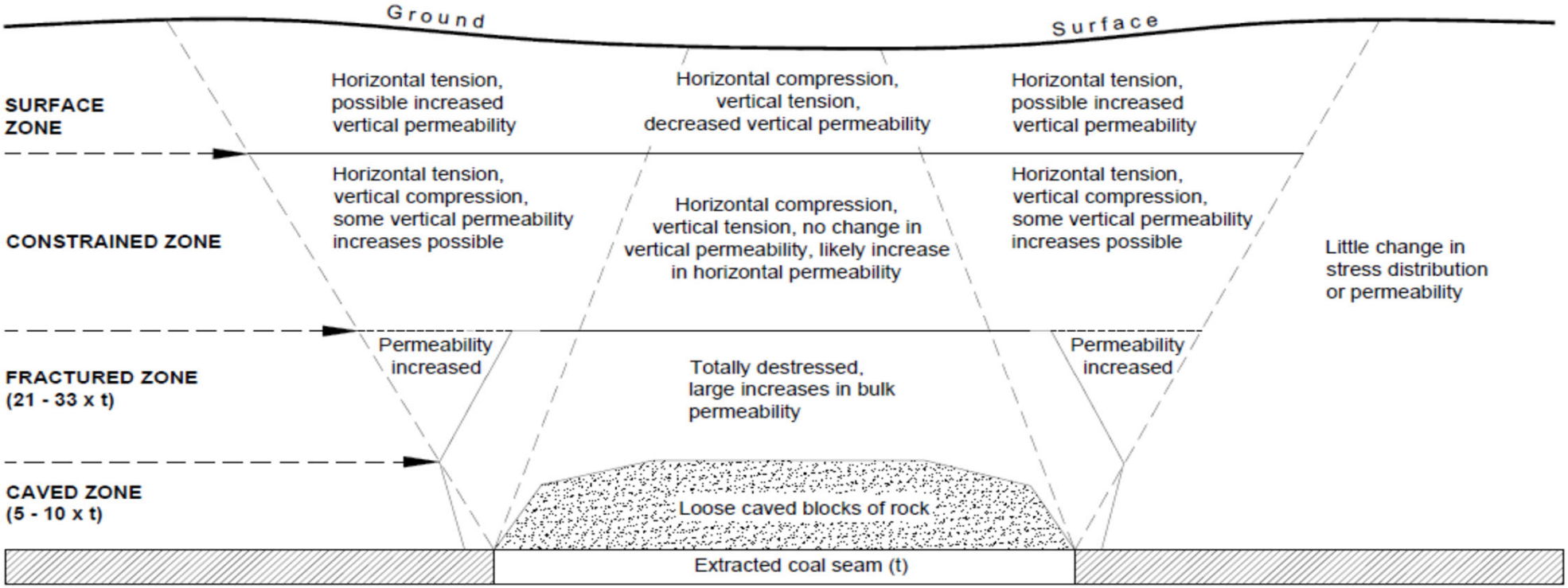

Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Hydrogeological Model above a Caved Longwall Panel **(adapted from Forster and Enever, 1992)**		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
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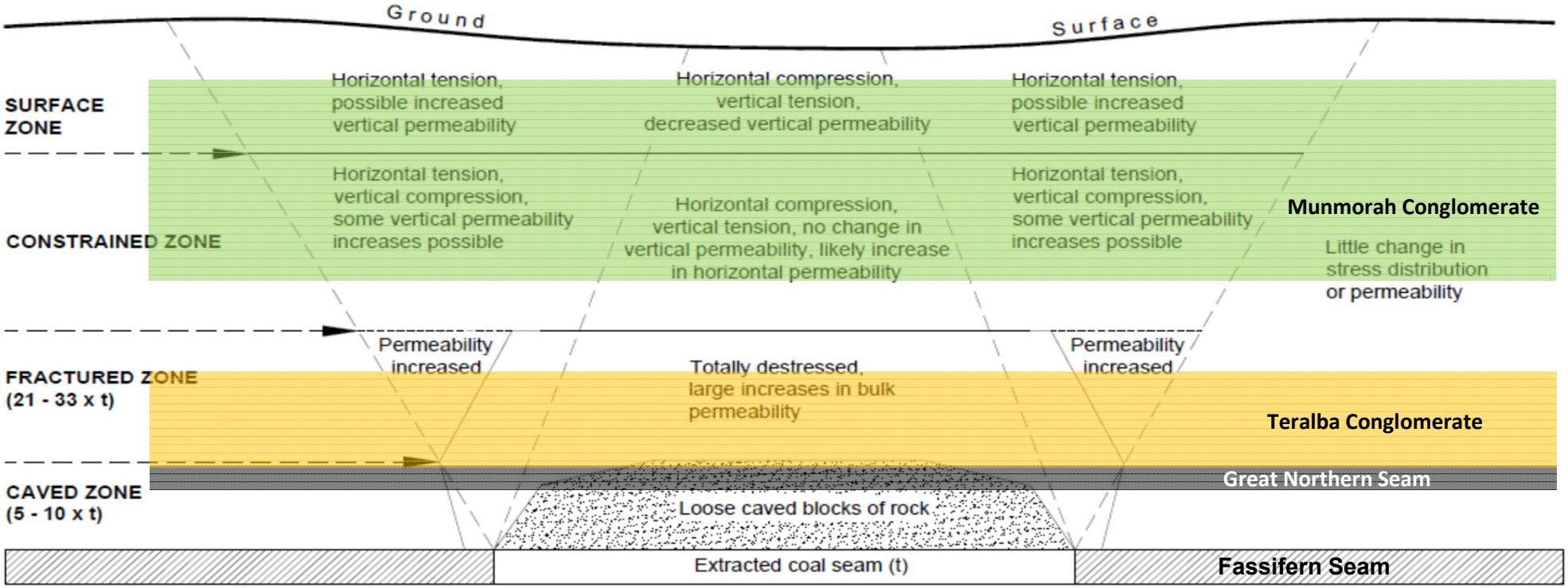

Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Hydrogeological Model above a Caved Longwall, including the Approximate Locations of the GN Seam, Teralba and Munmorah Conglomerates in the Overburden		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
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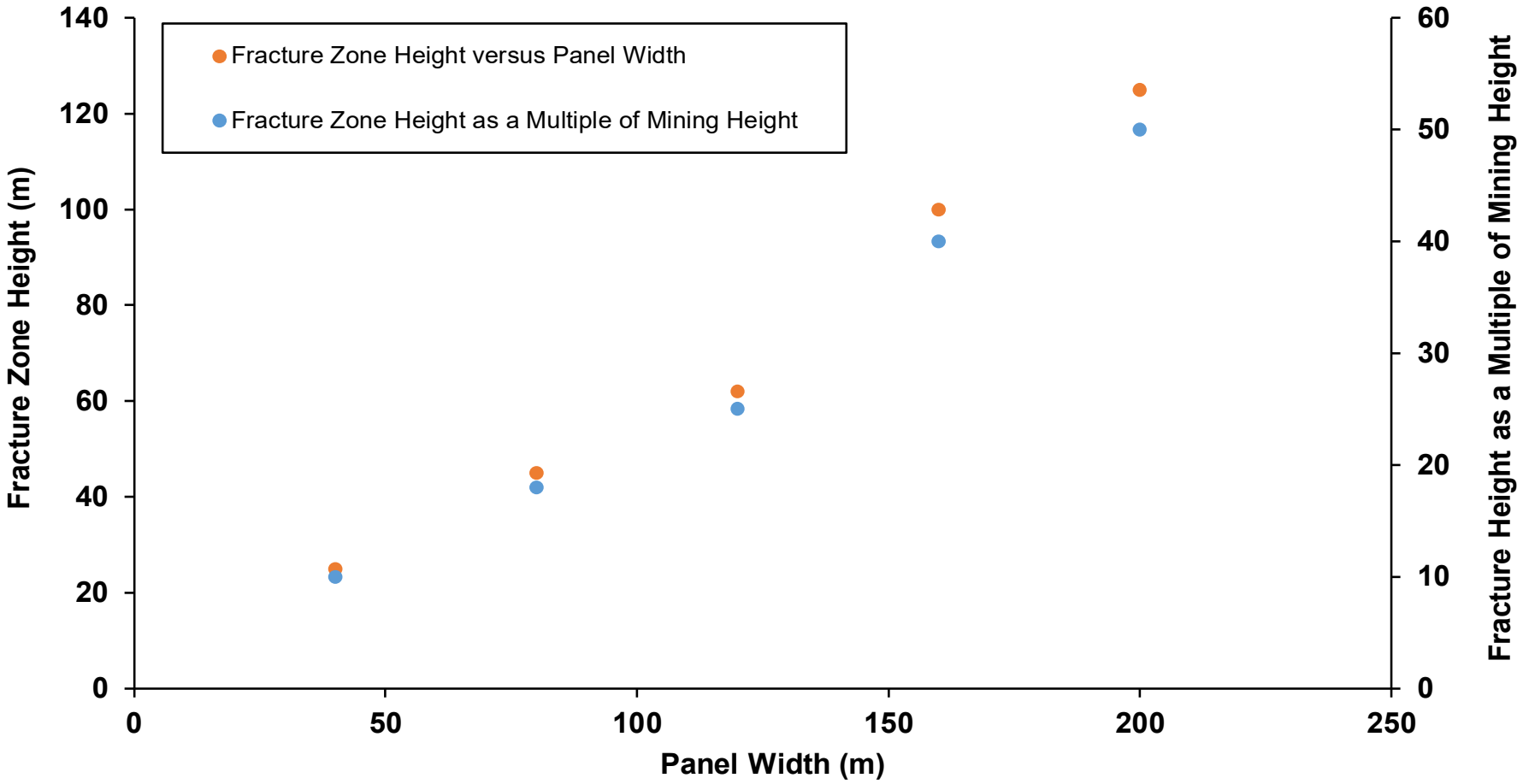

Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Fracture Zone Heights from Numerical Modelling (Follington and Isaac, 1990)		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
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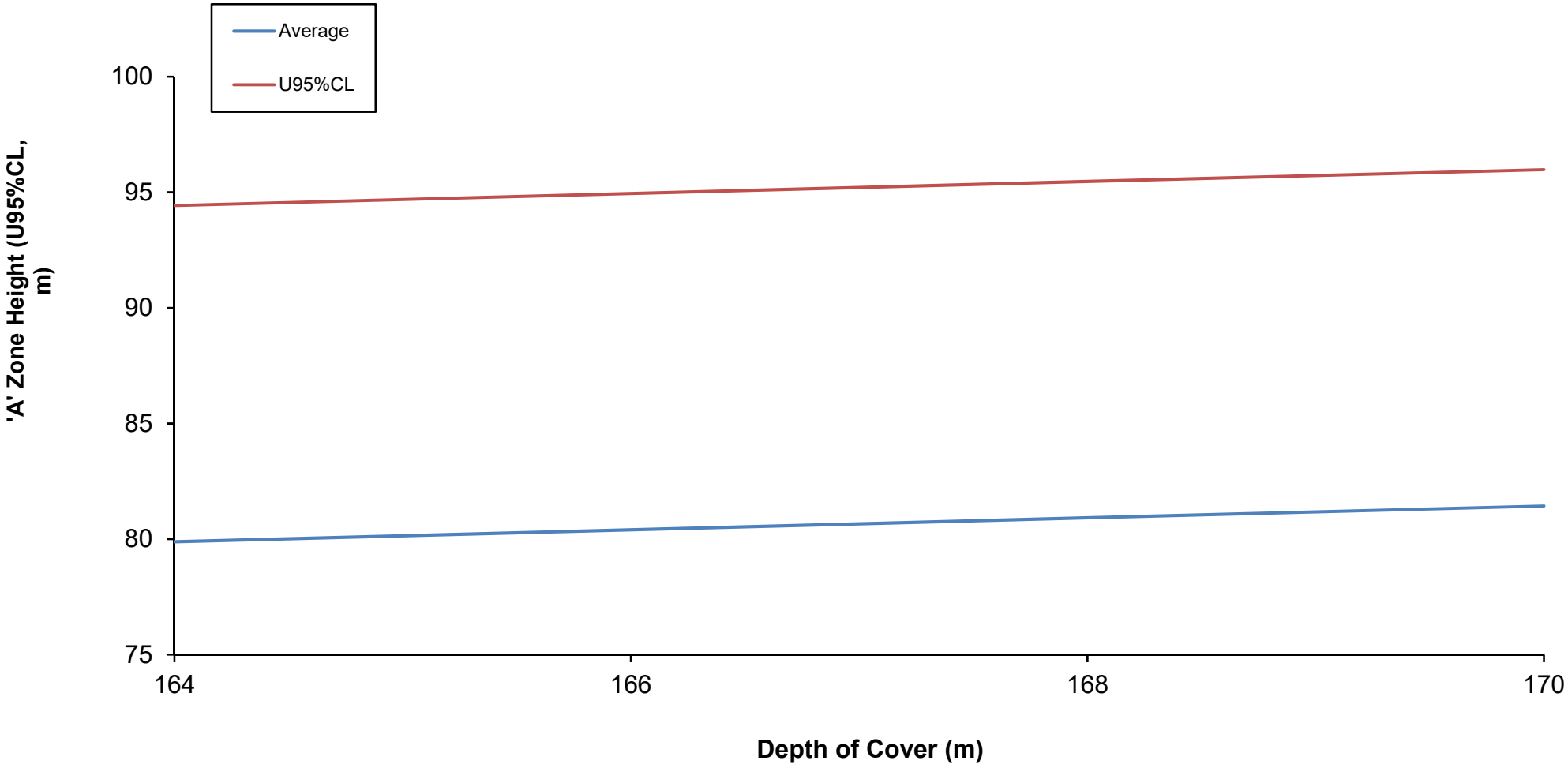

Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Heights of Connective Fracturing for CVC Panel S4, based on the **Ditton and Merrick (2014)** 'A' Zone Equation (Height = 3.5m)		
Date:	24.07.19				
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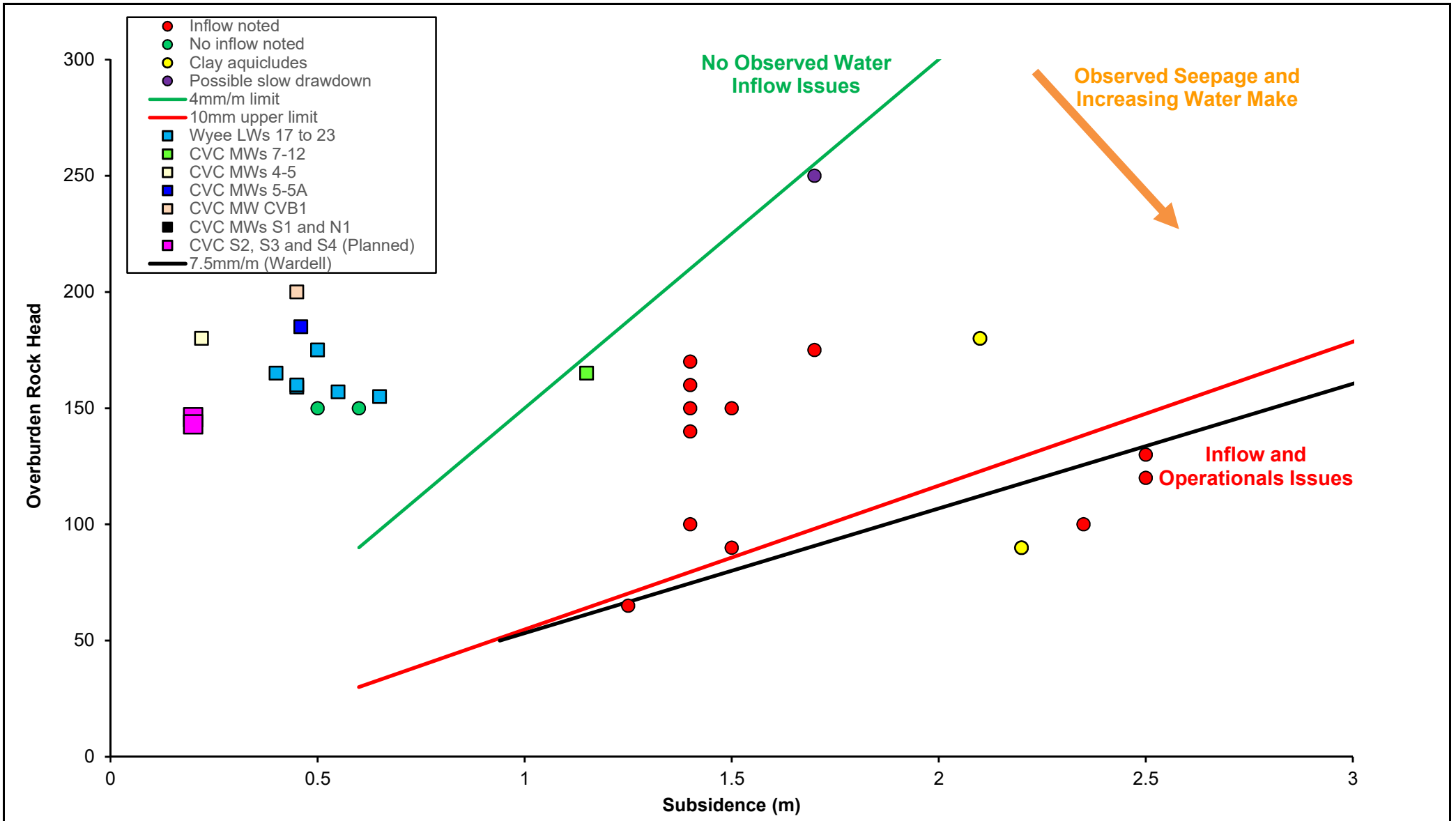
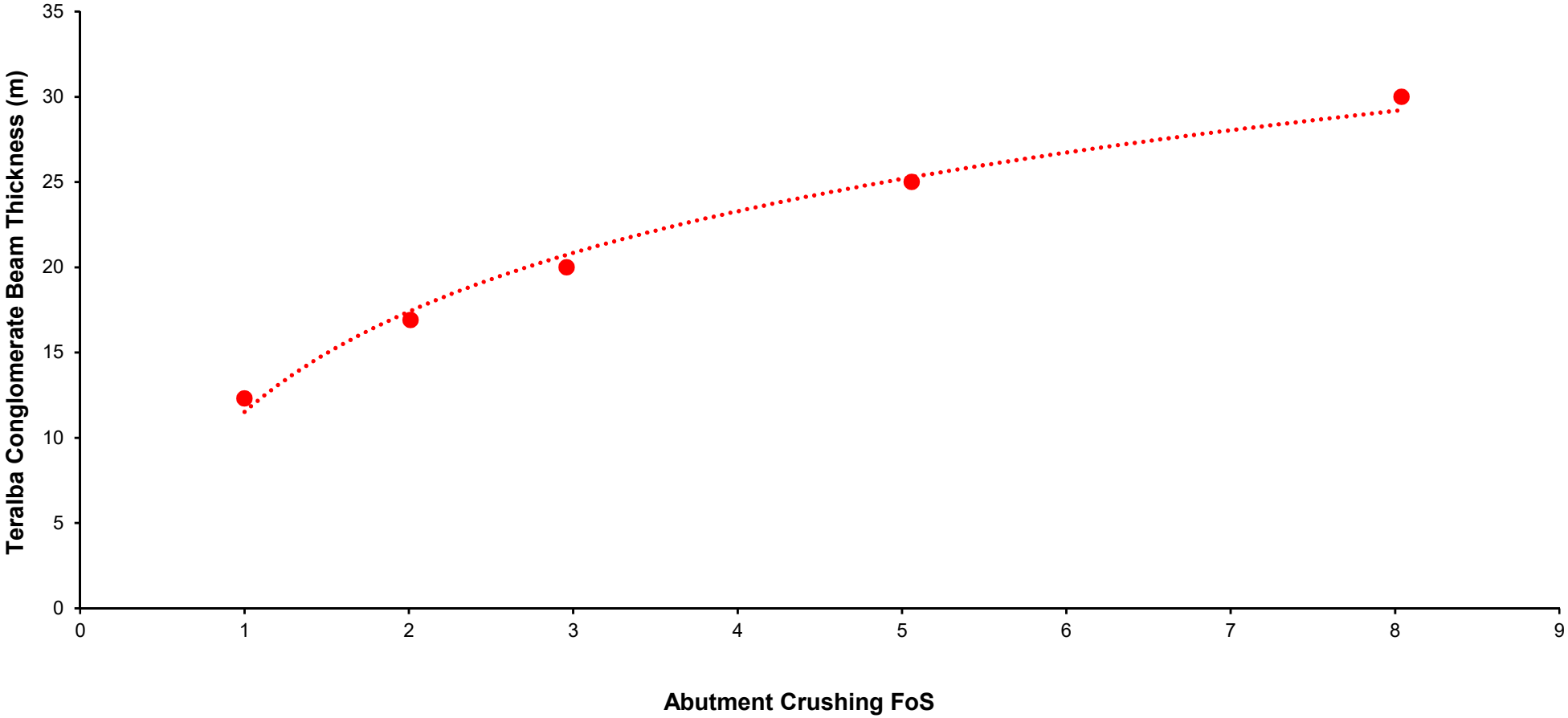


Note: Systematic tensile strain limit lines assume a k value of 0.6, whereas the CVC and Wyee values are based on the local k value of 0.4.

Engineer:	D. Hill
Drawn:	D. Hill
Date:	24.07.19

STRATA²

Client:	Chain Valley Colliery		
Title:	Australian Colliery Inflow Experiences relative to Subsidence and Rock Head Thickness (adapted from **SCT, 2008**), including CVC and Wyee Data		
Ref:	CHV-010	**Revision No:**	2
Scale:	N/A	**Figure No:**	9



Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Teralba Conglomerate Beam Stability Results		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
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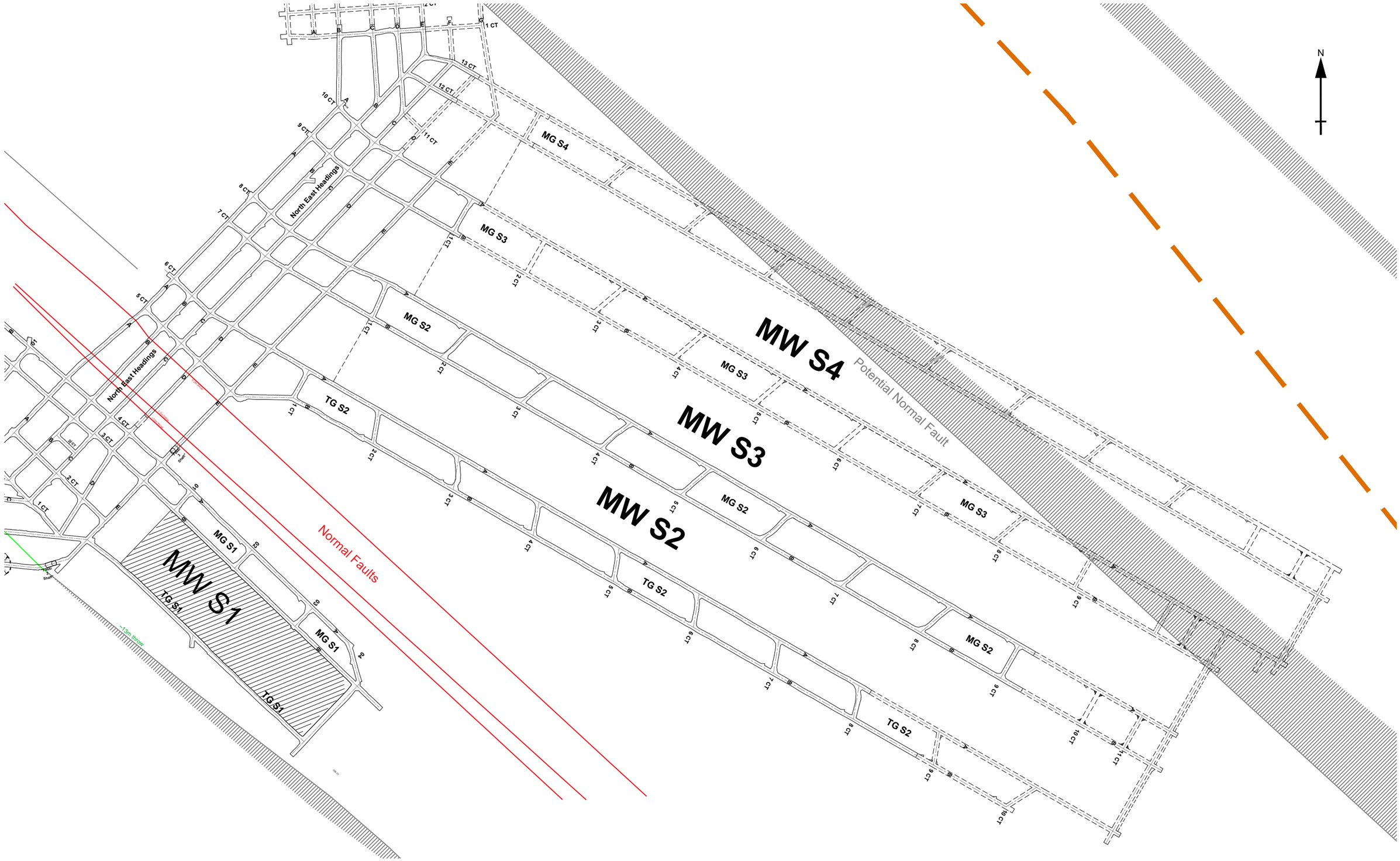

Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	R. de Laubadere	**Title:**	Mine Plan Showing Projected Fault in the Vicinity of MWS4		
Date:	31.07.19				
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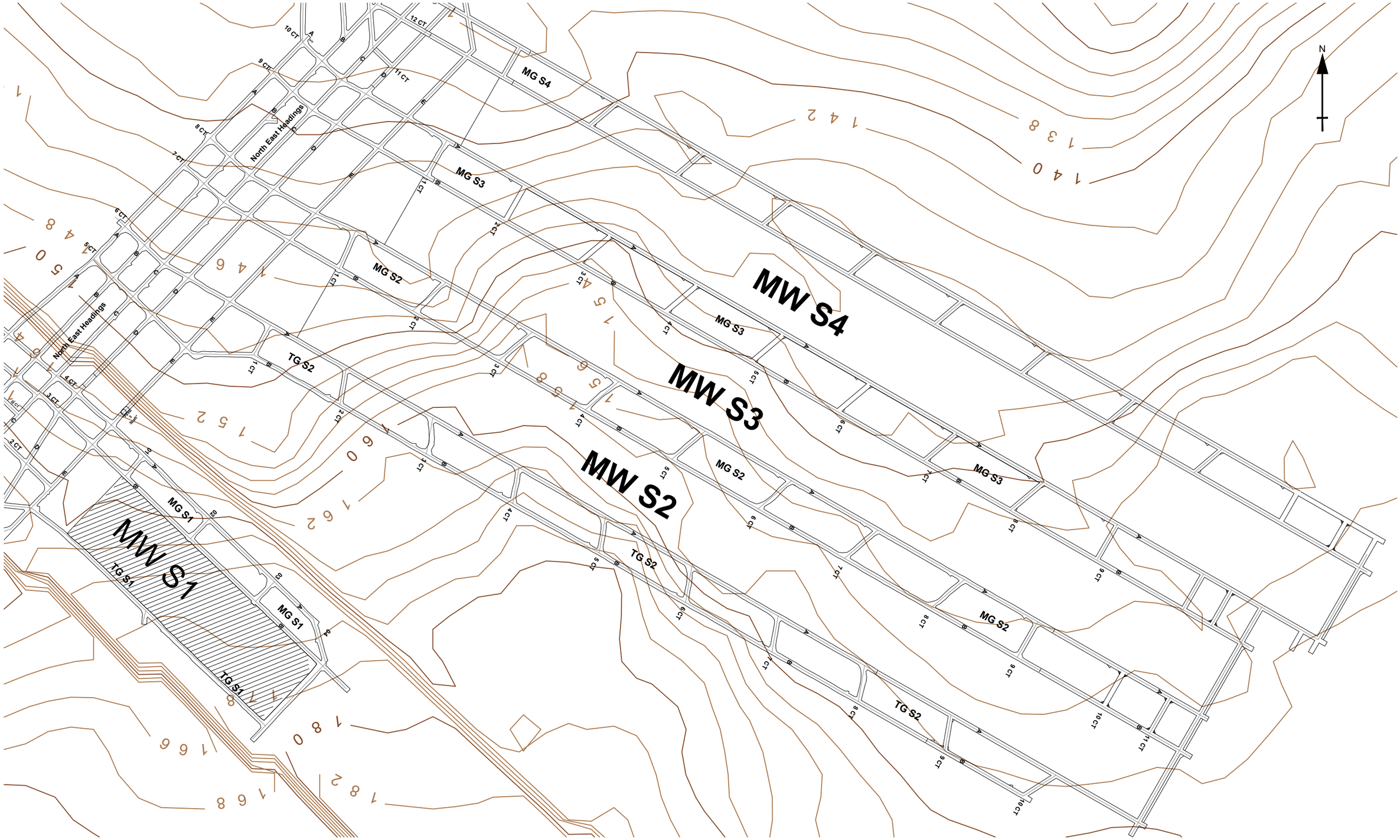

Key:

~ - Rock Head Contours (m)

Engineer:	D. Hill	**Client:**	Chain Valley Colliery
Drawn:	R. de Laubadere	**Title:**	Mine Plan Showing Rock Head Contours for MWS4
Date:	31.07.19		
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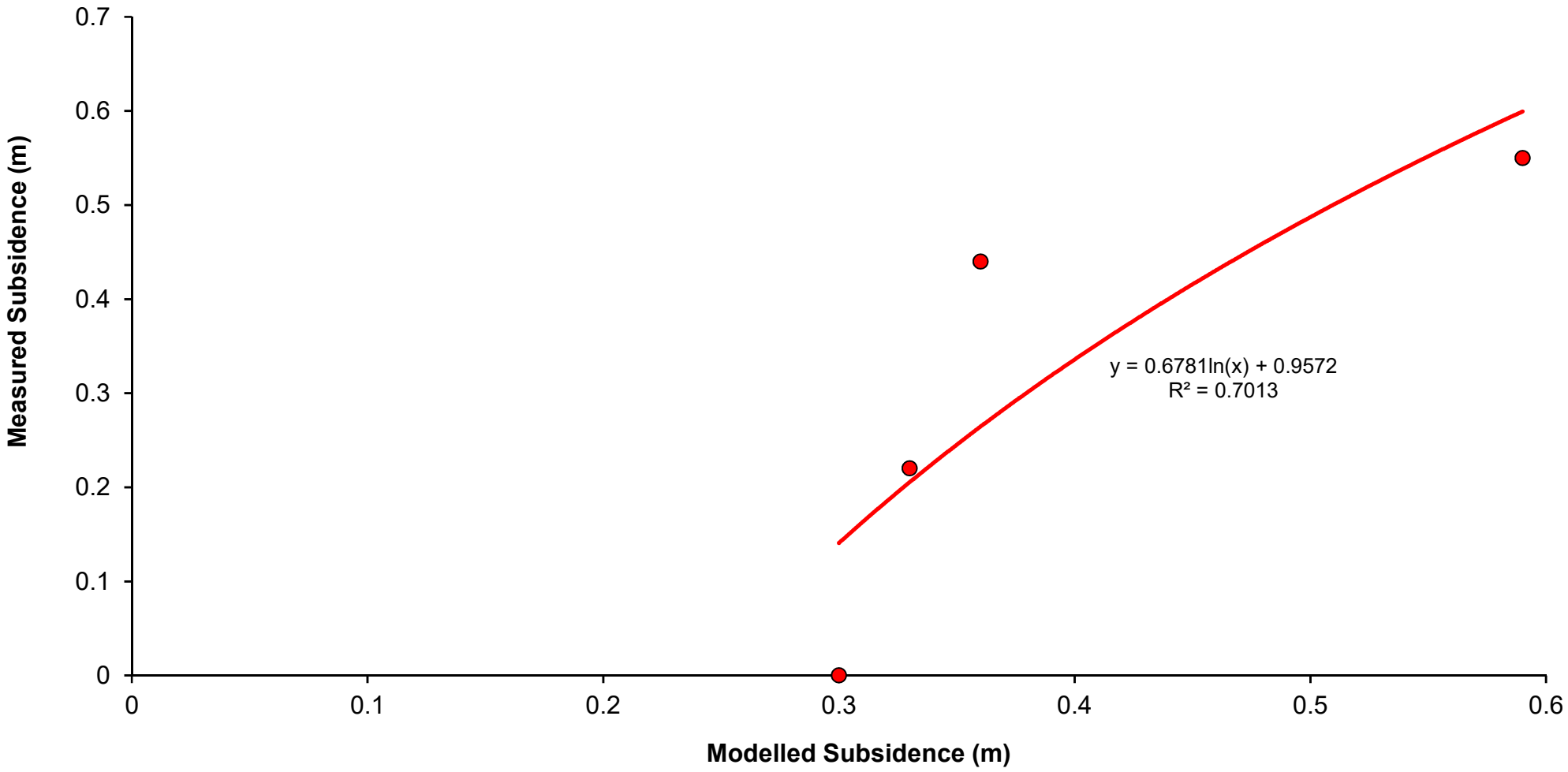
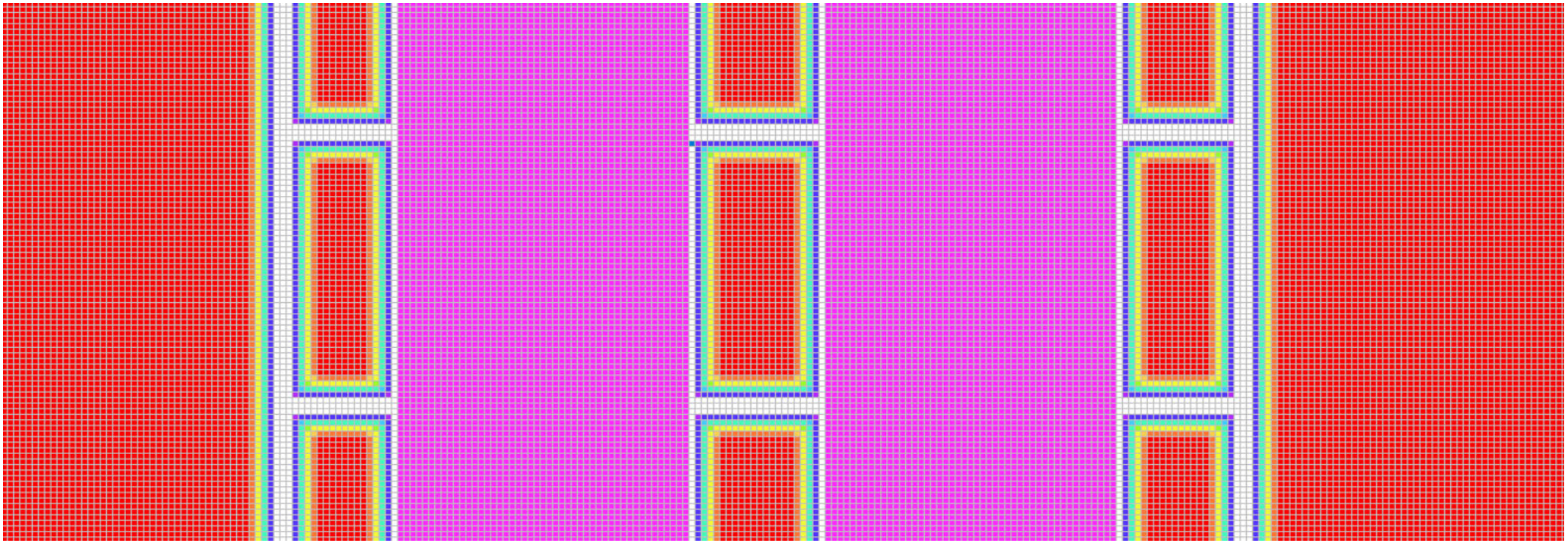
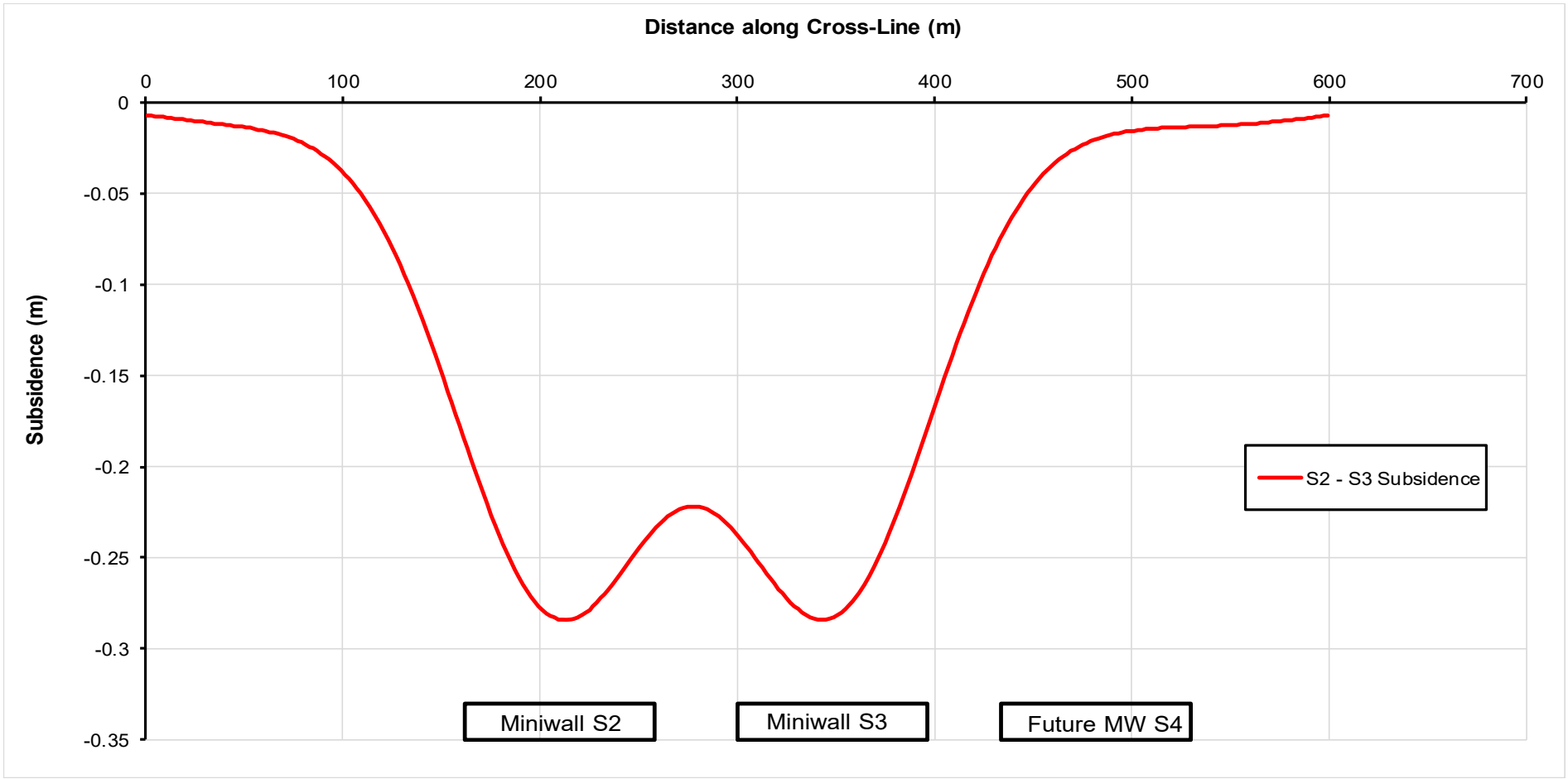


Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	LaModel Calibration Results: Predicted versus Measured Subsidence for Chain Valley Colliery Miniwall Panels and Wyee Colliery Longwall Panels		
Date:	24.07.19				
STRATA²		**Ref:**	CHV-010	**Revision No:**	2
		Scale:	N/A	**Figure No:**	13

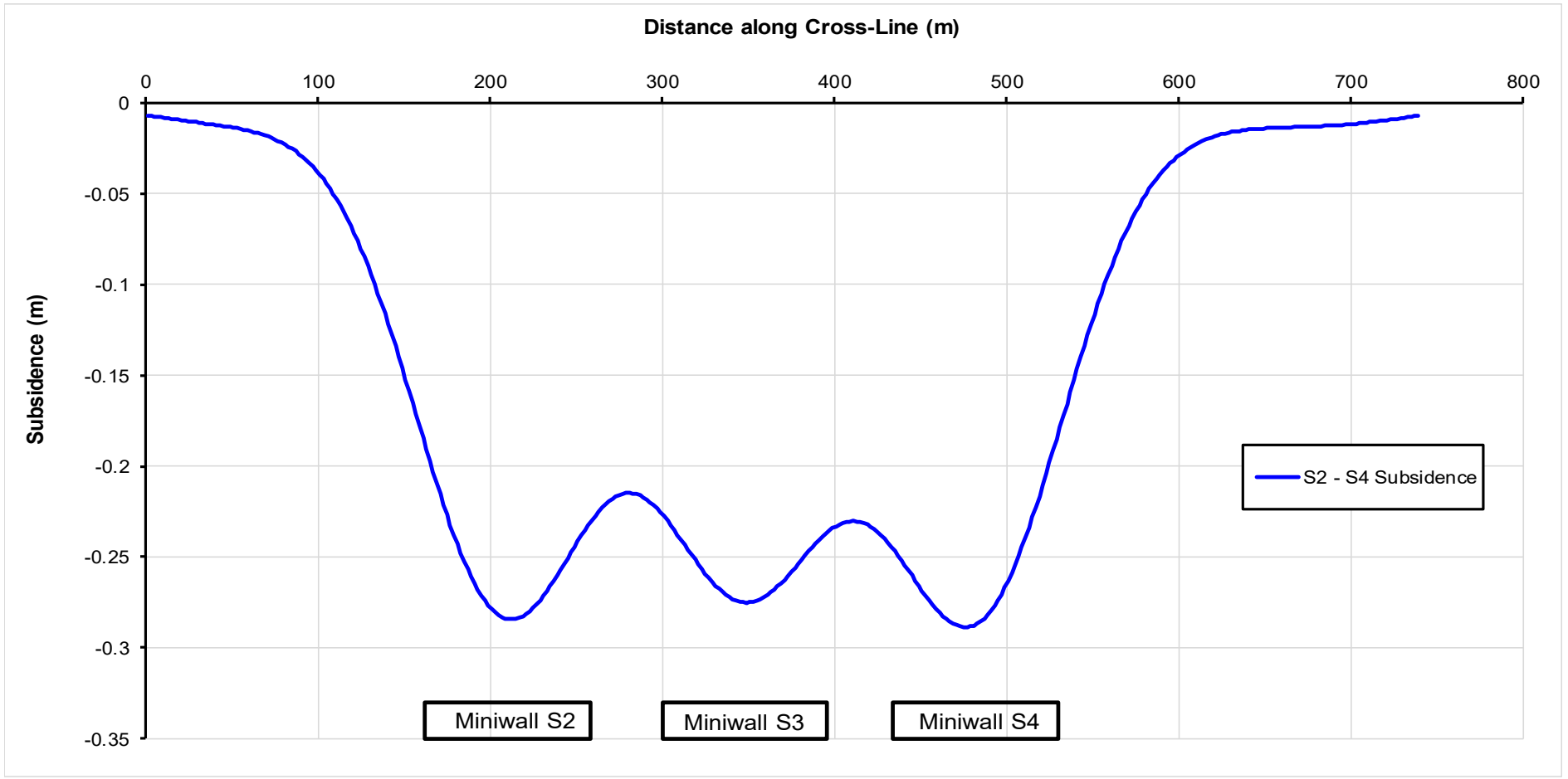
Abutment South of MW S2 | TG S2 | MW S2 | MG S2 | MW S3 | MG S3 | Future MW S4



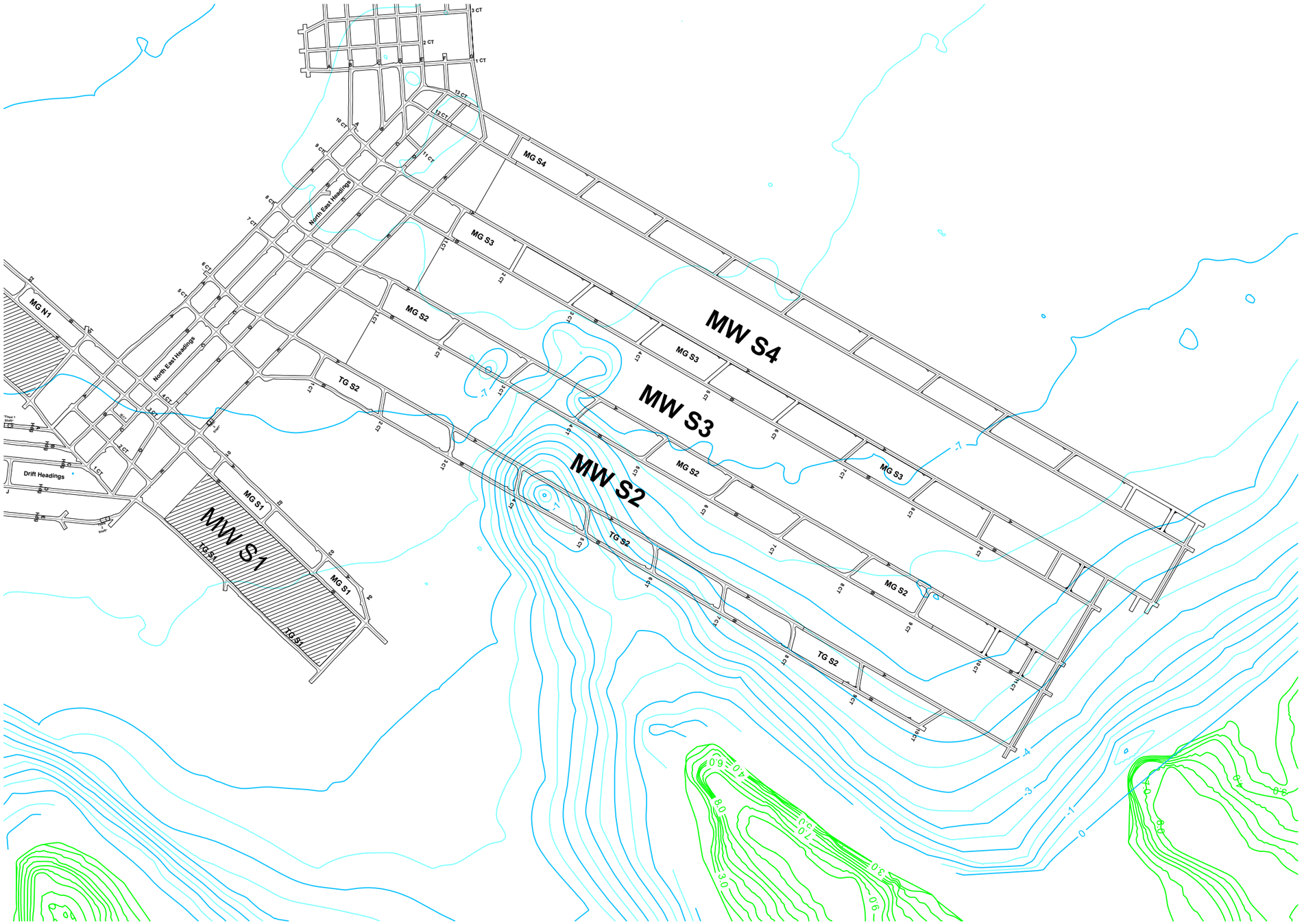
Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Section of LaModel Grid at Step 1		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
		Scale:	N/A	**Figure No:**	14



Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Modelled Subsidence Profile following Step 1		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
		Scale:	N/A	**Figure No:**	15



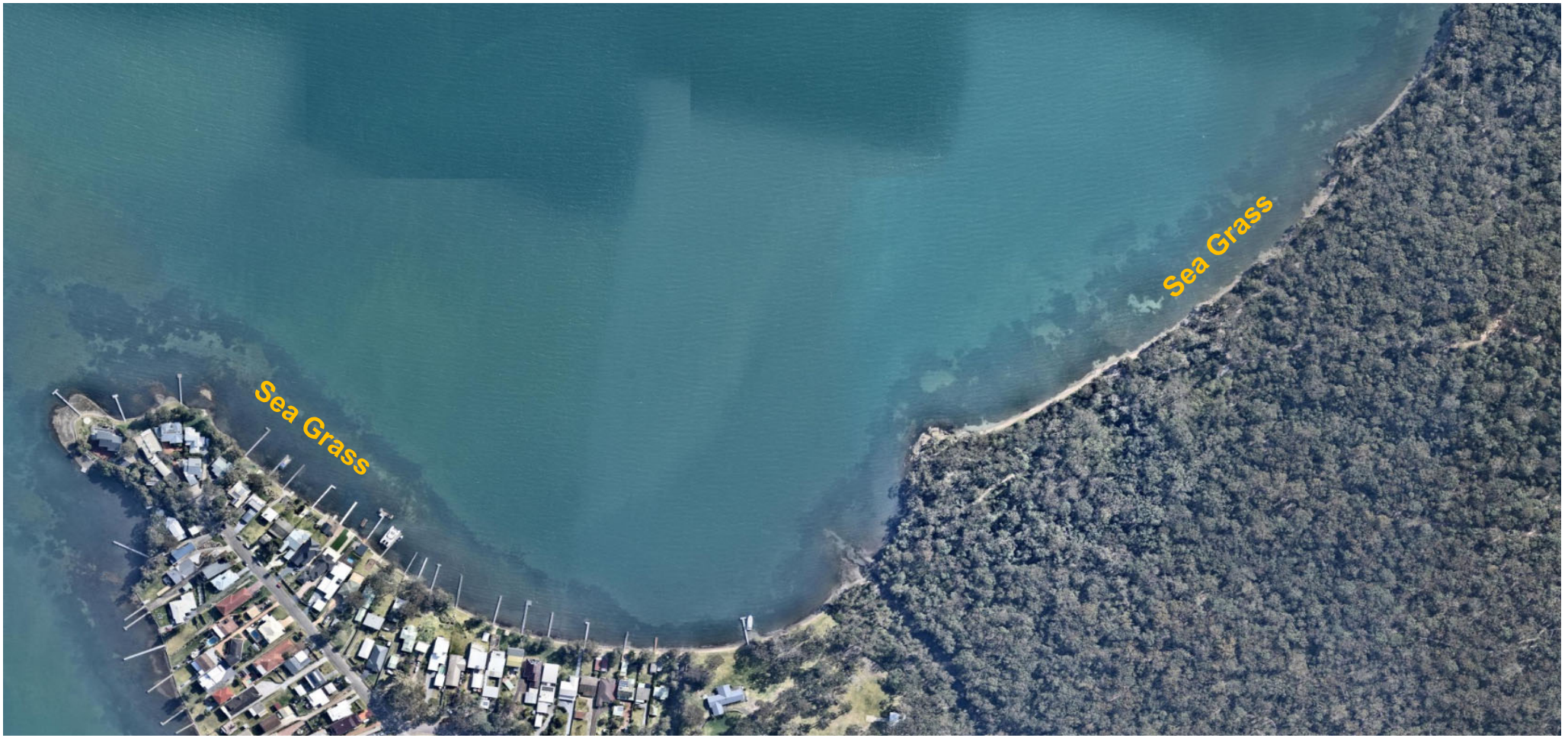
Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Modelled Subsidence Profile following Step 2		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
		Scale:	N/A	**Figure No:**	16



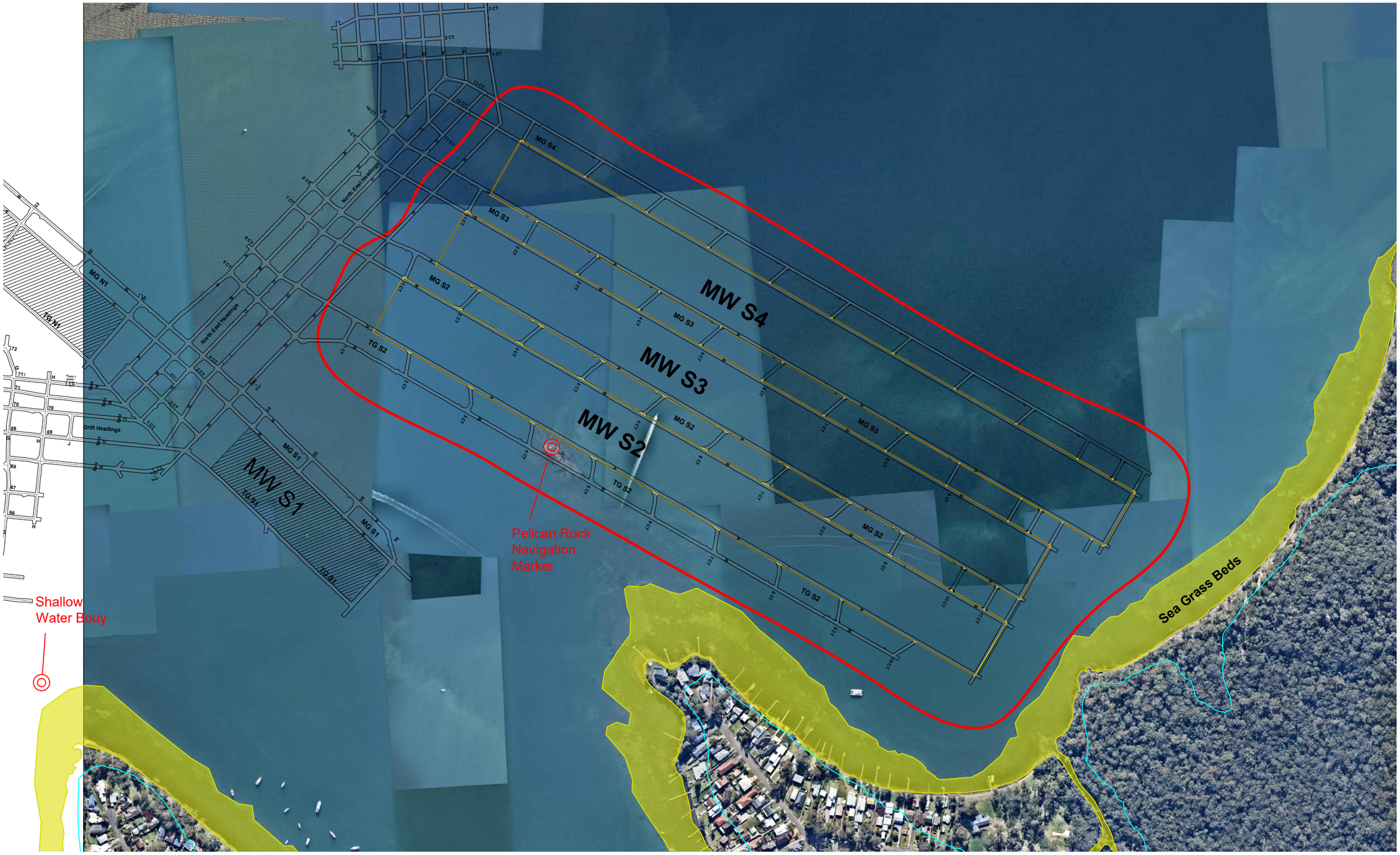
Key:

- Lake bed level contours (m)
- Surface level contours (m)

Engineer:	D. Hill	**Client:**	Chain Valley Colliery
Drawn:	I. Saliamon	**Title:**	Mine Plan Showing Surface and Lake Bed Level Contours
Date:	31.07.19		
STRATA^2		**Ref:**	CHV-010
		Revision No:	2
		Scale:	NTS
		Figure No:	17



Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Aerial Photograph showing Sea Grass Extent around Summerland Point		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
		Scale:	N/A	**Figure No:**	18

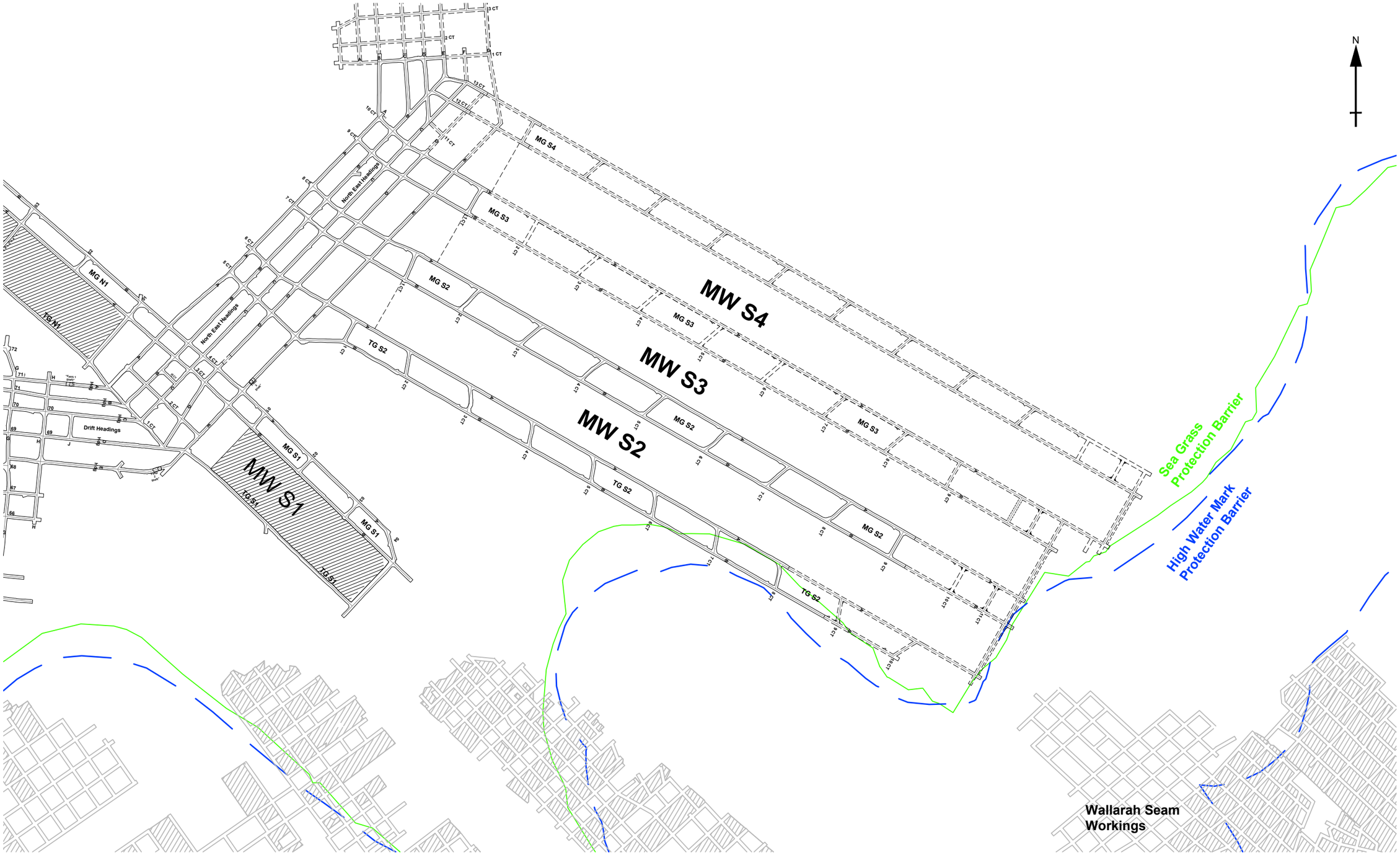


Key:

- High water mark
- Mapped sea grass beds
- Limit of Subsidence Based on Nominal Angle of Draws of 26.5°

Engineer:	D. Hill	**Client:**	Chain Valley Colliery
Drawn:	I. Saliamon	**Title:**	Mine Plan Showing Sea Grass Beds
Date:	31.07.19		
		Ref:	CHV-010
		Revision No:	2
		Scale:	NTS
		Figure No:	19

STRATA2

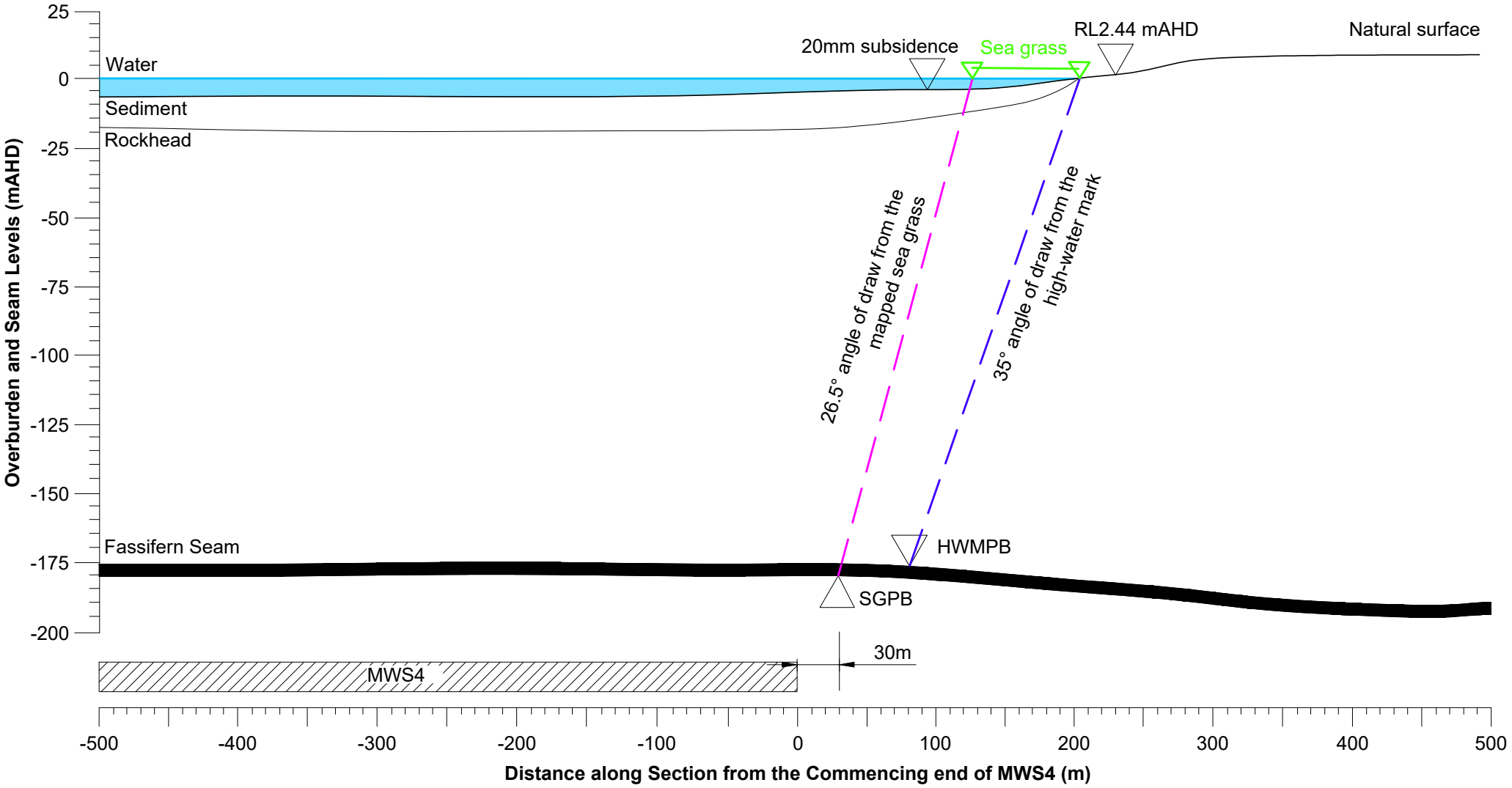


Key:

- High Water Mark Protection Barrier, based on a 35° Angle of Draw from the High-Water Mark
- Sea Grass Protection Barrier, based on a 26.5° Angle of Draw from the Sea Grass Beds

Engineer:	D. Hill	**Client:**	Chain Valley Colliery
Drawn:	I. Saliamon	**Title:**	Mine Plan Showing High Water Mark Protection Barrier and Sea Grass Protection Barrier
Date:	31.07.19		
		Ref:	CHV-010
		Revision No:	2
		Scale:	NTS
		Figure No:	20

STRATA²



Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	I. Saliamon	**Title:**	Long-section at the Commencing End of MWS4, along the Panel Centre Line		
Date:	05.05.20				
STRATA²		**Ref:**	CHV-010	**Revision No:**	2
		Scale:	NTS	**Figure No:**	21

Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Built Features South-East of MW S4 (Photograph courtesy of MSEC)		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
		Scale:	N/A	**Figure No:**	22

Engineer:	D. Hill	**Client:**	Chain Valley Colliery		
Drawn:	D. Hill	**Title:**	Pelican Rock Navigation Marker, South of MW S2 (Photograph courtesy of MSEC)		
Date:	24.07.19				
STRATA^2		**Ref:**	CHV-010	**Revision No:**	2
		Scale:	N/A	**Figure No:**	23

Appendix 16 First Workings Letter and Endorsement

Energy & Resources
Planning & Assessment
Contact: Colin Phillips
Telephone: 9274 6483
Email: colin.phillips@planning.nsw.gov.au

Chris Armit
Environment and Community Coordinator
Chain Valley Colliery
Delta Coal
PO Box 7115
Mannering Park NSW 2259

Dear Mr Armit

Chain Valley Extension Project (SSD 5465) – Miniwall S4 Extraction Plan
Approval of First Workings - Appointment of Experts

I refer to your letter of 29 June 2019 seeking approval for first workings associated with planned Miniwall S4. In accordance with condition 9 of Schedule 4 of the mine's consent, the Secretary has approved the first workings as shown in the plans attached to your letter.

I refer to your second letter dated 29 June 2019, and email of 03 September 2019, seeking the Secretary's endorsement of suitably qualified and experienced experts to prepare an Extraction Plan for Miniwall S4, in accordance with condition 7 of Schedule 4 of the mine's consent.

The Department has reviewed the qualifications of:

- Tim Chisholm, Mine Surveyor, Delta Coal;
- David Hill, Principal Geotechnical Engineer, Strata2;
- Chris Armit, Environmental Coordinator, Delta Coal; and
- Dave Richards, Environmental Scientist, EMM Consulting.

The Secretary has endorsed the appointment of the nominated experts.

If you require any further information, please contact Colin Phillips.

Yours sincerely

Matthew Sprott
A/Director Resource Assessments
Energy and Resource Assessments
As the Secretary's nominee