vgt environmental compliance solutions and laboratories

July 2022

~~Site~~ Rehabilitation Management Plan for Luddenham Clay / Shale Mine, MLA 592 (Act 1992)

www.vgt.com.au

We offer a personalised,
Professional and complete service
Tailored to meet individual needs.

Summary Table	
Name of Mine	Luddenham Clay / Shale Mine
RMP Commencement Date	July 2022
Mining Authorisations	~~MLA592~~ ML1816
Mine Lease Grant Date	~~Application 21/8/2020~~ 14 October 2021
Mining Lease Expiry	14 October 2042
Name of Authorisation Holder	Luddenham Operations Pty Ltd
~~Name and Contact Details of the Mine Manager~~	~~Mr Harry Scarlis, (02) 9898 9178~~ ~~(mob) 0405 695 526~~ ~~harry@klfholdings.com.au~~ ~~or as otherwise assigned~~
Name of Mine Operator (s)	PGH Bricks and Pavers Pty Ltd
Name and Contact Details of the Environmental Representative	Mr Harry Scarlis (02) 9898 9178 0405 695 526 harry@klfholdings.com.au or as otherwise assigned
Name of the Representative of the Authorisation Holder	Mr Harry Scarlis (02) 9898 9178 0405 695 526 harry@klfholdings.com.au or as otherwise assigned
Signature of the Representative of the Authorisation Holder	Harry Scarlis
Date of Submission	29/07/2022

Revision Table

Date	Version	Author	Reviewed	Approved
4/03/2021	D0	TO	GT	TO
22/06/2021	D1	TO	PB/JK	TO
1/07/2021	D2	TO	MF/PB/JK	TO
1/7/2021	D3	TO	PB/JK	TO
20/08/2021	D4	TO	SK/GT	TO
26/08/2021	F0	TO	DPIE	TO
5/10/2021	D5	TO	PB/JK/GT	TO
11/10/2021	F1	TO	DPIE	TO
27/04/2022	12397_LQ_RMP_RR_2022_D0	TO	GT/PB	TO
20/07/2022	12397_LQ_RMP_RR_2022_D1	TO	GT/PB	TO
28/07/2022	12397_LQ_RMP_RR_2022_F0	TO	PB	TO

Changes in red from changes required by DPIE review of 'Site Rehabilitation Plan' as required by consent conditions.

Changes in green due to changes required to comply with Mining Act and Regulation amendments.

Contents

Figures

Tables

Photography

Appendices

1 Introduction to Mining Project

~~1.1 SCOPE~~

1.1 HISTORY OF OPERATIONS

CFT No 13 Pty Ltd, a member of Coombes Property Group (CPG), has acquired the property at 275 Adams Road, Luddenham New South Wales (NSW) (Lot 3 in DP 623799) within the Liverpool City Council municipality. The subject property is host to an existing shale/clay mine (the mine site), see Figure One.

Under the consent condition a Site Rehabilitation Plan (SRP) is required and was originally approved by the Department of Planning, Infrastructure and Planning (DPIE) on the 18 October 2021. Since the approval of the SRP, the mine lease application for the site has been approved (ML1816) and is subject to conditions that require a Rehabilitation Management Plan to be prepared in accordance with the *Mining Amendment (Standard Conditions of Mining Leases— Rehabilitation) Regulation 2021, Schedule 1.* This has necessitated the amendment of the SRP to meet the mining regulation amendments.

This ~~Site~~ Rehabilitation Management Plan (“~~SRP~~ RMP”) for the Luddenham Clay / Shale Mine has been prepared by VGT Environmental Compliance Solutions Pty Ltd (VGT) on behalf of Luddenham Operations Pty Ltd to meet both consent conditions and mine lease conditions. ~~The Luddenham Clay / Shale Mine is located at 275 Adams Road, Luddenham, within the Liverpool Council municipality, and is described as Lot 3, DP 623799 see (*Figure One*).~~

The contents of this ~~SRP~~ RMP provide relevant information on the extraction, processing and rehabilitation operations for this site. The document also provides environmental risks associated with mine operations and the management strategies for water dust and noise on the site.

The ~~SRP~~ RMP outlines the long-term mine closure principles and outcomes and forms the basis for the estimation of the rehabilitation security deposit calculation (as required by the Resources Regulator) and serves to address Condition 33 of DA 315 -7 -2003 (as modified) that requires a Site Rehabilitation Plan in accordance with the rehabilitation guidelines in the document titled “*Sydney Regional Environmental Plan No. 9 – Extractive Industry (No. 2) – Planning Report*”.

~~It is anticipated that the contents of this Plan will form the basis of the Mine Operation Plan (MOP) to be developed. In recent changes to the Mining Act, MOP’s will evolve into a ‘Rehabilitation Management Plan’ and ‘Forward Works’ document.~~ The MOP period, referred to in this report, is expected to span from the date of approval of the Mine Lease until 31st December 2024, when extraction activities have been completed, but the attainment of the final landform has not been achieved. ~~This SRP will be updated at the end of this MOP period to manage rehabilitation activities during the subsequent MOP period.~~

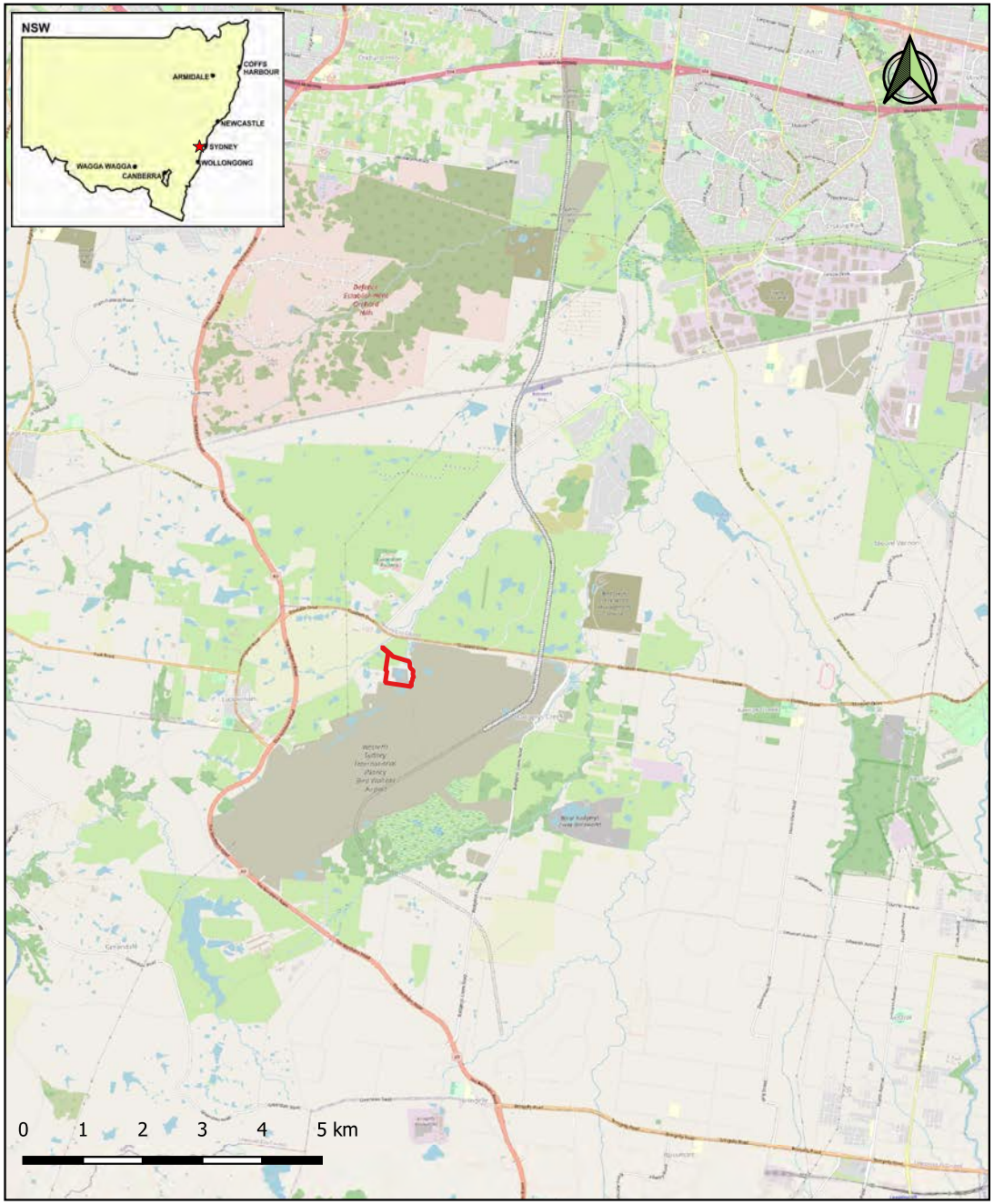
1.2 MINE CONTACTS

Table 1. Contact Details

Aspect	Mine Manager:
Name	Harry Scarlis
Company	Luddenham Operations Pty Ltd
Address	Level 5, Grosvenor Street,
	Bondi Junction NSW 2022
Mobile	0405 695 526
Phone	(02) 9898 9178
Email	harry@klfholdings.com.au

Plan of:	Luddenham Clay/Shale Mine RMP - Site Location	**Location:**	275 Adams Road, Luddenham NSW	**Source:**	Six Maps, MinView, Google Earth, QGIS Open Street Map, NSW Land Zoning WMS data	**Our Ref:**	12397_QGIS_LQ_RMP_2022_Q001_V0_F1
Figure:	ONE	**Council:**	Liverpool City Council	**Survey:**	Not Applicable	**Plan By:**	TO
Version:	V0	**Tenure:**	ML1816	**Projection:**	GDA2020 / MGA zone 56	**Project Manager:**	TO
Date:	27/04/2022	**Client:**	Coombes Property Group Pty Ltd	**Contour Interval:**	Not Applicable	**Office:**	Thornton

vgt environmental compliance solutions and laboratories



~~Figure Two Site Layout~~

~~1.2 BACKGROUND~~

~~2 Consents, Leases and Licences~~

1.3 CURRENT DEVELOPMENT CONSENTS, LEASES AND LICENCES

~~Quarrying~~ Mining operations were originally approved under State Significant Development (SSD) consent DA No. 315-7-2003 issued by the Minister for Infrastructure, Planning and Natural Resources on 23 May 2004. The existing consent has been modified a number of times i.e. MOD 1 to MOD3 (note, MOD 4 was withdrawn). MOD 5 was approved May 2021 and the conditions of consent are reproduced in *Appendix A*.

The mine is currently approved to produce and transport up to 300,000 tonnes per annum (tpa) of clay and shale product up to 31 December 2024.

1.3.1 Department of Planning, Infrastructure and Environment (DPIE)

Table 2. Development Approvals

No.	Date Approved	Expires	Notes
DA 315-7-2003	23rd May 2004	23rd May 2019	For the development and operation of a clay/shale mine on Lot 3, DP623799 and the construction and use of an access road and service facilities on Lot 1, DP 838361.
DA 315-7-2003 Mod 1	4th January 2006	23rd May 2019	Modification was to relocate the internal access road of the mine 200 metres to the south.
DA 315-7-2003 Mod 2	28th January 2010	31 December 2024.	Modification for the relocation of acoustic bunds, date for first environmental audit to be changed and to extend the consent until 15 years after the date of the modification.
DA 315-7-2003 Mod 3	April 2015	31 December 2024.	Modification to extraction sequencing, temporary stockpiling of excavated material within the approved mine footprint on Lot 1, composting activities for on-site rehabilitation, environmental monitoring programs and monitoring locations.
DA 315-7-2003 Mod 4	Withdrawn	-	-
DA No. 315-7-2003 Mod 5	24th May 2021	31 December 2024.	To recommence the mining operations, establish a new access road from Adams Road, establish a new stockpiling area and other infrastructure and minor administrative changes.

Table 3. Consent Rehabilitation Plan Requirements

Consent Condition	Details	Where Addressed in this Report
Schedule 4 **Condition 33**	Prior to the carrying out of any development on the site, the Applicant must prepare a Site Rehabilitation Plan in accordance with the rehabilitation guidelines in the document titled "Sydney Regional Environmental Plan No. 9 – Extractive Industry (No. 2) – Planning Report", to the satisfaction of the Planning Secretary. The Site Rehabilitation Plan must include a Biodiversity Management Plan.	This Report ~~Section 1.1~~ Section 1
Schedule 4 **Condition 34**	The Biodiversity Management Plan must include: (a) revegetation of the riparian zone of Oaky Creek; (b) protection, establishment and maintenance of the riparian zone; (c) protection of remnant native vegetation; (d) restoration of any areas within the riparian zone disturbed by the development; (e) a program to vegetate the noise attenuation bund; (f) a protocol for monitoring and relocating native fauna encountered during the recommissioning and dewatering of the quarry and storages; (g) a protocol for pre-clearance surveys for vegetation clearing activities; (h) salvage of resources during vegetation clearing activities for use in rehabilitation activities; and (i) measures for minimising the attraction of wildlife, in consultation with DITRDC and WSA.	Section 4 (EMM Biodiversity Management Plan 2021)
Schedule 4 **Condition 36**	Prior to 5 years of the estimated completion of extractive activities at the site, the Applicant must submit a Final Land Use Plan to the Department identifying the final land use of the site and method of treatment for the final void.	Addressed in Final Landuse Plan (EMM 2021)

Consent Condition	Details	Where Addressed in this Report
Schedule 4 **Condition 36A**	Prior to recommencing quarrying operations approved under Modification 5, or other timeframe agreed by the Planning Secretary, the Applicant must review and update the Site Rehabilitation Plan, Biodiversity Management Plan, and Final Land Use Plan in consultation with EPA, DITRDC and WSA, and to the satisfaction of the Planning Secretary. The updated plans must: (a) be consistent with any related approvals that provide for filling the final void, while also providing contingency rehabilitation activities in the event that such approvals are not obtained; and	~~Section 12~~ Section 10 This Plan serves as the Site Rehabilitation Management Plan and will be submitted to the appropriate authorities for approval. No approvals for filling the final void have been approved at this time. This Plan outlines the Conceptual Final Landform in the event approvals are not obtained.
	(b) include measures to minimise the short, medium and long term risks to the construction and operation of the Western Sydney Airport and other surrounding land users.	~~Section 4.1 and Section 4.2.16~~ Section 3 and Section **5.2.1.37**
Schedule 4 **Condition 37**	Prior to commencement of operations on Lot 3, DP 623799, the Applicant must provide a Rehabilitation Bond in the sum of $166,750 in the form of an insurance bond or bank guarantee acceptable to the Planning Secretary from any bank licensed pursuant to the Banking Act 1959 (Cth). The Rehabilitation Bond must be made in favour of the Minister administering the Environmental Planning & Assessment Act 1979 to ensure completion of the rehabilitation and landscaping works at the site. The sum of the Rehabilitation Bond is calculated based on $2.50 per square metre for a maximum exposed area of 6.67 hectares (ha). The Department may review the adequacy of Rehabilitation Bond to provide for the completion of rehabilitation and landscaping works on the site at intervals of not less than three years. The Applicant must ensure that the Rehabilitation Bond is in accordance with the sum determined by the review. Notes: (a) The Planning Secretary may at any time, and without notice to the Applicant, demand all or part of the monies available under the Rehabilitation Bond if, in the Planning Secretary's opinion, the Applicant has failed to make satisfactory progress on the rehabilitation and landscaping of the site.	~~Section 13~~ Section 11 Note: A rehabilitation security is also required under Mine Lease Conditions.

Consent Condition	Details	Where Addressed in this Report
	(b) The Secretary may apply the monies to ensure that the actions specified in the documents listed in condition 2 of Schedule 3 and/or any approved Site Rehabilitation Plan are achieved. (c) The Rehabilitation Bond will be released when the Applicant submits documentation prepared by a qualified rehabilitation consultant certifying that the final rehabilitation has been completed in accordance with the conditions of this consent and/or any approved Site Rehabilitation Plan, to the satisfaction of the Planning Secretary.	
Environmental Management **Management Plan Requirements**		
Schedule 6 **Condition 4**	4. Management plans required under this consent must be prepared in accordance with relevant guidelines, and include: (a) a summary of relevant background or baseline data;	Section 5.2
	(b) details of: (i) the relevant statutory requirements (including any relevant approval, licence or lease conditions); (ii) any relevant limits or performance measures and criteria; and (iii) the specific performance indicators that are proposed to be used to judge the performance of or guide the implementation of, the development or any management measures;	Section 1.3 Section 5.2 Section 4
	(c) any relevant commitments or recommendations identified in the document/s listed in condition 2 of Schedule 3;	This Plan
	d) a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;	Section 1.3 Section 5.2 Section 4
	(e) a program to monitor and report on the: (i) impacts and environmental performance of the development; and (ii) effectiveness of the management measures set out pursuant to sub-condition (d) above;	~~Section 11~~ ~~Section 12~~ Section 6 Section 7 Section 9 Section 10
	(f) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 9
	(g) a program to investigate and implement ways to improve the environmental performance of the development over time;	Section 10

Consent Condition	Details	Where Addressed in this Report
	(h) a protocol for managing and reporting any: (i) incident, non-compliance or exceedance of the impact assessment criteria or performance criteria; (ii) complaint; or (iii) failure to comply with statutory requirements; i) public sources of information and data to assist stakeholders in understanding environmental impacts of the development; and (j) a protocol for periodic review of the plan. i) Note: The Planning Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans	Section 10

1.3.2 Regional NSW- Mining Exploration and Geoscience (MEG)

~~A mine lease application has been submitted and approval is pending. Any conditions granted relating to rehabilitation will be addressed in a review of this report.~~

~~The details for Mining Lease XXX (Act 1992), held in the name of Luddenham Operations Pty Ltd are shown in *Table 4*. The conditions are included in Appendix B.~~

Mine Lease 1816 (Act 1992) was granted on the 14th October 2021 for a period of 21 years.

Table 4. Mining Authorisation

No.	Act	Company	Granted	Expires	Area (Ha)	Minerals
ML1816	1992	Luddenham Operations Pty Ltd	14/10/2021	14/10/2042	11.9	Clay / Shale Structural Clay

1.3.3 Environmental Protection Authority (EPA)

An Environmental Protection Licence EPL21562 ~~will be sought~~ was granted under the Protection of the Environment Operations Act (PoEOA) (see *Appendix C*).

1.3.4 Water Licences

The *NSW Water Act 1912* (Water Act) and *Water Management Act 2000* (WM Act) regulate the use and interference with surface water (streams, creeks, rivers, etc) and groundwater in NSW. The licencing provisions of the WM Act are applicable to the plan area.

A water access licence (WAL43685) ~~will be required~~ has been obtained by the landowner and is required to dewater the mine void of groundwater seepage. The Water Sharing Plans relevant to the site are:

- Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources 2011 – the Upper South Creek Management Zone within the Hawkesbury and Lower Nepean Rivers Water Source applies to the surface water in the vicinity of the site; and

- Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011 – the Sydney Basin Central Groundwater Source applies to groundwater in the vicinity of the site.

As outlined in *Section 4.3.6* of the *Modification Report,* groundwater intercepted by the mine pit was estimated to be 5 m3/day (Douglas Nicolaisen & Associates 2003). The project therefore requires a water access licence (WAL) under the Water Management Act 2003 (WM Act) for 1.8 ML/year from the *Sydney Basin Central Groundwater Source* regulated by the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011*. Accordingly, the applicants have applied to Natural Resourced Access Regulator (NRAR) for a zero share WAL. This zero share WAL was granted on 10 November 2020. The applicant has engaged a broker to secure sufficient entitlement on the open market and obtained a temporary trade of 2ML for the years 2020/21 and 2021/22.

As the mine is an approved SSD, in accordance with *Section 4.41* of the *EP&A Act,* there is no requirement to obtain a water supply work or use approval.

A groundwater monitoring network was installed in January 2009 prior to mining to understand the hydrogeology at the site and to monitor for potential impacts and are licenced under the Water Management Act 2000 (10BL602996). Three monitoring bores were installed to a depth of approximately 30 metres into the Bringelly Shale.

1.4 LAND OWNERSHIP AND LAND USE

1.4.1 Land Ownership and Land Use

The land is owned by CFT No13 Pty Ltd.

The site is approximately 19 hectares (ha) and is bordered to the east and south by the Commonwealth-owned Western Sydney Aerotropolis (WSA) site. In addition to WSA, surrounding land uses include a mix of agricultural, rural industrial and commercial, and residential development. Oaky Creek forms the eastern boundary of the site.

The site is battle-axe in shape with a thin corridor providing the access to Lot 3 DP 623799 from Adams Road, which is a local road joining Elizabeth Drive about 500 m north of the site and The Northern Road about 2.5 km south of the site.

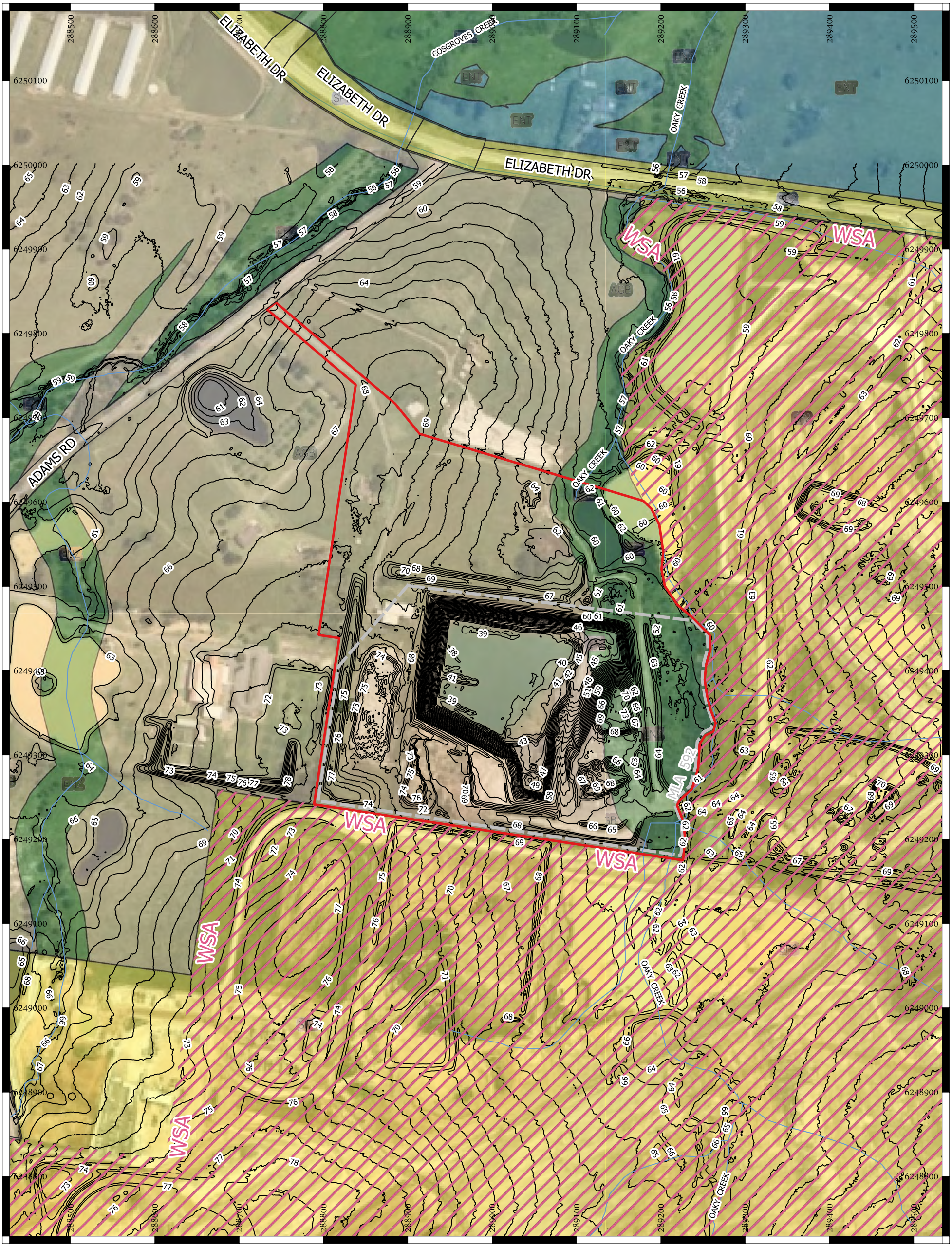
The area surrounding the site is sparsely populated, with the closest densely-populated area being the residential area of Luddenham approximately 2.2 km to the south-west. The closest occupied residence is about 100 m west of the site. There are two unoccupied residences to the north of the site. Consultation with the property owner of these residences has confirmed one of these residences is condemned and uninhabitable.

Hubertus Country Club and pistol range is immediately west of the site. The closest agricultural property is a duck farm located to the north-west, about 300 metres north-west of the intersection with Adams Road (approximately 650 metres from the mine excavation). The local context of the site is shown in *Figure Two*.

Plan of:	Luddenham Clay/Shale Mine RMP - Land Use and Land Zoning	**Location:**	275 Adams Road, Luddenham NSW	**Source:**	Six Maps, MinView, Google Earth, Nearmaps (12/01/2021), ELVIS Spatial Data, NSW zoning WMS data	**Our Ref:**	12397_QGIS_LQ_RMP_2022_Q002_V0_F2
Figure:	TWO	**Council:**	Liverpool City Council	**Survey:**	Elvis Spatial Data (July 2019)	**Plan By:**	TO
Version:	V1	**Tenure:**	ML1816	**Projectio**	GDA2020 / MGA zone 56: ESPG 7856	**Project Manager:**	TO
Date:	27/04/2022	**Client:**	Coombes Property Group Pty Ltd	**Contour Interval:**	1 Metre	**Office:**	Thornton

vgt environmental compliance solutions and laboratories

This figure may be based on third party data which has not been verified by vgt and may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and vgt does not warrant its accuracy.



N

Land Zoning

Zone
- 2(a)
- AGB
- B1
- B2
- B3
- B4
- B5
- B6
- B7
- B8
- C1
- C2
- C3
- C4
- DM
- DR
- E
- EM
- ENP
- ENT
- ENZ
- EP
- IN1
- IN2
- IN3
- IN4
- MAP
- MU
- P
- PEP
- R
- R1
- R2
- R3
- R4
- R5
- RE1
- RE2
- REC
- REZ
- RG
- RO
- RP
- RU1
- RU2
- RU3
- RU4
- RU5
- RU6
- RUR
- RW
- SET
- SP1
- SP2
- SP3
- SPU
- T
- U
- UD
- UL
- UR
- W
- W1
- W2
- W3

Legend

Features
- *Property Boundary*
- *Western Sydney Aerotropolis*
- *Existing contours*

Water Management Features
- *Creek*

Mine Lease
- *Mine Lease Boundary*

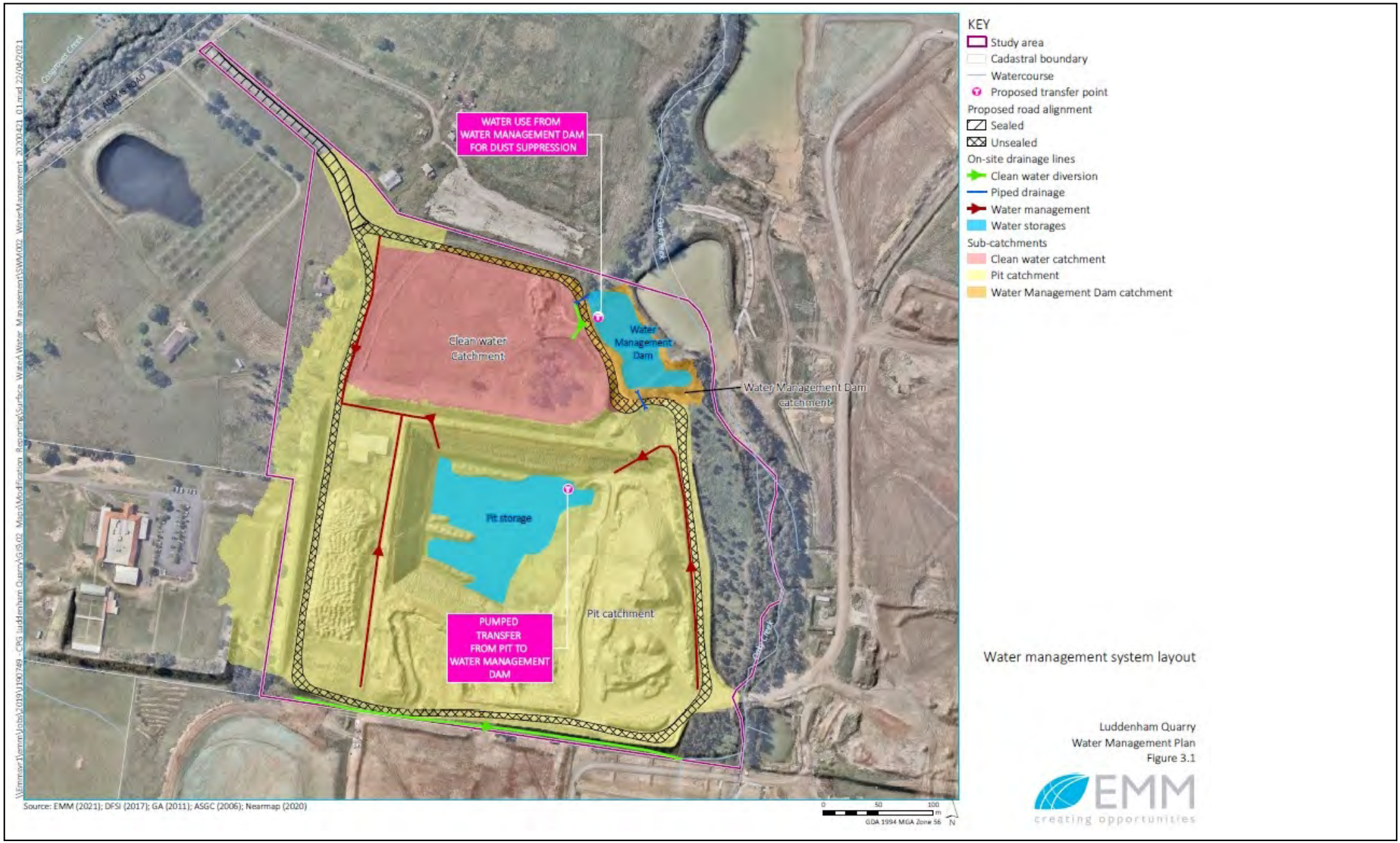
0 50 100 150 200 250 m

Plan of:	Luddenham Clay/Shale Mine RMP - Vegetation Communities	**Location:**	275 Adams Road, Luddenham NSW	**Source:**	EMM Biodiversity Management Plan (2021)	**Our Ref:**	12397_QGIS_LQ_RMP_2022_Q003_V0_F3
Figure:	THREE	**Council:**	Liverpool City Council	**Survey:**	Not Applicable	**Plan By:**	TO
Version:	V0	**Tenure:**	ML1816	**Projection:**	Not applicable	**Project Manager:**	TO
Date:	27/04/2022	**Client:**	Coombes Property Group Pty Ltd	**Contour Interval:**	Not Applicable	**Office:**	Thornton

vgt environmental compliance solutions and laboratories

Plan of:	Luddenham Clay/Shale Mine RMP - Water Catchment Areas	**Location:**	275 Adams Road, Luddenham NSW	**Source:**	EMM Soil and Water Management Plan (2021)	**Our Ref:**	12397_QGIS_LQ_RMP_2022_Q004_V0_F4
Figure:	FOUR	**Council:**	Liverpool City Council	**Survey:**	Not Applicable	**Plan By:**	TO
Version:	V0	**Tenure:**	ML1816	**Projection:**	Not applicable	**Project Manager:**	TO
Date:	27/04/2022	**Client:**	Coombes Property Group Pty Ltd	**Contour Interval:**	Not Applicable	**Office:**	Thornton

vgt environmental compliance solutions and laboratories



Water management system layout

Luddenham Quarry
Water Management Plan
Figure 3.1

EMM creating opportunities

2 Final Land Use

2.1 REGULATORY REQUIREMENTS FOR REHABILITATION

2.1.1 DPIE Rehabilitation Requirements

Table 5. Consent Rehabilitation Plan Requirements

~~Authority~~ Consent Condition	Condition No	Requirements	Where Addressed in this Report
Schedule 4	33	Prior to the carrying out of any development on the site, the Applicant must prepare a Site Rehabilitation Plan in accordance with the rehabilitation guidelines in the document titled "*Sydney Regional Environmental Plan No. 9 – Extractive Industry (No. 2) – Planning Report",* to the satisfaction of the Planning Secretary. The Site Rehabilitation Plan must include a Biodiversity Management Plan.	Site Rehabilitation Plan (VGT 10292_LQ_SRP_2021_F1) provided to DPIE in September 2021 and approved on 18/10/2021. This updated Rehabilitation Management Plan.
Schedule 4	34	The Biodiversity Management Plan must include: (a) revegetation of the riparian zone of Oaky Creek; (b) protection, establishment and maintenance of the riparian zone; (c) protection of remnant native vegetation; (d) restoration of any areas within the riparian zone disturbed by the development; (e) a program to vegetate the noise attenuation bund; (f) a protocol for monitoring and relocating native fauna encountered during the recommissioning and dewatering of the quarry and storages; (g) a protocol for pre-clearance surveys for vegetation clearing activities; (h) salvage of resources during vegetation clearing activities for use in rehabilitation activities; and (i) measures for minimising the attraction of wildlife, in consultation with DITRDC and WSA.	Appendix D (EMM Biodiversity Management Plan 2021)

~~Authority~~ Consent Condition	Condition No	Requirements	Where Addressed in this Report
Schedule 4	36	Prior to 5 years of the estimated completion of extractive activities at the site, the Applicant must submit a Final Land Use Plan to the Department identifying the final land use of the site and method of treatment for the final void.	Addressed in Final Landuse Plan (EMM 2021)
Schedule 4	36A	Prior to recommencing quarrying operations approved under Modification 5, or other timeframe agreed by the Planning Secretary, the Applicant must review and update the Site Rehabilitation Plan, Biodiversity Management Plan, and Final Land Use Plan in consultation with EPA, DITRDC and WSA, and to the satisfaction of the Planning Secretary. The updated plans must: (a) be consistent with any related approvals that provide for filling the final void, while also providing contingency rehabilitation activities in the event that such approvals are not obtained; and	Site Rehabilitation Plan (VGT 10292_LQ_SRP_2021_F1) provided to DPIE in September 2021 and approved on 18/10/2021. This updated Rehabilitation Management Plan. Appendix D Biodiversity Plan and Final Land Use Plan submitted to DPIE and are approved and available on www/luddenhamquarry.com.au. No approvals for filling the final void have been approved at this time. This Plan outlines the Conceptual Final Landform permitted under the current consents.

~~Authority~~ Consent Condition	Condition No	Requirements	Where Addressed in this Report
		(b) include measures to minimise the short, medium and long term risks to the construction and operation of the Western Sydney Airport and other surrounding land users.	Addressed in Site Rehabilitation Plan (VGT 10292_LQ_SRP_2021_F1) provided to DPIE in September 2021 and approved on 18/10/2021. This updated Rehabilitation Management Plan.
~~**MLA592**~~	~~2~~	~~Any disturbance resulting from the activities carried out under this mining lease must be rehabilitated to the satisfaction of the Minister.~~	
	~~3~~	~~**Mining Operations Plan and Annual Rehabilitation Report**~~ ~~(a) The lease holder must comply with an approved Mining Operations Plan (MOP) in carrying out any significant surface disturbing activities, including mining operations, ancillary mining activities and prospecting. The lease holder must apply to the Minister for approval of a MOP. An approved MOP must be in place prior to commencing any significant surface disturbing activities, including mining operations, ancillary mining activities and prospecting.~~ ~~(b) The MOP must identify the post mining land use and set out a detailed rehabilitation strategy which:~~ ~~(i) identifies areas that will be disturbed;~~ ~~(ii) details the staging of specific mining operations, ancillary mining activities and prospecting;~~ ~~(iii) identifies how the mine will be managed and rehabilitated to achieve the post mining land use;~~ ~~(iv) identifies how mining operations, ancillary mining activities and prospecting will be carried out in order to prevent and or minimise harm to the environment; and~~ ~~(v) reflects the conditions of approval under: • the Environmental Planning and Assessment Act 1979;~~ ~~• the Protection of the Environment Operations Act 1997; and~~ ~~• any other approvals relevant to the development including the conditions of this mining lease.~~	

~~Authority~~ Consent Condition	Condition No	Requirements	Where Addressed in this Report
		~~(c) The MOP must be prepared in accordance with the ESG3: Mining Operations Plan (MOP) Guidelines September 2013 published on the Department's website.~~ ~~(d) The lease holder may apply to the Minister to amend an approved MOP at any time.~~ ~~(e) It is not a breach of this condition if:~~ ~~(i) the operations which, but for this condition 3(e) would be a breach of condition 3(a), were necessary to comply with a lawful order or direction given under the Environmental Planning and Assessment Act 1979, the Protection of the Environment Operations Act 1997, the Work Health and Safety (Mines and Petroleum Sites) Act 2013 and Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 or the Work Health and Safety Act 2011; and Work Health and Safety Regulation 2017.~~ ~~(ii) the Minister had been notified in writing of the terms of the order or direction prior to the operations constituting the breach being carried out.~~ ~~(f) The lease holder must prepare a Rehabilitation Report to the satisfaction of the Minister. The report must:~~ ~~(i) provide a detailed review of the progress of rehabilitation against the performance measures and criteria established in the approved MOP;~~ ~~(ii) be submitted annually on the grant anniversary date (or at such other times as agreed by the Minister); and~~ ~~(iii) be prepared in accordance with any relevant annual reporting guidelines published on the Department's website.~~ ~~Note: The Rehabilitation Report replaces the Annual Environmental Management Report.~~	

~~Authority~~ Consent Condition	Condition No	Requirements	Where Addressed in this Report
Schedule 4	37	Prior to commencement of operations on Lot 3, DP 623799, the Applicant must provide a Rehabilitation Bond in the sum of $166,750 in the form of an insurance bond or bank guarantee acceptable to the Planning Secretary from any bank licensed pursuant to the Banking Act 1959 (Cth). The Rehabilitation Bond must be made in favour of the Minister administering the Environmental Planning & Assessment Act 1979 to ensure completion of the rehabilitation and landscaping works at the site. The sum of the Rehabilitation Bond is calculated based on $2.50 per square metre for a maximum exposed area of 6.67 hectares (ha). The Department may review the adequacy of Rehabilitation Bond to provide for the completion of rehabilitation and landscaping works on the site at intervals of not less than three years. The Applicant must ensure that the Rehabilitation Bond is in accordance with the sum determined by the review. Notes: (a) The Planning Secretary may at any time, and without notice to the Applicant, demand all or part of the monies available under the Rehabilitation Bond if, in the Planning Secretary's opinion, the Applicant has failed to make satisfactory progress on the rehabilitation and landscaping of the site. (b) The Secretary may apply the monies to ensure that the actions specified in the documents listed in condition 2 of Schedule 3 and/or any approved Site Rehabilitation Plan are achieved. (c) The Rehabilitation Bond will be released when the Applicant submits documentation prepared by a qualified rehabilitation consultant certifying that the final rehabilitation has been completed in accordance with the conditions of this consent and/or any approved Site Rehabilitation Plan, to the satisfaction of the Planning Secretary.	Security bond held by DPIE. Note: A rehabilitation security is also required under Mine Lease Conditions and held by the Regulator.

~~Authority~~ Consent Condition	Condition No	Requirements	Where Addressed in this Report
Environmental Management **Management Plan Requirements**			
Schedule 6	4	4. Management plans required under this consent must be prepared in accordance with relevant guidelines, and include: (a) a summary of relevant background or baseline data;	Addressed in Site Rehabilitation Plan (VGT 10292_LQ_SRP_2021_F1) provided to DPIE in September 2021 and approved on 18/10/2021. This updated Rehabilitation Management Plan.
		(b) details of: (i) the relevant statutory requirements (including any relevant approval, licence or lease conditions); (ii) any relevant limits or performance measures and criteria; and (iii) the specific performance indicators that are proposed to be used to judge the performance of or guide the implementation of, the development or any management measures;	
		(c) any relevant commitments or recommendations identified in the document/s listed in condition 2 of Schedule 3;	
		d) a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria;	
		(e) a program to monitor and report on the: (i) impacts and environmental performance of the development; and (ii) effectiveness of the management measures set out pursuant to sub-condition (d) above;	
		(f) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	
		(g) a program to investigate and implement ways to improve the environmental performance of the development over time;	
		(h) a protocol for managing and reporting any: (i) incident, non-compliance or exceedance of the impact assessment criteria or performance criteria; (ii) complaint; or	

~~Authority~~ Consent Condition	Condition No	Requirements	Where Addressed in this Report
		(iii) failure to comply with statutory requirements; ii) public sources of information and data to assist stakeholders in understanding environmental impacts of the development; and (j) a protocol for periodic review of the plan. ii) Note: The Planning Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans	

2.1.2 MEG Rehabilitation Requirements

The prescribed standard conditions in the Mining Regulation 2016, Schedule 8A, Part 2 apply in addition to the conditions in Schedule 2 of the Mine Lease. Conditions in the Regulation that relate to rehabilitation in this report are reproduced below.

Table 6. Mine Lease Conditions from the Regulation

Mining Regulation Section	Details	Where Addressed in this Report
Division 1 Protection of the environment and rehabilitation		
4	**Must prevent or minimise harm to environment** (1) The holder of a mining lease must take all reasonable measures to prevent, or if that is not reasonably practicable, to minimise, harm to the environment caused by activities under the mining lease. (2) In this clause— *Harm* to the environment has the same meaning as in the Protection of the Environment Operations Act 1997.	This Report
5	**Rehabilitation to occur as soon as reasonably practicable after disturbance** The holder of a mining lease must rehabilitate land and water in the mining area that is disturbed by activities under the mining lease as soon as reasonably practicable after the disturbance occurs.	Section 4 Section 1.3
6	**Rehabilitation must achieve final land use** (1) The holder of a mining lease must ensure that rehabilitation of the mining area achieves the final land use for the mining area.	This Report
	(2) The holder of the mining lease must ensure any planning approval has been obtained that is necessary to enable the holder to comply with subclause (1).	Section 1.3
	(3) The holder of the mining lease must identify and record any reasonably foreseeable hazard that presents a risk to the holder's ability to comply with subclause (1). **Note—** Clause 7 requires a rehabilitation risk assessment to be conducted whenever a hazard is identified under this subclause.	Section 3 Section 9
	(4) In this clause— final land use for the mining area means the final landform and land uses to be achieved for the mining area— (a) as set out in the rehabilitation objectives statement and rehabilitation completion criteria statement, and (b) for a large mine—as spatially depicted in the final landform and rehabilitation plan, and	Section 4 Section 5 Section 2

Mining Regulation Section	Details	Where Addressed in this Report
	(c) if the final land use for the mining area is required by a condition of development consent for activities under the mining lease—as stated in the condition. planning approval means— (a) a development consent within the meaning of the Environmental Planning and Assessment Act 1979, or (b) an approval under that Act, Division 5.1.	
Division 2 Risk assessment		
7	**Rehabilitation risk assessment** (1) The holder of a mining lease must conduct a risk assessment (a rehabilitation risk assessment) that— (a) identifies, assesses and evaluates the risks that need to be addressed to achieve the following in relation to the mining lease— (i) the rehabilitation objectives, (ii) the rehabilitation completion criteria, (iii) for large mines—the final land use as spatially depicted in the final landform and rehabilitation plan, and (b) identifies the measures that need to be implemented to eliminate, minimise or mitigate the risks	Section 3
	(2) The holder of the mining lease must implement the measures identified.	This Report and annual reporting.
	(3) The holder of a mining lease must conduct a rehabilitation risk assessment— (a) for a large mine—before preparing a rehabilitation management plan, and (b) for a small mine—before preparing the rehabilitation outcome documents for the mine, and (c) whenever a hazard is identified under clause 6(3)—as soon as reasonably practicable after it is identified, and (d) whenever given a written direction to do so by the Secretary.	Section 3

Mining Regulation Section	Details	Where Addressed in this Report
Division 3 Rehabilitation documents		
10	(1) The holder of a mining lease relating to a large mine must prepare a plan (a rehabilitation management plan) for the mining lease that includes the following—	
	(a) a description of how the holder proposes to manage all aspects of the rehabilitation of the mining area,	This Report
	(b) a description of the steps and actions the holder proposes to take to comply with the conditions of the mining lease that relate to rehabilitation,	This Report
	(c) a summary of rehabilitation risk assessments conducted by the holder,	Section 3
	(d) the risk control measures identified in the rehabilitation risk assessments,	Section 3
	(e) the rehabilitation outcome documents for the mining lease,	Section 4, Section 5
	(f) a statement of the performance outcomes for the matters addressed by the rehabilitation outcome documents and the ways in which those outcomes are to be measured and monitored	
12	**Rehabilitation outcome documents** (1) The holder of a mining lease must prepare the following documents (the rehabilitation outcome documents) for the mining lease and give them to the Secretary for approval— (a) the rehabilitation objectives statement, which sets out the rehabilitation objectives required to achieve the final land use for the mining area, (b) the rehabilitation completion criteria statement, which sets out criteria, the completion of which will demonstrate the achievement of the rehabilitation objectives, (c) for a large mine, the final landform and rehabilitation plan, showing a spatial depiction of the final land use. (2) If the final land use for the mining area is required by a condition of development consent for activities under the mining lease, the holder of the mining lease must ensure the rehabilitation outcome documents are consistent with that condition	Section 4, Section 5

2.1.3 Sydney Regional Environmental Plan No. 9- Extractive Industry (no.2) – Planning Report

Schedule 4 Condition 33 requires that the Site Rehabilitation Plan is prepared in accordance with the Sydney Regional Environmental Plan No. 9- Extractive Industry (no.2) – Planning Report rehabilitation guidelines. The SREP No.9 itself does not contain any rehabilitation guidelines. Rather it refers to Council requirements to consider that any rehabilitation plan is 'prepared in accordance with the Guidelines for Rehabilitation Plans in the Extractive Industry Report'. It notes that the *Extractive Industry Report* means the report prepared by the Department of Planning dated 1994 and titled "Sydney Regional Environmental Plan No 9—Extractive Industry (No 2) Planning Report".

Best Practice mine rehabilitation is regulated through the Resources Regulator via the *Mining Act (1992) No 29* and *Mining Regulation (2016)* and amendments which has dictated the format of this Plan. Notwithstanding this, the relevant items from the *SREP no 9 (1994) Rehabilitation Guidelines* and where they are addressed in this report are reproduced in the table below.

Table 7. *Sydney Regional Environmental Plan No. 9- Extractive Industry (no.2) – Planning Report Rehabilitation Guidelines* Requirements

Item	Where Addressed in this Report
1. Contain schedules detailing the proposed phases of rehabilitation of extracted area to ensure that progressive rehabilitation is coordinated with the extractive operations.	Section 4, Section 6
2. Identify a final land use option towards which progressive rehabilitation can proceed.	Section 2 Final Land Use Plan (EMM August 2021)
3. Ensure that after rehabilitation, the site is compatible with its surroundings and does not require ongoing maintenance in addition to normal land management practices.	Section 4, Section 5, Section 6, Section 7, Section 8, Section 9, Section 10
4. Identify a final stable and permanent landform which is environmentally and visually acceptable.	Section 2 Final Land Use Plan (EMM August 2021)
5. Ensure that the rehabilitated land surface is in a stable form conducive to sustainable vegetation cover.	Section 4, Section 5, Section 6, Section 7, Section 8, Section 9, Section 10
6. Include and Erosion and Sediment Control Plan	Section 5.2.1.32 Soil and Water Management Plan (EMM June 2021)

Item	Where Addressed in this Report
7. Include a Water Management Plan	Section 6.2.1.32 Soil and Water Management Plan (EMM June 2021)
8. The rehabilitation plans should include information on: soil handling, vegetation handling, erosion and sediment control, excavations, rock faces, overburden dumps, tailings/reject disposal, visual amenity, removal of facilities infrastructure.	Section 5
9. Monitoring and reporting of extractive industry operations.	Section 7, Section 10,
10. Security deposit	Section 11

~~5 POST MINING LAND USE~~

2.2 FINAL LAND USE OPTIONS ASSESSMENT

2.2.1 Final Land Form

An assessment of the final land use options has not been undertaken as the Mod 5 development consent defines the final landuse.

The Conceptual Interim Final Landform is shown in *Figure Eight* and comprises a water filled void. The void has been envisaged in each consecutive consent modification to be back-filled and be generally consistent with the original landform contours, which existed prior to the commencement of quarry operations. At present however, the site does not have consent to import material to backfill the void and thus, at the cessation of mining, water will accumulate in the void to an approximate depth of around 10 metres (i.e. 20 m below ground level). Water balance modelling undertaken by EMM suggests that the void would fill to approximately RL42 metres over a period of 70 years. A Water Access Licence will be sought for the remaining water body in the final landform.

Further development approvals will be sought to permit the backfilling of the void to permit future agribusiness/commercial/industrial landuses and be consistent with the adjacent Aerotropolis SEPP operations.

Note, the final landform is unlikely to be achieved by the end of the MOP period.

2.2.2 Post Mining Land Use

The conceptual final interim land use for the site will be a fenced void surrounded by Agribusiness and environmental conservation for areas of the site zoned Environment and Recreation under the Aerotropolis SEPP."

To avoid sterilisation of over 50% of the subject property from future land use consistent with the Aerotropolis SEPP, a future development application will be lodged to seek approval for the infill of the quarry void with non-hazardous unrecyclable 'General solid waste (non-putrescible)' (EPA 2014) generated by the ARRC to produce a safe, stable and non-polluting final landform suitable for commercial/industrial final land use.

This is generally consistent with the original 2003 EIS (Douglas Nicolaisen & Associates 2003) commitments for the site, with the exception of the changed final land use for the site (other than Oaky Creek) from pastoral/rural uses to commercial/industrial uses.

No change to the biodiversity land use of the Oaky Creek riparian zone as prescribed in Schedule 4, Condition 34 of the consent is proposed.

2.3 FINAL LAND USE STATEMENT

The conceptual final interim land use for the site will be pastoral/rural uses with a fenced water filled void surrounded by Agribusiness and environmental conservation for areas of the site zoned Environment and Recreation under the Aerotropolis SEPP.

No change to the biodiversity land use of the Oaky Creek riparian zone as prescribed in Schedule 4, Condition 34 of the consent is proposed.

2.4 FINAL LAND USE AND MINING DOMAINS

2.4.1 Final Land Use Domains

Table 8. Post Mining Land Use Domain Codes

~~Code~~	Secondary Domains (Post Mining)	Description
~~A~~	Infrastructure	This domain incorporates the site access road and haul roads to be retained for future property access.
~~B~~	~~Water Management Area~~ Water Storage Area	This domain is limited to the In-Pit Sump and the Water Management Dam.
~~C~~	~~Rehabilitation Area- Grassland~~ Agriculture Grazing	This Domain comprises the final void area and surrounds as well as infrastructure areas not retained at the completion of extraction activities.
~~H~~	~~Relinquished Lands~~	~~The whole site at Mine Lease relinquishment.~~
~~J~~	~~Conservation and Biodiversity Offset Area~~ Native Ecosystem	This domain consists of approximately 3ha of land comprising the riparian zone offset area along Oaky Creek.

2.4.2 Mining Domains

Table 9. Operational Domain Codes

~~Code~~	Primary Domains (Operational)	Description
~~1~~	Infrastructure Area	This domain includes the haul roads and hardstand areas.
~~3~~	Water Management Area	This domain is limited to the In-Pit Sump and the Water Management Dam.
~~4~~	Overburden Emplacement Area	This domain incorporates stockpiles and bunds surrounding the extraction area where overburden has been placed.
~~5~~	~~Stockpile Material~~	~~This domain includes the product stockpiles.~~
~~6~~	~~Void (open cut void)~~ Active Mining Area (Open cut void)	This domain incorporates the active cells.
~~9~~	~~Conservation and Biodiversity Offset Area~~ Other	This domain consists of approximately 3ha of land comprising the riparian zone offset area along Oaky Creek.

3 Rehabilitation Risk Assessment

4.1 ENVIRONMENTAL RISK ASSESSMENT

A risk assessment of Environmental and Rehabilitation issues has been undertaken in accordance with standard risk assessment practices outlined in ISO 31000 *Risk Management – Principles and Guidelines*. The Consequence/ Likelihood Matrix has been used with the following scale definitions:

TABLE 11 Consequence/Likelihood Matrix

			Consequence				
			1	2	3	4	5
			Insignificant	Minor	Moderate	Major	Severe
Likelihood	E	Almost Certain	IV	III	II	I	I
	D	Likely	IV	III	III	II	I
	C	Possible	V	IV	III	II	II
	B	Unlikely	V	IV	III	III	II
	A	Rare	V	V	IV	III	II

Likelihood Scale

E	Almost Certain	Expected to occur within weeks
D	Likely	Will probably occur, has happened within recent months
C	Possible	Might occur at sometime within next 2-3 months
B	Unlikely	Could occur within 6-12 months although unlikely
A	Rare	Might occur at some time in exceptional circumstances

Consequence

5	Severe	Irreversible long term environmental harm.
4	Major	Prolonged environmental impact with significant remedial measures required.
3	Moderate	Moderate environmental impacts with immediate remedial measures effective.
2	Minor	Minimal environmental harm with minor remediation activities
1	Insignificant	Little or no environmental harm. Remediation not required.

Note: In this document if an issue has been assessed to have a Consequence/ Likelihood rating of V, management procedures have not been developed except where relevant.

Table 12 Site Summary Environmental Risk Assessment

Environmental Risks	Description	Likelihood	Consequence	Risk
Erosion and Sediment Control	Risk of sediment leaving the site	Rare	Minor	V
Flora	Risk of harm to endangered ecological communities	Rare	Minor	V
Fauna	Risk of harm to endangered species	Rare	Minor	V
Air Quality	Risk of harm caused by nuisance dust emissions	Possible	Minor	IV
Surface Water Quality	Risk of harm caused by uncontrolled discharge	Unlikely	Minor	IV
Groundwater	Risk of impact on groundwater	Rare	Moderate	IV
Noise	Risk of noise impact on neighbours from operations on the site	Possible	Minor	IV
Trespassing	Risk of vandalism to site and rehabilitation	Rare	Minor	V
Visual Amenity	Risk of impact on local residences	Possible	Insignificant	V
Heritage	Risk of harm to items of aboriginal heritage	Rare	Minor	V
Waste	Risk of harm caused by waste	Rare	Minor	V
Hazards	Risk of harm due to fuel, oils cleaning products etc	Rare	Minor	V

Table 13 Site Summary Rehabilitation Risk Assessment

Environmental Risks	Description	Likelihood	Consequence	Risk
Geology and Geochemistry	Risk of low pH in growth medium	Possible	Minor	IV
Erosion and Sediment Control	Risk of soil loss due to erosion	Possible	Moderate	III
Soil and Overburden Types(s) and Suitability	Risk of growth media be unsuitable for growth of grasses	Possible	Moderate	III
Flora	Risk of weeds impacting on growth of grasses	Possible	Moderate	III
Fauna	Risk of endangered fauna habitat for foraging being impacted by the final landform	Rare	Minor	V
Fauna	Risk of feral animals impacting on ecological sustainability	Unlikely	Minor	IV
Slopes and Slope Management	Risk of unstable slopes impacting on final landform	Possible	Moderate	III
Surface Water Quantity	Risk of insufficient water for revegetation	Unlikely	Major	III
Bushfire	Risk of harm to vegetation, fauna and rehabilitation plantation	Rare	Moderate	IV
Trespassing	Risk of impact on rehabilitation areas by public	Unlikely	Minor	IV
Waste	Risk of harm caused by waste	Rare	Minor	V
Hazards	Risk of harm due to fuel, oils cleaning products etc	Rare	Minor	V

Identification of hazards and a risk assessment and identification of risk controls has been undertaken and is summarised below.

The following table details risks analysed in accordance with the aviation safeguarding risks identified under the National Airports Safeguarding Framework (National Airports Safeguarding Framework Principles and Guidelines).

Table 10. Review of Risks with Regard to National Airports Safeguarding Framework

Guideline/Impact	Criteria	Comments
Guideline A- Measures for Managing Impacts of Airport Noise	No specific criteria	The Site is not considered to be 'noise sensitive use' and will not be adversely impacted by airport noise.
Guideline B- Managing Risk of Building Generated Windshear and Turbulence at Airports	Does the entire structure lie outside of the assessment trigger area at each runway end? i.e. no part of the structure is within the rectangle: a. 1200m perpendicular from the runway centreline (or extended runway centreline); b. 900 m beyond the runway threshold towards the landside of airport; and c. 500 m from the runway threshold along the runway	There are no buildings proposed on the site. A demountable site office and site shed will be present on site during quarry operations. These will be removed prior to the start of WSA operations. No further assessment required.
Guideline C- Managing Risk of Wildlife Strikes in Vicinity of Airport & Attachment 1	Mines and quarries are not identified in Attachment 1 of Guideline C as land uses that present a risk of attracting wildlife. Notwithstanding, a review of potential risks of wildlife attraction of the quarry has been carried out. **Mining Land Uses** Operations will cease in December 2024 prior to the scheduled start of WSA operations in 2026. Operations at the quarry, including presence of plant and machinery, quarry staff and dewatering of the quarry void is likely to reduce the site's attractiveness to wildlife. **Proposed Final Land Use** The conceptual final interim land use for the site will be a fenced void surrounded by Agribusiness and environmental conservation for areas of the site zoned Environment and Recreation. The final water filled void presents a moderate risk and for this reason, a modification application will be submitted to DPIE to permit the void to be filled and agribusiness land use, compatible with the WSA to be established on the infilled void.	Mitigation measures have been addressed in this report.

Guideline/Impact	Criteria	Comments
Guideline D- Managing the risk of wind turbine farms as physical obstacles to air navigation	Not Applicable	No action required.
Guideline E- Managing Risk of Distraction to Pilots from Lighting in the Vicinity of Airport	To ensure that lighting in the vicinity of airports does not compromise aviation safety	No lighting is required for the operation as operations are undertaken during daylight hours. Operations will cease in December 2024 prior to the scheduled start of WSA operations in 2026 No action required.
Guideline F- Managing the Risk of Intrusion into the Protected Airspace of Airports	If a building or structure penetrates 'prescribed airspace' of a federal leased airport, a 'controlled activity' approval is required from the Australian Department of Infrastructure and Transport pursuant to the Airports Act 1995 (the Act). Controlled activities are defined in section 182 of the Act and include the following: • structures such as buildings, antennas and cranes; and • in some circumstances, activities causing non-structural intrusions into the protected airspace of artificial light, reflected sunlight, air turbulence, smoke, dust, steam or other gases or particulate matter	No structures will intrude into the protected airspace of the airport. No action required. Operations will cease in December 2024 prior to the scheduled start of WSA operations in 2026
Guideline G- Protecting Aviation Facilities- Communications, Navigation and Surveillance (CNS)	Assess and manage inappropriate development located in the Building Restriction Area (BRA) of a CNS that can compromise their effectiveness.	There are no buildings or structures within the Building Restriction Area (BRA). No action required
Guideline H- Protecting Strategically Important Helicopter Landing Sites (SHLS)	Not Applicable	No action required.
Guideline I- Public Safety Areas (Designated Areas of Land at the End of Airport Runways	Not Applicable	The Site is not located at the end of the proposed Airport runway. No action required.

The following table summarises the assessment of short, medium and long term risk to the WSA from operations on the site. It is assumed that the extraction operations are of short term duration and the construction of the WSA has not been completed. Rehabilitation of the site (to the Conceptual Interim Final Landform) encompasses the medium term risks which are still assumed to occur whilst the WA is still under construction. Longer term risks are assumed to be those to the WSA once rehabilitation is complete and the WSA development is complete.

Future changes to the final landform and landuse, such as backfilling of the site for industrial landuses, would require the risks to be reassessed.

Table 11. Short, Medium and Long Term Risks to WSA

Risk Duration	Risk Type	Description	Likelihood	Consequence	Risk
Short (Extraction Phase)	Air Quality	Risk of harm caused by nuisance dust emissions.	Possible	Insignificant	V
	Water Quality	Risk of harm caused by pollution of water courses.	Rare	Minor	V
	Noise	Risk of noise impact on WSA from operations on the site	Rare	Insignificant	V
	Litter	Risk of litter blowing onto WSA.	Rare	Insignificant	V
	Traffic	Risk of traffic impacts to WSA.	Rare	Insignificant	V
	Geotechnical	Risk of harm to infrastructure due to landform instability.	Rare	Insignificant	V
	Public Safety	Risk of harm to public, WSA staff and contractors from trespassing.	Rare	Moderate	IV
	Bushfire	Risk of bushfire encroaching onto WSA.	Rare	Insignificant	V
	Bird Strike	Risk of increased bird strike to aircraft.	Rare	Insignificant	V
Medium (Rehabilitation Phase)	Air Quality	Risk of harm caused by nuisance dust emissions.	Possible	Insignificant	V
	Water Quality	Risk of harm caused by pollution of water courses.	Rare	Minor	V
	Noise	Risk of noise impact on WSA from operations on the site	Rare	Insignificant	V
	Litter	Risk of litter blowing onto WSA.	Rare	Insignificant	V
	Traffic	Risk of traffic impacts to WSA.	Rare	Insignificant	V
	Geotechnical	Risk of harm to infrastructure due to landform instability.	Rare	Insignificant	V
	Public Safety	Risk of harm to public, WSA staff and contractors from trespassing.	Rare	Moderate	IV
	Bushfire	Risk of bushfire encroaching onto WSA.	Rare	Insignificant	V

Risk Duration	Risk Type	Description	Likelihood	Consequence	Risk
	Bird Strike	Risk of increased bird strike to aircraft.	Rare	Insignificant	V
Long (Rehabilitation Completion)	Air Quality	Risk of harm caused by nuisance dust emissions.	Rare	Insignificant	V
	Water Quality	Risk of harm caused by pollution of water courses.	Rare	Insignificant	V
	Noise	Risk of noise impact on WSA from operations on the site	Rare	Insignificant	V
	Litter	Risk of litter blowing onto WSA.	Rare	Insignificant	V
	Traffic	Risk of traffic impacts to WSA.	Rare	Insignificant	V
	Geotechnical	Risk of harm to infrastructure due to landform instability.	Rare	Insignificant	V
	Public Safety	Risk of harm to public, WSA staff and contractors from trespassing.	Rare	Moderate	IV
	Bushfire	Risk of bushfire encroaching onto WSA.	Rare	Insignificant	V
	Bird Strike	Risk of increased bird strike to aircraft.	Rare	Moderate	IV

Table 12. General Rehabilitation Risk Assessment

Hazard	Risks	Risk Controls	Details
Administrative failures.	Insufficient skills and experience of rehabilitation personnel.	Only experienced contractors will be engaged to conduct rehabilitation activities.	
	Lack of clearly defined responsibilities.	Responsibilities and roles for rehabilitation will be defined in the contractual arrangements with contractors and Proponent.	
	Insufficient funding for or prioritisation of rehabilitation activities.	Proponent will ensure that sufficient funds are available to conduct rehabilitation activities. Note, a rehabilitation bond is held over the site and will be reviewed annually for the life of the mine.	
Erosion	Harm to rehabilitation works.	Slopes to be reduced in out-of-pit areas (outside the void footprint).	Slopes to be reduced to a maximum of 3H:1V in out of pit areas.
		Reduce slopes as far as possible In-Pit (within the void footprint).	Consider benched mining design on highwalls if assessed necessary by geotechnical engineer.
		Reduce slope lengths out of Pit.	Slope Lengths shall not exceed 80 metres before being broken by earth banks or similar.
		Reduce track slopes.	Slopes of major tracks are to be <10 degrees or have cross drains/banks installed. Where unsuitable soils are present, tracks are to be stabilised with crushed bricks, concrete, gravel or similar.
		Roughen exposed surfaces.	Track walk or lightly rip exposed surfaces to encourage infiltration of rainwater.
		Achieve ground coverage factor of at least 0.05 (70%).	Coverage to be achieved via vegetation, mulch or similar within 30 days of completion of works.
		Topsoil stockpile management.	Slopes no greater than 3H:1V. Stockpile height no greater than 1.5 metres. No stockpiles to be constructed in areas of concentrated flows.
		Overburden stockpile management.	Slopes no greater than 3H:1V. Stockpile height no greater than 3 metres. No stockpiles to be constructed in areas of concentrated flows.
Sediment Entrainment	Entrained sediment harms downstream environments	Runoff from design storm to be contained in-site.	Sediment dams designed for 90th % 5-day storm event. Drains to be designed for 1 in 10-year design storm. Spillways to be designed for 1 in 100-year design storm. Receiving capacity of sediment dams to be maintained by; • Reuse of water on-site for dust suppression; and • Water to be pumped to pit sump if capacity not sufficient to contain design storm prior to storm events. Pit maintained to have capacity to contain a volume greater than the design storm.

Hazard	Risks	Risk Controls	Details
		Surface water captured on exposed surfaces to be directed to sediment dams.	Sediment dam to be constructed for each catchment in the disturbed area. Drains to be installed to direct dirty surface water to sediment dams.
		Silt fences installed.	Installation of silt fences around disturbed area as appropriate. No silt fences to be constructed in areas of concentrated flows.
		Topsoil stockpile management	Slopes no greater than 3H:1V. Stockpile height no greater than 1.5 metres. No stockpiles to be constructed in areas of concentrated flows.
		Overburden stockpile management.	Slopes no greater than 3H:1V. Stockpile height no greater than 3 metres. No stockpiles to be constructed in areas of concentrated flows.
Surface Water Quality	Decrease in downstream water quality.	Monitoring.	Surface water quality monitoring will continue within Oaky Creek, upstream and downstream of the site and within the mine pit and the Water Management Dam. All monitoring will be undertaken in accordance with Approved Methods for Sampling and Analysis of Water Pollutants in NSW (DEC 2004)
		Reuse dirty water on site.	Dirty water to be reused for dust suppression.
		Runoff from design storm to be contained in-site.	Sediment dams designed for 90th % 5-day storm event. Drains to be designed for 1 in 10-year design storm. Spillways to be designed for 1 in 100-year design storm. Receiving capacity of sediment dams to be maintained by; • Reuse of water on-site for dust suppression; and • Water to be pumped to pit sump if capacity not sufficient to contain design storm prior to storm events. Pit maintained to have capacity to contain a volume greater than the design storm.
		Surface water captured on exposed surfaces to be directed to sediment dams.	Sediment dam to be constructed for each catchment in the disturbed area. Drains to be installed to direct dirty surface water to sediment dams.
		Separation of clean water and dirty water.	Upstream clean water to be diverted via diversion drains or bunds as far as possible.
		Implement Surface Water Strategy.	Implement strategy as described in the Water Management Plan.
Geotechnical Stability In-Pit	Failure of In-Pit Slopes	Reduce slopes In-Pit.	Batter slopes with overburden material.
		Benched mining on highwalls.	
		Batter designs validated by qualified engineer.	

Hazard	Risks	Risk Controls	Details
Groundwater Quality and Flows	Decrease in groundwater quality and changes in flows	Groundwater interaction will be minimised.	Pit floor will not be deeper than 30 metres below the original surface.
		Groundwater quality and depth monitoring.	Bores will be monitored annually and if significant variations noted, an investigation will be undertaken.
		Implement Groundwater Strategy.	Implement strategy as described in the Water Management Plan.
		Groundwater take to be licenced.	Water Access Licence (WAL43685) obtained.
Wind Erosion	Rehabilitation areas impacted by wind erosion.	Air quality monitoring.	Air quality monitoring will be conducted in accordance with the Air Quality Management Plan.
		Dust suppression.	Water cart to be engaged during mining, hauling and rehabilitation activities. During adverse conditions: • Cease mining or hauling activities in adverse wind conditions: and • Increase water cart frequency.
		Achieve groundcover factor of at least 0.05 (70% coverage) on areas of long term inactivity.	Coverage to be achieved via vegetation, mulch or similar within 30 days of completion of works.
Heritage	Harm to heritage items	Protection of existing heritage items/sites.	AHIMS site #45-5-2280 will continue to be avoided and protected by fencing. The riparian corridor along the western bank of Oaky Creek will continue to be avoided by mining activities.
		Protection of unexpected heritage items.	In the event that unexpected Aboriginal objects, sites or places are discovered, DPIE will be notified as soon as practicable after they are first identified.
		Protection of human skeletal remains	The immediate vicinity will be secured to protect the find. The police will be notified immediately.
Bushfire	Harm to rehabilitation areas.	Limit access for deliberately lit fires.	Appropriate fencing is to be repaired and maintained. Locked access gate outside of operating hours. Visitors to sign in to the office.
		Maintain fire breaks.	
Waste	Harm to rehabilitation areas.	Control on-site waste storage and removal	Waste will be stored in small, designated waste storage area within the site entry area. Wastes will be stored in bins with a lid. Oily rags, filters, drums and waste batteries will be stored on a self-bunded pallet or similar. Wastes will be removed by licenced contractor.

Table 13. Active Mining Phase Rehabilitation Risk Assessment

Hazard	Risks	Risk Controls	Details
Salvage of Biological Resources	Loss of biological resources.	Minimise loss of biological resources through suitable land clearing, salvage and handling practices.	Areas to be land cleared will be clearly marked to ensure only land to be cleared is disturbed. Land clearing is to be supervised by proponent's staff. Felled trees are to be salvaged and reused immediately by placing on rehabilitated land. If no suitable rehabilitation areas are available felled trees will be stored in windrows for reuse in future rehabilitation. Note, there is little to no vegetation remaining within the extraction area. Topsoil material to be stripped will be used immediately or stored in stockpiles no greater than 1.5 metres in height and be revegetated with temporary grass species or otherwise stabilised as described in the erosion risk controls above. Note, there is little to no topsoil remaining in the extraction area.
	Limited biological resources available on site.	Importation of topsoil/growth medium material.	If on-site topsoil/growth medium deficit is noted, material may be imported to assist in rehabilitation.
Weather Conditions	Adverse weather conditions during land clearing.	Land clearing activities will not be undertaken during adverse weather conditions.	Land clearing will not be undertaken during periods of prolonged rainfall where damage to soil structure and erosion impacts are greatest.
Geochemical/ Chemical soil conditions	Adverse geochemical/chemical composition of soil/ interburden / overburden materials.	Soil testing of soils / interburden and overburden material will be undertaken.	Materials stockpiled on site will be tested for suitability prior to re-use in rehabilitation. Ameliorants will be applied to the materials as required.

Table 14. Decommissioning Phase Rehabilitation Risk Assessment

Hazard	Risks	Risk Controls	Details
Infrastructure	Retained roads and hardstands are not safe and stable.	All roads and hardstand areas to be retained for the final landuse will be reduced in width/size to that suitable for the final landuse.	Roads not required for final landuse are removed. Hardstand areas reduced to a size required for the final landuse. Slopes of major tracks are to be <10 degrees or have cross drains/banks installed. Where unsuitable soils are present, tracks are to be stabilised with crushed bricks, concrete, gravel or similar.
	Utility services present a safety hazard.	Services not required for final landuse are disconnected.	Relevant services disconnected by qualified contractors
Hazardous Materials	Harm to environment due to hazardous materials.	No hazardous materials remain	All hazardous material removed

Table 15. Landform Establishment Phase Rehabilitation Risk Assessment

Hazard	Risks	Risk Controls	Details
Unstable landform	The final landform is unstable.	Continued monitoring of the landform establishment works by suitably qualified person/s.	Slopes to be reduced until all slopes meet the approved final landform. Suitably qualified geotechnical engineer engaged to assess the instability and provide a range of recommendations to remediate the instability.
Final landform unsuitable for final landuse.	Final landform does not conform to approved final landform.	Landform to be remediated to approved final landform.	Slopes to be reduced until all slopes meet the approved final landform. Investigate importation of suitable material to batter slopes such as VENM, ENM is required. Survey plan to be prepared to show final slopes meet the approved final landform.
Landform not suitable for target plant species	Target plant species unable to establish.	Soil testing of soils / inter-burden and overburden material will be undertaken.	Materials stockpiled on site will be tested for suitability prior to re-use in rehabilitation. Ameliorants will be applied to the materials as required.

Table 16. Growth Medium Establishment Phase Rehabilitation Risk Assessment

Hazard	Risks	Risk Controls	Details
Unsuitable physical and structural substrate	Substrate compacted	Substrates to be placed in such a way to maintain soil structure as far as possible.	Minimise vehicle movement over the emplaced substrates. Substrates to be lightly ripped to permit water infiltration and air penetration prior to topsoil placement.
Subsoil and topsoil deficit	Insufficient on-site material available for growth medium.	Available topsoils are stockpiled appropriately and reused on the site.	Records to include amounts of subsoil and topsoils stripped, locations and depths re-spread. If on-site topsoil/growth medium deficit is noted, material may be imported to assist in rehabilitation.
Substrate chemically unsuitable	Substrate inadequate to support revegetation or agricultural land capability.	Soil testing of soils / interburden and overburden material will be undertaken.	Materials stockpiled on site will be tested for suitability prior to re-use in rehabilitation. Ameliorants will be applied to the materials as required. Importation of more suitable materials to be investigated and undertaken if deemed necessary.

Table 17. Ecosystem and Land Use Establishment Phase Rehabilitation Risk Assessment

Hazard	Risks	Risk Controls	Details
Lack of target seed availability and quality	Seeds unable to be sourced for rehabilitation.	Egologist or other suitably qualified persons to be engaged to investigate suitable alternatives.	
Poor seed viability and dormancy	Insufficient germination of seeds to provide groundcover.	Certified seed stock to be utilised as far as possible in rehabilitation.	
Ant and Insect predation	Seed stock depleted by predation.	Protect sown seeds as far as possible.	Seeds to be lightly covered by soil when spread. Apply liquid tackifier if required to bind seeds to the surface. Keep soil moist by mulching or application of water to deter ants.
Damage to seed through revegetation processes	Insufficient germination of seeds to provide groundcover.	Protect seeds from damage during rehabilitation.	Experienced contractors to be employed for rehabilitation works. Rehabilitation areas to be protected from vehicular traffic by fencing or similar barriers. Minimise handling of seeds during storage and use.
Weed Infestation	Weed number overwhelm revegetation.	Regular inspection and spraying for weeds will be undertaken.	Monitoring confirms that after 2 years the non-native/non-target species (weeds) represents less than 20% of projected foliage cover or equivalent to surrounding vegetation not disturbed by mining activities.
Inappropriate rehabilitation techniques	Failure of rehabilitation.	Ensure approved rehabilitation plan is followed.	Experienced contractors to be employed for rehabilitation works. Rehabilitation to be undertaken in accordance with the Rehabilitation Plan approved by DPIE and this plan. Proponent to supervise rehabilitation works to ensure compliance with any approved plans and best practice techniques are utilised.
		Approved plans will be reviewed as required to ensure best practice techniques are employed.	
Adverse weather conditions	Failure of rehabilitation.	Revegetation will not be undertaken during periods of drought.	
		Rehabilitation works will not be undertaken during wet periods where soils and seed planting may be damaged.	
		A water cart may be employed to water rehabilitation areas during dry or windy periods until vegetation is established.	
Inappropriate Seasonal timing of revegetation	Failure of rehabilitation.	Revegetation will preferably be planted during the spring and autumn seasons to avoid hot and dry weather conditions and winter frost.	

Table 18. Ecosystem and Land Use Development Phase Rehabilitation Risk Assessment

Hazard	Risks	Risk Controls	Details
Weather and climatic influences	Failure of rehabilitation.	A water cart may be employed to water rehabilitation areas during dry or windy periods until vegetation is established.	
		Reseeding of failed areas may be undertaken as advised by ecologist or suitably qualified person/s	
Long term water quality and quantity issues	Decrease in downstream water quality.	Mine personnel identify site of erosion and remediate through additional earthworks, soil works including addition of ameliorants, supplementary revegetation or other stabilisation method.	
	Groundwater seepage increases salinity in remaining water bodies.	Engage hydrologist and/or geotechnical engineer to assess impacts and remediation measures if required.	
Damage to rehabilitation	Grazing by native and domestic fauna adversely impacting on ecosystem development.	Rural fences and gates installed around disturbed area.	Feral animal controls will be implemented if required. Controlled grazing of domestic stock. Monitoring reports indicate the level of grazing is appropriate.
	Deliberate vandalism of rehabilitation areas.	Rural fences and gates installed around disturbed area to prevent unauthorised access that may damage rehabilitation.	Monitoring indicates evidence of trespassing and/or damage to rehabilitation areas. Appropriate fencing, signage and bunding is to be repaired and maintained.
	Bushfire damages rehabilitation areas.	Where possible regular slashing/mowing of pasture areas will be undertaken.	
	Weed number overwhelm revegetation.	Regular inspection and spraying for weeds will be undertaken.	Monitoring confirms that after 2 years the non-native/non-target species (weeds) represents less than 20% of projected foliage cover or equivalent to surrounding vegetation not disturbed by mining activities.
	Insect and plant disease overwhelm revegetation.	Regular inspections to be undertaken and spraying undertaken as appropriate.	
Insufficient establishment of target species and limited species diversity	Vegetation community does not become established on final landform affecting final land use and ecosystem.	Suitably qualified ecologist or revegetation expert engaged to assess reasons for divergence of failure of endemic species establishment and recommend actions to ensure that the final vegetation community corresponds as closely as possible to the approved community.	Sowing of additional seed mix for targeted species or additional species endemic to the pre-disturbance community. Use of Tubestock, seed and mulch mix or other application techniques. Soil amelioration works such as addition of fertiliser. Additional weed control activities (mechanical and/or chemical).
Erosion and failure of landform	Vegetation is unable to be established due to erosion.	Mine personnel identify site of erosion and remediate through additional earthworks, soil works including addition of ameliorants, supplementary revegetation or other stabilisation method.	If the above is unsuccessful, a suitably qualified professional in sediment and erosion control will be engaged to prepare and assessment report and recommendations to be implemented.
	Visual inspection indicates that the final landform is the source of unacceptable levels of sedimentation downstream.	Mine personnel identify site of erosion and remediate through additional earthworks, soil works including addition of ameliorants, supplementary revegetation or other stabilisation method.	If the above is unsuccessful, a suitably qualified professional in sediment and erosion control will be engaged to prepare and assessment report and recommendations to be implemented.

4 Rehabilitation Objectives

~~Rehabilitation will be in accordance with three key principles.~~

- ~~Least possible disturbance;~~
- ~~Erosion control and sediment management; and~~
- ~~Progressive rehabilitation~~

~~Conceptual objectives of rehabilitation activities are presented in *Table 23* below.~~

~~*Table 23 Rehabilitation Objectives and Targets*~~

~~Feature~~	~~Objective~~	~~Target~~
~~**Safety**~~	~~Significant hazards removed, controlled or contained~~	~~At completion of rehabilitation, no reasonably preventable hazards or reported incidents on site for 12 months.~~
~~**Land Use**~~	~~Provide for a landform suitable for agribusiness landuse.~~	~~Revegetation layer (grasses and shallow rooted shrubs).~~
	~~Maintain Biodiversity Values in Riparian Areas~~	~~Maintain riparian zone offset of 40 metres from Top of Bank of Oaky Creek.~~
~~**Landform**~~	~~Provide a geotechnically stable landform.~~	~~A gently bowled landform with a water body (for stock water) within the floor of the bowl in the north east.~~
	~~Provide a non-polluting landform~~	~~Water quality monitoring results show that the landform is non-polluting within the meaning of Section 120 of the Protection of the Environment Operations Act 1997. In particular, 'downstream' water quality monitoring will record total suspended solids <50mg/L or within 10% of 'upstream' levels (whichever is the greater).~~
~~**Biodiversity**~~	~~Revegetated areas provide a vegetation community with maintenance requirements no greater than adjoining vegetation not disturbed by mining activities.~~	~~Rehabilitation is consistent with the Biodiversity Management Plan (EMM 2021).~~ ~~Rehabilitation monitoring confirms that the established vegetation communities are self-sustaining (refer to *Table 27* for detailed criteria).~~
	~~Revegetated areas contain species consistent with surrounding vegetation communities.~~	~~Rehabilitation is consistent with the Biodiversity Management Plan (EMM 2021).~~ ~~Rehabilitation monitoring confirms the non-native and non-target species (weeds) represent less than 10% of projected foliage cover or equivalent to surrounding vegetation not disturbed by mining activities.~~
~~**Tenement Relinquishment**~~	~~Allow for the relinquishment of the mining lease and the return of the security lodged over the Mining Lease within a reasonable time after the end of the mine life.~~	~~5 years after final rehabilitation.~~

6.2 DOMAIN REHABILITATION OBJECTIVES

Rehabilitation objectives for the MOP area are outlined in *Section 5.3*.

6.3 REHABILITATION PHASES

It is envisaged that rehabilitation will not be completed at the end of the MOP period.

Table 26 Summary of Rehabilitation Phases Proposed at End of the MOP (by Domain)

Domain/ Rehabilitation Phase	Infrastructure/ Infrastructure (1A)	Water Management/ Water Management (3B)	Overburden Emplacement/ Grassland (4C)	Void/ Grassland (6C)	Conservation and Biodiversity Offset Area (9J)
Active Mining Area	✓	✓	✓	✓	✓
Decommissioning	✗	✗	✗	✗	✗
Landform Establishment	✗	✗	✗	✗	✗
Growth Medium Development	✗	✗	✗	✗	✗
Ecosystem and Land Use Establishment	✗	✗	✗	✗	✗
Ecosystem and Land Use Sustainability	✗	✗	✗	✗	✗
Relinquished Lands	✗	✗	✗	✗	✗

7 Performance Indicators and Completion Criteria

Table 27 Rehabilitation Objectives and Completion Criteria

Objective	Performance Indicator	Completion Criteria	Monitoring Methodology	Monitoring Frequency	Completion Justification/Source Once Completed	Progress at Start of MOP and Expected Completion
Phase 1 - Decommissioning						
Domain 1 - Infrastructure						
All infrastructure and services not suitable for the final landuse will be removed.	Services not required for final landuse are disconnected.	Relevant services disconnected by qualified contractors	Report from qualified contractors	Upon decommissioning completion	EIS and Supplementary Reports	Not commenced/ Post extraction completion
	Infrastructure not required for final land use is removed	Relevant infrastructure removed.	Relinquishment inspection and report	Upon decommissioning completion	EIS and Supplementary Reports	Not commenced/ Post extraction completion
All roads and hardstand areas to be retained for the final landuse will be reduced in width/size to that suitable for the final landuse.	Roads not required for final landuse are removed.	Roads removed unless specified to be retained	Relinquishment inspection and report	Upon decommissioning completion	EIS and Supplementary Reports	Not commenced/ Post extraction completion
	Roads required for final landuse are reduced in width (if required)	Roads reduced in width to that suitable for final land use.	Relinquishment inspection and report	Upon decommissioning completion	EIS and Supplementary Reports	Not commenced/ Post extraction completion
	Hardstand areas reduced to a size required for the final landuse	Hardstand areas reduced in size to that suitable for final landuse.	Relinquishment inspection and report	Upon decommissioning completion	EIS and Supplementary Reports	Not commenced/ Post extraction completion
Sediment runoff to be contained	Sediment retained in water management structures	Sediment Dams will be designed to Best Practice according to the 'Blue Book' Criteria for a 5 day 90th percentile storm event. All drains will be designed for the 1 in 10 years design storm event. All spillways will be designed for the 1 in 100-year design storm event and do not re-entrain sediment.	Basins currently meet specifications (see Section 4.2.5.4).). Inspection for capacity by mine manager.	On construction completion and monthly until relinquishment.	DECC- Managing Urban Stormwater, EIS and Supplementary Reports	Not commenced/ Post extraction completion
Domain free from hazardous materials	No hazardous materials remain	All hazardous material removed	Contamination report prepared by qualified person.	Following decommissioning with follow up validation testing as required.	EIS and Supplementary Reports	Not commenced/ Post extraction completion

Objective	Performance Indicator	Completion Criteria	Monitoring Methodology	Monitoring Frequency	Completion Justification/Source Once Completed	Progress at Start of MOP and Expected Completion
Phase 1 – Decommissioning (continued)						
Domain 3 – Water Management						
Sediment dams to be retained in the final landform are converted to clean water dams.	No sediment laden water enters the remaining clean water dam system.	Dams have been desilted to increase capacity and minimise sediment entrainment in discharged water. The catchment areas for the remaining sediment dams are sufficiently rehabilitated so as to only contain clean water runoff.	Basins currently meet specifications (see Section 4.2.5.4). Inspection for capacity by mine manager.	On construction completion and monthly until relinquishment.	DECC- Managing Urban Stormwater, EIS and Supplementary Reports	Not commenced/ Post extraction completion
	Sediment dam discharge due to overtopping does not entrain sediment.	Sediment Dams will be designed to Best Practice according to the 'Blue Book' Criteria for a 5 day 90th percentile storm event. All drains will be designed for the 1 in 10 years design storm event. All spillways will be designed for the 1 in 100 year design storm event and do not re-entrain sediment.	Basins currently meet specifications (see Section 4.2.5.4). Inspection for capacity by mine manager.	On construction completion and monthly until relinquishment.	DECC- Managing Urban Stormwater, EIS and Supplementary Reports	Not commenced/ Post extraction completion
Water discharged from the site is consistent with the baseline ecological, hydrological and geomorphic conditions of the surrounding environment	Water quality monitoring results show that the landform is non-polluting.	Water Quality meets the objective of Section 120 of the Protection of the Environment Operations Act 1997. In particular the EPL Monitoring Point will record pH between 6.5 and 8.5, turbidity < 150 NTU.	Downstream water to be monitored for pH, EC, NTU, TSS prior to discharge. NATA laboratory	Prior to discharge	EPL EIS and Supplementary Reports	Not commenced/ Post extraction completion
Domain 4 – Overburden Emplacement Area						
All overburden will be removed and reused in the establishment of the final landform.	No remaining overburden stockpiles	All overburden stockpiles are removed and or incorporated into the final landform.	Relinquishment inspection and report	Upon decommissioning completion	EIS and Supplementary Reports	Not commenced/ Post extraction completion
Sediment runoff to be contained.	Sediment retained in water management structures	Sediment Dams will be designed to Best Practice according to the 'Blue Book' Criteria for a 5 day 90th percentile storm event. All drains will be designed for the 1 in 10 years design storm event. All spillways will be designed for the 1 in 100 year design storm event and do not re-entrain sediment.	Basins currently meet specifications (see Section 4.2.5.4). Inspection for capacity by mine manager.	On construction completion and monthly until relinquishment.	DECC- Managing Urban Stormwater, EIS and Supplementary Reports	Not commenced/ Post extraction completion
Domain 5 – Stockpile Material						
All remaining stockpiles will be removed and/or reused in the establishment of the final landform.	No remaining stockpiles	All remaining stockpiles are removed.	Relinquishment inspection and report	Upon decommissioning completion	EIS and Supplementary Reports	Not commenced/ Post extraction completion
Domain 6 – Open Cut Void						
No activities within this domain are required during this phase						
Domain 9 - Conservation and Biodiversity Offset Area						
No activities within this domain are required during this phase						

Objective	Performance Indicator	Completion Criteria	Monitoring Methodology	Monitoring Frequency	Completion Justification/Source Once Completed	Progress at Start of MOP and Expected Completion
Phase 2 - Landform Establishment						
Domain 1 – Infrastructure						
Domain landform is safe, stable and non-polluting, fit for the purpose of the intended final land use	The interim final landform will be a gently bowled landform with a water body (for stock water) within the floor of the bowl in the north east.	Slopes are no greater than 3 horizontal to 1 vertical and slope lengths shall not exceed 80 metres before being broken by earth banks or similar.	Survey on completion by registered surveyor. Geotechnical assessment report.	Upon completion of landform establishment phase. Progress reported in ARR	DECC- Managing Urban Stormwater EIS and Supplementary Reports	Not commenced/ Post extraction completion
	Suitable sediment and erosion controls in place	Sediment Dams will be designed to Best Practice according to the 'Blue Book' Criteria for a 5 day 90th percentile storm event. All drains will be designed for the 1 in 10 years design storm event. All spillways will be designed for the 1 in 100 year design storm event and do not re-entrain sediment.	Basins currently meet specifications (see Section 4.2.5.4). Inspection for capacity by mine manager.	On construction completion and monthly until relinquishment.	DECC- Managing Urban Stormwater, EIS and Supplementary Reports	Not commenced/ Post extraction completion
Access tracks to be retained	Tracks suitable for private access or pedestrian usage	Slopes of major tracks <10° or have cross drains/banks installed. Where unsuitable soils are present, tracks to be stabilised with crushed bricks, concrete, gravel or similar.	Survey on completion by registered surveyor. Stabilisation methods to be recorded and reported by Site Contractor in CCR and RR	Upon completion of landform establishment phase. Progress reported in ARR	ML Conditions, DECC- Managing Urban Stormwater design EIS and Supplementary Reports	Not commenced/ Post extraction completion
Domain 3 - Water Management						
Water management structures to be retained. No landform establishment activities applicable to this domain.						
Domain 4 - Overburden Emplacement Area						
Ensure overburden emplacement areas has been battered/shaped to the final landform.	The interim final landform will be a gently bowled landform with a water body (for stock water) within the floor of the bowl in the north east.	Slopes are no greater than 3 horizontal to 1 vertical and slope lengths shall not exceed 80 metres before being broken by earth banks or similar.	Survey on completion by registered surveyor. Geotechnical assessment report.	Upon completion of landform establishment phase. Progress reported in ARR	DECC- Managing Urban Stormwater EIS and Supplementary Reports	Not commenced/ Post extraction completion
Sediment runoff to be contained.	Sediment retained in water management structures	Sediment Dams will be designed to Best Practice according to the 'Blue Book' Criteria for a 5 day 90th percentile storm event. All drains will be designed for the 1 in 10 years design storm event. All spillways will be designed for the 1 in 100 year design storm event and do not re-entrain sediment.	Basins currently meet specifications (see Section 4.2.5.4). Inspection for capacity by mine manager.	On construction completion and monthly until relinquishment.	DECC- Managing Urban Stormwater, EIS and Supplementary Reports	Not commenced/ Post extraction completion

Objective	Performance Indicator	Completion Criteria	Monitoring Methodology	Monitoring Frequency	Completion Justification/Source Once Completed	Progress at Start of MOP and Expected Completion
Phase 2 – Landform Establishment						
Domain 5 – Stockpile Material						
Domain landform is safe, stable and non-polluting, fit for the purpose of the intended final land use	The interim final landform will be a gently bowled landform with a water body (for stock water) within the floor of the bowl in the north east.	Slopes are no greater than 3 horizontal to 1 vertical and slope lengths shall not exceed 80 metres before being broken by earth banks or similar.	Survey on completion by registered surveyor. Geotechnical assessment report.	Upon completion of landform establishment phase. Progress reported in ARR	DECC- Managing Urban Stormwater EIS and Supplementary Reports	Not commenced/ Post extraction completion
	Suitable sediment and erosion controls in place	Sediment Dams will be designed to Best Practice according to the 'Blue Book' Criteria for a 5 day 90th percentile storm event. All drains will be designed for the 1 in 10 years design storm event. All spillways will be designed for the 1 in 100 year design storm event and do not re-entrain sediment.	Basins currently meet specifications (see Section 4.2.5.4). Inspection for capacity by mine manager.	On construction completion and monthly until relinquishment.	DECC- Managing Urban Stormwater, EIS and Supplementary Reports	Not commenced/ Post extraction completion
Domain 6 – Open Cut Void						
Domain landform is safe, stable and non-polluting, fit for the purpose of the intended post-mining land use(s)	The interim final landform will be a water body (for stock water) within the former void	Slopes are stable leading to the water body.	Survey on completion by registered surveyor. Geotechnical assessment report.	Upon completion of landform establishment phase. Progress reported in ARR	DECC- Managing Urban Stormwater EIS and Supplementary Reports	Not commenced/ Post extraction completion
Domain landform is effectively drained and protected from erosion	Landform drains towards water management domain	Sediment Dams will be designed to Best Practice according to the 'Blue Book' Criteria for a 5 day 90th percentile storm event. All drains will be designed for the 1 in 10 years design storm event. All spillways will be designed for the 1 in 100 year design storm event and do not re-entrain sediment.	Basins currently meet specifications (see Section 4.2.5.4). Inspection for capacity by mine manager.	On construction completion and monthly until relinquishment.	DECC- Managing Urban Stormwater, EIS and Supplementary Reports	Not commenced/ Post extraction completion
Access tracks to be retained	Tracks suitable for private access or pedestrian usage	Slopes of major tracks <10° or have cross drains/banks installed. Where unsuitable soils are present, tracks to be stabilised with crushed bricks, concrete, gravel or similar.	Survey on completion by registered surveyor. Stabilisation methods to be recorded and reported by Site Contractor in CCR and RR	Upon completion of landform establishment phase. Progress reported in ARR	ML Conditions, DECC- Managing Urban Stormwater design EIS and Supplementary Reports	Not commenced/ Post extraction completion
Materials (including topsoils of the disturbed areas) are recovered, appropriately managed and used efficiently as resource in the rehabilitation	Available topsoils are stockpiled appropriately and reused on the site	Available topsoil is spread over final landform	Site contractor to record growth medium management procedures in Annual Reports. Records to include amounts stripped, locations and depths re-spread	Annually in ARR	ARR	Not commenced/ Post extraction completion
Domain 9 – Conservation Area						
No activities within this domain are required during this phase						

Objective	Performance Indicator	Completion Criteria	Monitoring Methodology	Monitoring Frequency	Completion Justification/Source Once Completed	Progress at Start of MOP and Expected Completion
Phase 3 - Growth Medium Development						
Domain A - Infrastructure						
No revegetation is to occur in this domain, therefore no activities are required during this phase						
Domain B - Water Management						
No revegetation is to occur in this domain, therefore no activities are required during this phase						
Domain C - Rehabilitation Area – Grassland						
Establish soil/growing medium suitable for establishment of grassland or woodland vegetation community	Revegetation layer established	A topsoil established of at least 100 millimetres thick and comprising clean soils, which can include compost to help with vegetation establishment and growth.	Small 'test pits' dug and photographed to show final soil depth, report indicates required thicknesses achieved.	Upon completion of landform establishment phase. Progress reported in ARR	EIS and Supplementary Reports Environmental Management Plan (to be developed)	Not commenced/ Post extraction completion
	Soil quality comparable to that in undisturbed areas	Analysis of soil samples record similar parameter for pH, EC, Dispersion percentage and organic content.	Soil analysis report included in ARR or relinquishment report.	Following spreading of soil and annually for 5 years	EIS and Supplementary Reports Environmental Management Plan (to be developed)	Not commenced/ Post landform establishment
Domain J - Conservation Area						
No activities within this domain are required during this phase.						

Objective	Performance Indicator	Completion Criteria	Monitoring Methodology	Monitoring Frequency	Completion Justification/Source Once Completed	Progress at Start of MOP and Expected Completion
Phase 4 - Ecosystem and Land Use Establishment						
Domain A - Infrastructure						
No revegetation is to occur in this domain, therefore no activities are required during this phase.						
Domain B - Water Management						
Wetlands water management structure to remain therefore no activities required during this phase.						
Domain C - Rehabilitation Area – Grassland						
Re-establishment of a grassland/woodland community with a similar composition to the pre-disturbance community.	Revegetation species mix applied as suggested in Site Rehabilitation Management Plan	A target coverage factor of 70% will be subject to further refinement.	Monitoring including photography to be conducted by suitably qualified person and reported annually.	Monthly for the first 6 months, then 6 monthly until completion criteria achieved	EIS and Site Rehabilitation Management Plan	Not commenced/ Ongoing
	The rehabilitated area does not constitute an erosion hazard.	Total projected foliage cover is greater than or equal to 70%.	Monitoring including photography to be conducted by suitably qualified person and reported annually.	Monthly for the first 6 months, then 6 monthly until completion criteria achieved	DECC Managing Urban Stormwater EIS	Not commenced/ Ongoing
	Weeds not preventing revegetation from establishing	Monitoring confirms that after 2 years the non-native/non-target species (weeds) represents less than 20%of projected foliage cover or equivalent to surrounding vegetation not disturbed by mining activities.	Monitoring including photography to be conducted by suitably qualified person and reported annually.	Monthly for the first 6 months, then 6 monthly until completion criteria achieved	EIS and Site Rehabilitation Management Plan	Not commenced/ Ongoing
	Grazing by native and domestic fauna not adversely impacting on ecosystem development	Rural fences and gates installed around disturbed area to allow controlled grazing of domestic stock. Feral animal controls will be implemented if required. Monitoring reports indicate the level of grazing is appropriate.	Monitoring including photography to be conducted by suitably qualified person and reported annually.	Monthly for the first 6 months, then 6 monthly until completion criteria achieved	EIS and Site Rehabilitation Management Plan	Not commenced/ Ongoing
Domain J - Conservation Area						
Ensure that ecosystem suitable for enhancement of vegetation community	Weeds not impacting existing riparian vegetation.	Monitoring confirms that the non-native/non-target species (weeds) represents less than 20%of foliage cover.	Monitoring including photography to be conducted by suitably qualified person and reported annually.	Monthly for the first 6 months, then 6 monthly until completion criteria achieved	EIS, MOP, Site Rehabilitation Management Plan & Biodiversity Management Plan	Not commenced/ Ongoing

Objective	Performance Indicator	Completion Criteria	Monitoring Methodology	Monitoring Frequency	Completion Justification/Source Once Completed	Progress at Start of MOP and Expected Completion
Phase 5 – Ecosystem and Land use Sustainability						
Domain A - Infrastructure						
No activities are required during this phase						
Domain B - Water Management						
No activities required during this phase						
Domain C- Rehabilitation Area – Grassland						
Re-establishment of a grassland community with a similar composition to the pre-disturbance community.	Vegetation self-sustaining.	Monitoring confirms: • Evidence of new growth of endemic species. • Evidence of successive generations of endemic species • No further active weed control required (beyond that considered necessary at analogue sites).	Monitoring including photography to be conducted by suitably qualified person and reported annually.	Monthly for the first 6 months, then 6 monthly until completion criteria achieved	EIS and related plans	Not commenced/ Relinquishment of tenement
Domain J - Conservation Area						
Conservation and Biodiversity offset area is established and self-sustaining	Vegetation self-sustaining.	Monitoring confirms: • Evidence of new growth of endemic species. • Evidence of successive generations of endemic species • No further active weed control required (beyond that considered necessary at analogue sites).	Monitoring including photography to be conducted by suitably qualified person and reported annually.	Monthly for the first 6 months, then 6 monthly until completion criteria achieved	EIS, MOP, Site Rehabilitation Management Plan & Biodiversity Management Plan	Not commenced/ Relinquishment of tenement

Objective	Performance Indicator	Completion Criteria	Monitoring Methodology	Monitoring Frequency	Completion Justification/Source Once Completed	Progress at Start of MOP and Expected Completion
Phase 6 – Relinquishment						
All Domains						
Relinquishment	Demonstrated compliance with all completion criteria	Outlined above	Relinquishment Report to be prepared by suitably qualified person describing compliance with all criteria	Prior to relinquishment	-	Not commenced/ Relinquishment of tenement

4.1 REHABILITATION OBJECTIVES AND REHABILITATION COMPLETION CRITERIA

Table 19. Rehabilitation Objectives and Rehabilitation Completion Criteria

Final Land Use	Mining Domain	Proposed Rehabilitation Objectives	Indicator	Proposed Completion Criteria	Validation Method, Monitoring or Record
Infrastructure	Infrastructure	Retention of infrastructure: All infrastructure that is to remain as part of the final land use is safe and does not pose any hazard to the community.	Retention of infrastructure: All infrastructure that is to remain as part of the final land use is safe and does not pose any hazard to the community.	Hazards isolated and secured.	Statement provided by suitably qualified engineer.
			Damage to access tracks has been repaired and stabilised.	Repairs complete.	As-constructed final landform plan, photos etc.
			Tracks suitable for private access or pedestrian usage.	Slopes of major tracks <10° or have cross drains/banks installed. Where unsuitable soils are present, tracks to be stabilised with crushed bricks, concrete, gravel or similar	Survey on completion by registered surveyor.
			Where applicable, necessary approvals are in place (e.g. development consent under the Environmental Planning and Assessment Act 1979) where buildings and infrastructure are to be retained as part of final land use.	Permits and approval documents issued.	Copy of any relevant approvals.
			The structural integrity of the infrastructure is suitable and safe for use as part of the intended final land use.	The structural integrity of the infrastructure has been inspected by a suitably qualified engineer and determined to be suitable and safe as part of the intended final land use.	Engineering report/statement, photos, risk assessment verifying modes of failure are adequately addressed to minimise risks to public safety or the environment.
			Infrastructure is in a condition (e.g. structural, electrical, other hazards) that is suitable for the intended final land use.	Formal acceptance from the subsequent landowner that infrastructure is in a condition that is suitable for the intended final land use in accordance with formal agreement.	Formal acceptance from landowner.
		Wildlife Attraction: Minimise risk to WSA due to bird strike due to wildlife attraction to retained infrastructure such as fences, lighting etc..	Structures, fencing and lighting will minimise areas for wildlife, especially birds, to use for breeding, roosting, or perching. This will include: no eaves or ensuring no access to the roof cavity through the eaves; and using 'bird-spikes' on roof edges, fences and lighting.	Bird-spikes or other measures are installed as appropriate.	Statement provided and before/after photos.
Water Storage	Water Management Area Active Mining Area (Open cut void)	Surface Water Storage: Water quality within final water body is similar to, or better than the pre-disturbance runoff water quality.	Water quality parameters and trigger values for Oaky Creek as developed in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence. Analysis includes: pH, Conductivity, Turbidity, Ammonia, oxidised nitrogen, total nitrogen, reactive phosphorous, total phosphorus, dissolved metals (Al, As, B, Cd, Cr, Cu, Fe, Mn, Ni, Pb & Zn).	Water quality discharged from rehabilitated mining operation meet specifications in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence.	Water quality monitoring reports. Environment Protection Licence relinquished by Environment Protection Authority. Independent hydrological assessment report. Achievement of criteria to be evaluated over a period of 5 years.
		Water Approvals; Final water body is appropriately licensed (e.g. under the Water Management Act 2000) and where required, ensure sufficient licence shares are held in the water source(s) to account for water take.	Final landform considers advice from relevant Government Agency whether sufficient licence shares are available in the water source to account for water stored in voids and dams in the proposed final landform	Water approvals / licences are granted by relevant NSW Government Agency.	Confirmation from relevant Government Agency that relevant water approvals / licences are able to be granted.

Final Land Use	Mining Domain	Proposed Rehabilitation Objectives	Indicator	Proposed Completion Criteria	Validation Method, Monitoring or Record
		Wildlife Attraction; Minimise risk to WSA due to bird strike due to wildlife attraction to final water bodies.	Installation of netting or lines across it with moving flags to deter birds prior to the commencement of WSA operations.	Bird deterrents installed.	Statement provided and before/after photos.
Agriculture Grazing	Infrastructure Overburden Emplacement Active Mining Area (Open cut void)	Removal of Infrastructure: All infrastructure that is not to be used as part of the final land use is removed to ensure the site is safe and free of hazardous materials.	Removal of all services (power, water, communications) that have been connected on the site as part of the operation.	All utility infrastructure removed.	Statement provided, utility service disconnection record / notification.
			Removal of all plant, equipment and associated infrastructure including processing facilities, stockpile areas, loading facilities, office complex, portable offices, exploration core samples, camp facilities, storage racks, samples.	Infrastructure removed.	As-constructed final landform plan, photos, decommissioning reports etc
			Removal of all water management infrastructure (including pumps, pipes and power).	Infrastructure removed.	Statement provided and before/after photos.
		Land Contamination: There is no residual soil contamination on site that is incompatible with the final land use or that poses a threat of environmental harm.	Waste material and/or visible contamination areas on site surface.	There are no visible signs of contamination following the removal of plant, equipment and materials. All rubbish/ waste materials removed from site.	Statement provided and before/after photos.
			Soil testing for contaminants of concern as listed by Health Investigation Level of the National Environment Protection (Assessment of Site Contamination) Measure (1999) applicable to land use type.	Contamination will be appropriately remediated so that appropriate guidelines for land use are met, e.g. Health Investigation Level of the National Environment Protection (Assessment of Site Contamination) Measure (1999). Excess sludge/material has been removed from surface water dams.	Contamination Remediation Report prepared by Land Contamination Consultant Site Contamination Audit Report and Site Audit Statement prepared by EPA Accredited Auditor (where required).
		Landform Stability: The final landform is stable for the long-term and does not present a risk of environmental harm downstream/downslope of the site or a safety risk to the public/stock/native fauna. Landform that is commensurate with surrounding natural landform and where appropriate, incorporates geomorphic design principles. The elevation and contours of the rehabilitated landform will be generally consist with the original landform contours which existed prior to the development but would reflect the master plan for the agribusiness/commercial/industrial development of the site.	Visual - indicators of erosion and land instability. Visual - indicators that surface water management structure are functioning as designed. Measured - survey of rehabilitated landform to verify final landform construction in accordance with Final Landform and Rehabilitation Plan. Measured – survey/monitoring of rehabilitated landform to specifically monitor settlement and/or material loss via erosion.	Visual- minimal erosion that would not require moderate to significant ongoing management and maintenance works. Visual – no signs of land instability such as mass movement. Visual - no areas of active gully erosion. Visual - no evidence of tunnel erosion. Visual – no evidence of active scour likely to compromise surface water management structure. Survey verifies final landform complies with final landform construction in accordance with Final Landform and Rehabilitation Plan. Survey verifies that settlement and/or material loss is within predicted limits and will not compromise final landform drainage via differential settlement. Total projected foliage cover is greater than or equal to 70% (Blue Book C -factor equivalent of 0.05)	Before and after photos, rehabilitation monitoring reports, as-constructed surveys, erosion surveys, and independent geotechnical reports (where required) that indicate long-term stability of rehabilitated landform. Stability will continue to be evaluated over 5 years.
				Significant surface water management structures (e.g. spillways, drop structures, major drains and creek diversions) have been constructed in accordance with Managing Urban Stormwater ‘Blue Book’ DECC 2008 requirements.	An engineering assessment undertaken by a suitably qualified person concludes that significant surface water management structures (e.g. spillways, drop structures, and major drains) have been constructed in accordance with Managing Urban Stormwater ‘Blue Book’ DECC 2008 requirements.

Final Land Use	Mining Domain	Proposed Rehabilitation Objectives	Indicator	Proposed Completion Criteria	Validation Method, Monitoring or Record
				High risk landforms (such as steep slopes, high walls) have been constructed in accordance with geotechnical design.	An engineering assessment undertaken by a suitably qualified person concludes that high risk landforms (such as steep slopes, high walls) have been constructed in accordance with geotechnical design.
		Surface Water: Runoff water quality from mine site is similar to, or better than the pre-disturbance runoff water quality.	Water quality parameters and trigger values for Oaky Creek as developed in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence. Analysis includes: pH, Conductivity, Turbidity, Ammonia, oxidised nitrogen, total nitrogen, reactive phosphorous, total phosphorus, dissolved metals (Al, As, B, Cd, Cr, Cu, Fe, Mn, Ni, Pb & Zn).	Water quality discharged from rehabilitated mining operation meet specifications in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence.	Water quality monitoring reports. Environment Protection Licence relinquished by Environment Protection Authority. Independent hydrological assessment report. Achievement of criteria to be evaluated over a period of 5 years
		Groundwater Quality; Groundwater quality is similar to, or better than the pre-disturbance groundwater quality.	Water quality parameters and trigger values for groundwater as developed in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence. Analysis includes: pH, Conductivity, Turbidity, Ammonia, oxidised nitrogen, total nitrogen, reactive phosphorous, total phosphorus, dissolved metals (Al, As, B, Cd, Cr, Cu, Fe, Mn, Ni, Pb & Zn).	Groundwater quality monitored from rehabilitated mining operation meet specifications in the Soil and Water Management Plan (EMM 2021 and as updated from time to time).	Independent hydrological assessment report. Achievement of criteria to be evaluated over a period of 5 years
		Bushfire: The risk of bushfire and impacts to the community, environment and infrastructure has been addressed as part of rehabilitation.	Appropriate bushfire hazard controls (where required) have been implemented on the advice from the NSW Rural Fire Service.	Bushfire controls implemented.	Statement provided and before/after photos.
		Agricultural Revegetation: Revegetation is sustainable for the long-term and only requires maintenance that is consistent with the intended final land use. Land use capability is capable of supporting the target agricultural land use.	Routine Soil Test (bulked soil samples 0-10 cm) Includes: Total Carbon (TC), Total Nitrogen (TN), Organic Matter, TC/TN Ratio; Bray I and II Phosphorus; Colwell Phosphorus; Available cations (Calcium, Magnesium, Potassium, Ammonium, Nitrate, Phosphate, Sulphur); Available Micronutrients (Zinc, Manganese, Iron, Copper, Boron, Silicon); Exchangeable (Sodium, Potassium, Calcium, Magnesium, Hydrogen, Aluminium, Cation Exchange Capacity); pH and EC (1:5 water); Basic Colour, Basic Texture.	Land and Soil Capability classification or Agricultural Land Classification criteria met. The re-established topsoil / subsoil substrate is capable of supporting the targeted pasture / cropping regime on a sustained basis. Pasture establishment is consistent with the range of species utilised within the region. Pasture establishment is in good health and provides adequate cover.	Rehabilitation monitoring reports, independent soil reports, environmental monitoring records, independent agronomist reports. Achievement of criteria to be evaluated over a period of 5 years.
			Resilience demonstrated by the effects of drought and fire on composition, structure and other function attributes of pasture and cropping lands.	Appropriate and reliable access to water for livestock. Appropriate animal refuge areas for livestock (e.g. wooded/treed areas) during extreme weather conditions. Resilience to drought and fire.	
			No further active weed control required beyond that considered necessary at analogue sites.	Monitoring confirms the non-target species (weeds) represent less than 10% of projected foliage cover or equivalent to surrounding vegetation not disturbed by mining activities.	

Final Land Use	Mining Domain	Proposed Rehabilitation Objectives	Indicator	Proposed Completion Criteria	Validation Method, Monitoring or Record
			Grazing by native and domestic fauna not adversely impacting on pasture development.	Rural fences and gates installed around disturbed area to allow controlled grazing of domestic stock. Feral animal controls have been implemented as required. Monitoring reports indicate the level of grazing is appropriate.	
		Wildlife Attraction; Minimise risk to WSA due to bird strike due to wildlife attraction to vegetated areas.	No new planting (e.g. for landscaping) will occur on the site that produces fruit or flowers that are likely to attract birds and wildlife.	No vegetation planted that produce fruit or flowers.	Before and after photos, rehabilitation monitoring reports, environmental monitoring records,
			Waste/litter that may attract birds and vermin to be removed from the site.	No waste/litter remaining on site.	Before and after photos, rehabilitation monitoring reports, environmental monitoring records,
Native Ecosystem	Other (Riparian Zone)	Riparian Zone: Maintain Biodiversity Values in Riparian Areas.	Rehabilitation is consistent with the Biodiversity Management Plan (EMM 2021).	Maintain riparian zone offset of 40 metres from Top of Bank of Oaky Creek.	Before and after photos, rehabilitation monitoring reports, environmental monitoring records,

4.2 REHABILITATION OBJECTIVES AND REHABILITATION COMPLETION CRITERIA – STAKEHOLDER CONSULTATION

Consultation was undertaken during the application phase of the development with DPIE, government agencies responsible for safeguarding Western Sydney Airport (WSA) construction and operations, the EPA, and neighbours. As required under Condition 36A of the development consent, consultation has been carried out with WSA, EPA and the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) on the draft SRP.

A draft Site Rehabilitation Plan (SRP), as required by consent conditions, was provided to the Department of Infrastructure, Transport, Regional Development and Communications, Western Sydney Airport (WSA) and the Environment Protection Authority (EPA) in July 2021 and comments were provided via email correspondence~~. The following summaries the key relevant issues that are required to be addressed in this report (see *Appendix G*).~~ Issues raised during consultation were addressed in the final SRP which was approved in 18 October 2021.

Table 20. Stakeholder Consultation

Stakeholder	Consultation Activities	Matters Subject to Consultation	Where Addressed in this Report	Actions Relating to Rehabilitation Objectives and Completion Criteria
Department of Infrastructure, Transport, Regional Development and Communications	Comments provided to DPIE on draft Site Rehabilitation Management Plan dated 2/8/2021.	Site Rehabilitation Plan I note your email specifies the Site Rehabilitation Plan (SRP) inclusive of a Biodiversity Management Plan (BMP) has been prepared in conjunction with the Mining Operation Plan. However, a BMP was not included in the documents provided for consultation with the Department.	BMP has been prepared and is included in this report.	Wildlife attraction considered in the Rehabilitation Objectives and Completion Criteria. These include: • Waste/litter removal; • Installation of bird deterrents in water bodies and remaining infrastructure; and • No planting of fruiting or flowering vegetation.
		'Schedule 4 condition 33 of the conditions of consent for Mod 5 specifies that the SRP must include a BMP and schedule 4 condition 34(i) specifies that the BMP must include measures for minimising the attraction of wildlife, in consultation with the Department and WSA. The Department reiterates the need for information on, and comprehensive assessment of, the risks of wildlife attraction as a result of the quarry, quarrying operations, waste being disposed into the quarry at the subject site, and the cumulative impact of the subject site alongside other wildlife-attracting land uses that are located within the vicinity of the subject site. This information and assessment, in accordance with the National Airports Safeguarding Framework's (NASF) Guideline C, is necessary to inform consideration and appropriate application of wildlife mitigation and/or management measures.'	This information has been discussed in the BMP. ~~Relevant items have been considered in this report in Section 4.2.16, & 4.2.13.3~~ Relevant items have been considered in this report in Section 6.6.1.37 & Section 6.6.1.26.3 Final Land Use Plan (EMM August 2021) Biodiversity Management Plan (Appendix D)	

Stakeholder	Consultation Activities	Matters Subject to Consultation	Where Addressed in this Report	Actions Relating to Rehabilitation Objectives and Completion Criteria
		This information has been discussed in the SRP, Final Land Use Plan (EMM August 2021) and Biodiversity Management Plan (2021).		
		'While some information regarding mitigation and/or management of wildlife attraction risks have been included in the Land Use Plan (LUP) and SRP, in the absence of a comprehensive analysis of the risks, it remains unclear whether the proposed measures are suitable and would safeguard the long-term operations of the airport. Therefore, the Department requests this information and assessment be provided to ourselves and WSA.' Specific comments relating to wildlife risk are addressed with consideration to the *National Airports Safeguarding Framework Guideline C* in the Final Land Use Plan (EMM August 2021) and in the Biodiversity Management Plan.	The Department of Infrastructure's comments have been considered in the finalisation of the LUP (not included in this report). Specific comments relating to wildlife risk are addressed with consideration to the *National Airports Safeguarding Framework Guideline C* in Section 5.2.1.37 & Section 5.2.1.26.3 Final Land Use Plan (EMM August 2021) and in the Biodiversity Management Plan.	

Stakeholder	Consultation Activities	Matters Subject to Consultation	Where Addressed in this Report	Actions Relating to Rehabilitation Objectives and Completion Criteria
		Other The plans appear to be reliant on the approval of the infilling of the quarry void that is subject to a future and separate development application and the approval of the Luddenham Advanced Resource Recovery Centre (ARRC)(SSD-10446) that is currently under consideration by the NSW Department of Planning, Industry and Environment. The plans also include a number of references that the SSD application for the ARRC 'needs to be approved'. Noting that the ARRC is a separate application that has yet to be finalised and the infilling of the quarry void is subject to a future and separate application, the Department considers it would be more appropriate for the SRP and LUP to be prepared in a manner that is independent of the outcomes of these applications.	Noted This report has been updated to be independent of any future approvals.	
Western Sydney Airport	Comments provided to DPIE on draft Site Rehabilitation Management Plan dated 16/7/2021.	Section 3.3.6 – this should reference Condition 40 of the Mod 5 Quarry approval, noting the maximum length of heavy vehicles allowed and the restriction on movements at the intersection of Elizabeth Drive and Adams Road.	~~Section 3.3.6~~ Section 5.2.1.8	

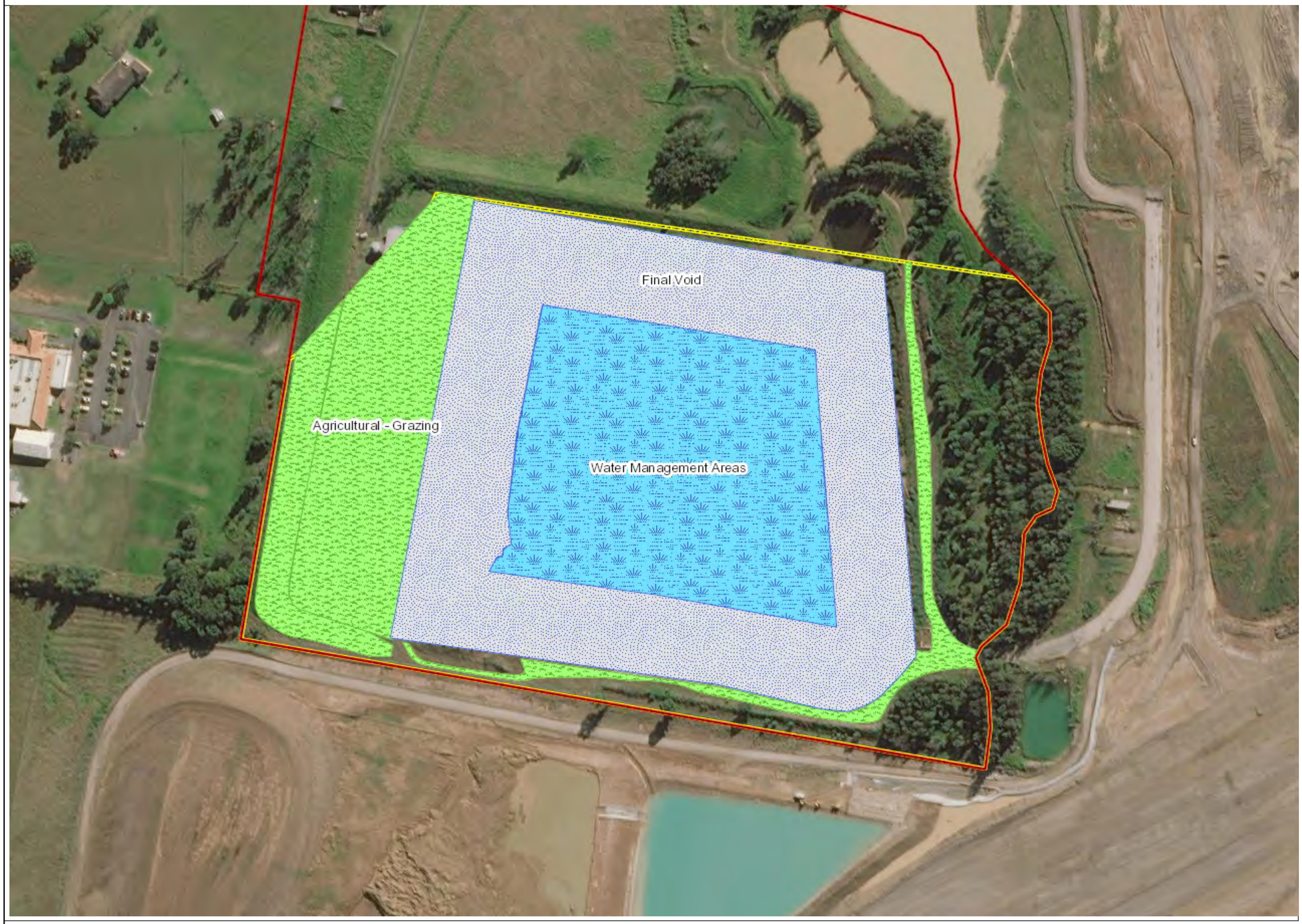
Stakeholder	Consultation Activities	Matters Subject to Consultation	Where Addressed in this Report	Actions Relating to Rehabilitation Objectives and Completion Criteria
		Section 3.3.11 – Additional measures here are to include wildlife mitigation measures associated with the risk to WSI.	~~Section 4.2.16~~ Section 5.2.1.37 Final Land Use Plan (EMM August 2021) Biodiversity Management Plan (Appendix D)	
		Section 4.2.2.2, First bullet point – Given the reference on 3.3.11 that "progressive rehabilitation opportunities are limited until the resource is exhausted", the first point here should be explored further detailing the situations in which progressive rehabilitation would be able to occur.	~~Section 3.3.11 and Section 4.2.2.2~~ Section 5.2.1.13 & Section 5.2.1.32	
		Section 4.2.13 – Note that in addition to the waste management measures here, measures to specifically reduce waste management risk to WSA (i.e. wildlife management) measures should be included here as well. This section should include an additional subheading to this effect.	~~Section 4.2.13.3~~ Section 5.2.1.26	

Stakeholder	Consultation Activities	Matters Subject to Consultation	Where Addressed in this Report	Actions Relating to Rehabilitation Objectives and Completion Criteria
		Section 4.2.16 – Note that the risks identified here in relation to WSA are insufficient in analysis depth or detail. The risks here need to be: o identified in accordance with the short, medium and long term growth of WSI, as prescribed by the Western Sydney Airport Plan; o analysed in accordance with the aviation safeguarding risks identified under the National Airports Safeguarding Framework (National Airports Safeguarding Framework Principles and Guidelines (infrastructure.gov.au)); and o communicated in this plan such that specific risks are aligned to specific mitigation measures.	~~Section 4.2.16~~ Section 5.2.1.37 Final Land Use Plan Biodiversity Management Plan (Appendix D)	

Stakeholder	Consultation Activities	Matters Subject to Consultation	Where Addressed in this Report	Actions Relating to Rehabilitation Objectives and Completion Criteria
EPA	Response provided to DPIE on draft Site Rehabilitation Management Plan dated 28/7/2021.	The EPA's position on post approval management plans (including the NMP, AQMP and SWMP) is to encourage the development of such plans to ensure that proponents have determined how they will meet their statutory obligations and designated environmental objectives. However, we do not approve or endorse these documents as our role is to set environmental objectives for environmental management and not to be directly involved in the development of strategies to achieve those objectives. Therefore we will not be providing comments on the NMP, AQMP and SWMP. These documents are important for our decision making, such as with the licence application, and ensure compliance with s45 of the POEO Act and to support those decisions.	Noted	Not required.

5 Final Landform and Rehabilitation Plan

Luddenham Clay Mine (ML1816) Plan 1- Final Landform Features



Legend

- Final Landform Features
- Final Landuse
  - Agricultural – Cropping
  - Agricultural – Grazing
  - Rehabilitation Biodiversity Offset Area
  - Final Void
  - Heritage Area
  - Industrial
  - Infrastructure
  - Native Ecosystem
  - Water Management Areas
  - Water Storage (Excluding Final Void)
  - Other
- Project Approval Boundary
- Mine Operations Area
- World Imagery
- Low Resolution 15m Imagery
- High Resolution 60cm Imagery
- High Resolution 30cm Imagery
- Citations

Notes

Plan Number: 12400_CPG_FLRP_Plan 1_V0
plan Date: 6/06/2022
Data Theme Submission IDs: 1898, 1906

135.8 0 67.89 135.8 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Luddenham Clay Mine (ML1816) Plan 2- Final Landform Contours

Legend

- Final Landform Contours
- Project Approval Boundary
- Mine Operations Area
- World Imagery
- Low Resolution 15m Imagery
- High Resolution 60cm Imagery
- High Resolution 30cm Imagery
- Citations

Notes

Plan Number: 12400_CPG_FLRP_Plan 2_V0
plan Date: 6/06/2022
Data Theme Submission IDs: 1898, 2245

135.8 0 67.89 135.8 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

8 Rehabilitation Implementation

Rehabilitation will be undertaken in accordance with the Site Rehabilitation Plan, Biodiversity Management Plan, and Final Land Use Plan as required in the consent conditions.

8.1 STATUS AT MOP COMMENCEMENT

The Domains at the commencement of the MOP are shown in Figure Seven.

8.1.1 Domain A Infrastructure

The infrastructure areas encompass the haul and access roads, raw material stockpile and hardstand areas. During the MOP period the entrance to the site will be upgraded as required by the consent.

8.1.2 Domain 3 Water Management Area

Domain 3 encompasses the water management areas on site including the In-Pit Sump and the Water Management Dam in the north-east of the mine. Maintenance to the Water Management Dam is planned during the MOP period in preparation for future development at the site (yet to be approved).

8.1.3 Domain 4 Overburden Emplacement

Domain 4 encompasses the overburden emplacements in stockpiles and bunds around the site see *Figure Two*. Once mining ceases on the site any leftover overburden materials will be utilised to fill voids, create benches and batter slopes to final gradients followed by vegetation coverage establishment. Extraction activities will be completed in the MOP period therefore rehabilitation of Domain 4 will likely commence.

8.1.4 Domain 5 Stockpile Areas

Domain 5 encompasses the material stockpiles areas in the east and west of the main pit void. The stockpile material will be exported off-site during the MOP period.

8.1.5 Domain 6 Void (Open Cut Void)

Domain 6 consists of the mine void area, excluding water management areas. Once mining has ceased, the mine void will be permitted to fill with surface water.

Figure 7 Domains at MOP Commencement

8.2 PROPOSED REHABILITATION ACTIVITIES DURING THE MOP PERIOD

Rehabilitation of the site is expected to commence at the end of the MOP period. Rehabilitation will be undertaken in accordance with the Site Rehabilitation Management Plan and Vegetation Management Plan.

8.2.1 Domain 1 Infrastructure to Domain A Infrastructure Progress

The infrastructure areas encompass the haul and access roads, raw material stockpile and hardstand areas.

Rehabilitation will aim to:

- Ensure relevant services are disconnected by qualified contractors.
- Ensure relevant infrastructure is removed.
- Remove roads that are not specified to be retained.
- Reduce road widths to that suitable for final land use.
- Ensure sediment dams are fulfilling the design storm criteria according to the 'Blue Book'.
- Ensure all hazardous material is removed.

Remaining access roads will be utilised in the final landuse.

8.2.3 Domain 3 Water Management Area to Domain B Water Management Area Progress

Domain 3 encompasses the water management areas on site including the In-Pit Sump and the Water Management Dam. The sediment dams will remain in the final landform (Domain B).

8.2.4 Domain 4 Overburden Emplacement to Domain C Rehabilitation (Grassland)

Domain 4 encompasses the overburden emplacements in stockpiles and bunds around the site see *Figure Two*. Once mining ceases on the site any leftover overburden materials will be utilised to fill voids, create benches and batter slopes to final gradients followed by vegetation coverage establishment.

8.2.5 Domain 5 Stockpile Areas to Domain C Rehabilitation (Grassland)

Domain 5 encompasses the stockpile areas to the east and west of the void. The stockpile material will be removed from the site and the storage areas rehabilitated to Grassland (Domain C).

8.2.6 Domain 6 Void (Open Cut Void) to Domain C Rehabilitation (Grassland)

Domain 5 consists of the mine void area, excluding water management areas. Once mining has ceased, surface and groundwater will be permitted to collect in the mine void.

Figure Eight – Domains at MOP Completion

8.3 SUMMARY OF REHABILITATION AREA DURING THE MOP PERIOD

The following tables summarise the progress of each domain by measurements from the most recent aerial found on Nearmap, NSW Sixmaps ClipnShip data, QGIS and figures submitted with this Plan.

Table 28 Domain 1 to Domain A Progress

Primary Domain	Secondary Domain	Code (with map legend)	Rehabilitation Phase	Area at start of MOP (ha)	Area at end of MOP (ha)
Infrastructure(1)	Infrastructure(A)	1A	Active	2.4	2.4
			Decommissioning	Nil	Nil
			Landform Establishment	Nil	Nil
			Growth Medium Establishment	Nil	Nil
			Ecosystem Establishment	Nil	Nil
			Ecosystem Sustainability	Nil	Nil
			Relinquished Lands	Nil	Nil
			Total	2.4	2.4

Table 29 Domain 3 to Domain B Progress

Primary Domain	Secondary Domain	Code (with map legend)	Rehabilitation Phase	Area at start of MOP (ha)	Area at end of MOP (ha)
Water Management Area (3)	Water Management Area (B)	3B	Active	1.8	0.5
			Decommissioning	Nil	Nil
			Landform Establishment	Nil	Nil
			Growth Medium Establishment	Nil	Nil
			Ecosystem Establishment	Nil	Nil
			Ecosystem Sustainability	Nil	Nil
			Relinquished Lands	Nil	Nil
			Total	1.8	0.5

Table 30 Domain 4 to Domain C Progress

Primary Domain	Secondary Domain	Code (with map legend)	Rehabilitation Phase	Area at start of MOP (ha)	Area at end of MOP (ha)
Overburden Emplacement (4)	Rehabilitation - Grassland (C)	4C	Active	0.9	0.9
			Decommissioning	Nil	Nil
			Landform Establishment	Nil	Nil
			Growth Medium Establishment	Nil	Nil
			Ecosystem Establishment	Nil	Nil
			Ecosystem Sustainability	Nil	Nil
			Relinquished Lands	Nil	Nil
			Total	0.9	0.9

Table 31 Domain 6 to Domain C Progress

Primary Domain	Secondary Domain	Code (with map legend)	Rehabilitation Phase	Area at start of MOP (ha)	Area at end of MOP (ha)
Void (Open Cut Void) (6)	Rehabilitation - Grassland (C)	4C	Active	5.4	6.8
			Decommissioning	Nil	Nil
			Landform Establishment	Nil	Nil
			Growth Medium Establishment	Nil	Nil
			Ecosystem Establishment	Nil	Nil
			Ecosystem Sustainability	Nil	Nil
			Relinquished Lands	Nil	Nil
			Total	5.4	6.8

8.4 RELINQUISHMENT PHASE ACHIVED DURING THE MOP

The rehabilitation of the site is anticipated to be incomplete within the MOP period, it is therefore unlikely that the relinquishment phase will be completed.

5.1 LIFE OF MINE REHABILITATION SCHEDULE

It should be noted that the life of the mine is limited to the expiration of the development consent on 31st December 2024. Rehabilitation activities will continue beyond the cessation of mining in 2024.

Table 21. Life of Mine Rehabilitation Schedule

Rehabilitation Activity		Timing	Assumptions and Principles (Milestones)
Active mining	Minimal topsoil to be generated for use in rehabilitation. Any topsoil generated will be stored in perimeter bunds as final surfaces no available. Minimal overburden generated for use in rehabilitation. Any overburden generated will be stored in perimeter bunds as final surfaces no available.	Up to December 2024	Resource is not yet exhausted.
Removal of product stockpiles	Any remaining material stockpiles will be removed offsite. If stockpile material remains it will be utilised in battering slopes to achieve the final landform.	Up to December 2024	Raw material exhausted from extraction area. Mining has ceased.
Water Management	In-Pit sump to be reduced in volume to permit access to pit for mining and rehabilitation.	Up to December 2024	Resource is not yet exhausted. Rehabilitation on in-pit slopes commences.
Removal of Infrastructure	Removal of roads not required in the final landform for rehabilitation and maintenance unless required for void filling activities subject to separate approvals. Removal of services not required in final landform unless required for void filling activities subject to separate approvals.	2024-2026	Mining has ceased. Infrastructure is no longer required for rehabilitation purposes.

Rehabilitation Activity		Timing	Assumptions and Principles (Milestones)
Batter in-Pit Slopes	Overburden material within the eastern portion of the pit void will be utilised to assist in battering in pit slopes commencing with the north western highwalls, if assessed as required by the geotechnical engineer. Battering of the eastern faces of the pit as stockpiled material is removed from the pit. Slopes will be lightly ripped where possible to key in overburden material.	2024-2026	Mining has ceased. Water levels in the pit are lowered sufficiently to permit access to the north western high walls. Stockpiled material/overburden in the east of the pit is removed to permit access to the eastern faces.
Topsoil Emplacement	Topsoil material stored in bunds will be tested for suitability and ameliorated if required. Final slopes will be lightly ripped where possible to key in topsoil material. Topsoil bunds will be removed and reused on final surfaces.	2024-2026	Final slopes have been achieved. Final slopes have been ripped. Topsoil is suitable for target species.
Establishment of Vegetation	Seeding/planting of pasture species is undertaken on finished surfaces Watering/Irrigation as required to assist establishment of vegetation.	2024-2026	Suitable topsoil has been spread on final surfaces. Watering/irrigation to occur after seeding/planting.
Monitoring and Maintenance of Rehabilitation	Monitor progress of rehabilitation areas. Continue weed management and pest management. Repair failed rehabilitation areas.	2024-2027	Completion of vegetation establishment.

5.2 PHASES OF REHABILITATION AND GENERAL METHODOLOGIES

5.2.1 Active Mining Phase

5.2.1.1 Project Description

Clay / Shale is extracted from the site using open cut methods and stockpiled to the west of the void and within the extraction footprint. The site is nearing exhaustion of resources with the south western portion of the mine area remaining to be excavated. Material won from the site is transported offsite via the access road on Adams Road and thence Elizabeth Drive. Production is limited to 300,000 tonnes per annum.

As per the development consent, extraction operations will cease in December 2024 (i.e. at the end of the MOP period), however rehabilitation activities are unlikely to be complete.

5.2.1.2 Asset Register

Each domain is listed in *Table 22*.

Table 22. Current Operational Domain Assets

Code	Primary Domains (Operational)	Area (Ha)	Asset – Use	Removal Details
1	Infrastructure Area	8.07	Road trucks Haul roads Front end loader Excavator Bulldozer Dump Trucks Raw Material stockpiles Crusher and Screens	Demolition post-mine life would involve removal of mobile plant and equipment, relocation of topsoil, and raw material stockpiles. Haul roads would be retained to enable access to the site. Any remaining product stockpiles will be spread or sold prior to revegetation. Plant and equipment will be removed.
3	Water Management Area	1.97	Water Management Dam In-Pit Sump	Water Management Dam will be retained in the final landform.
4	Overburden Emplacement Material	3.54	Overburden storage and visual/acoustic bunds	The acoustic bunds will be retained in the final landform for use in the Resource Recovery Facility with the exception of the northern bund which will be removed to account for the construction of the ARRC. Other available overburden material will be used to batter slope and rehabilitate the site.
5	Stockpiled Material		Included in Infrastructure	
6	Void (open cut void)	7.92	Mobile equipment, including front end loader, excavator, crusher and screens.	Assets within the extraction area will primarily be used for extraction transportation to stockpiling areas. At closure, any remaining product stockpiles will be spread or sold prior to revegetation (or other use). The In-Pit Sump will be retained during the operation of the ARRC.

~~3.3 PROPOSED ACTIVITIES~~

5.2.1.3 Construction

5.2.1.3.1 Site Access

The relocation of the site access road to Adams Road will be undertaken.

The modification has approval for vehicles up to 19-metres (m) long, to access the site. Swept path analysis carried out as part of the traffic impact assessment indicate that the current Adams Road/site access road intersection is suitable for 19-m-long

The site access road will be sealed between Adams Road and the weighbridge. The existing internal roads will be upgraded to accommodate heavy vehicles accessing the relocated weighbridge and access road.

5.2.1.3.2 Equipment Laydown Area

A new equipment laydown area will be established to the north of the extended western stockpile. The area will contain a demountable shed with a maximum height of 2.5 m. A small amount of fuel and chemicals required for site operations (including petrol, grease and flocculant) will be stored in a dedicated area within the site shed in accordance with the relevant Australian Standards. Maintenance of mobile plant will occur offsite. The mine equipment fleet will be refuelled by a mobile refuelling vehicle.

5.2.1.3.3 Site Entry Infrastructure

Site entry infrastructure will include a wheel wash, site office, site shed, amenities and staff and visitor carparking area. The site office, site shed and amenities will be demountable structures with a maximum height of 2.5 m and minimal ground disturbance required for installation.

5.2.1.3.4 Construction Hours

Construction work will occur during standard construction hours for approximately four to six weeks, which are:

- Monday to Friday 7:00 am to 6:00 pm;
- Saturday 8:00 am to 1:00 pm; and
- no construction work will take place on Sunday or public holidays.

5.2.1.4 Mining Operations

The extraction will be undertaken using a dozer with ripper attachment; raw materials are loaded with an excavator and placed into dump trucks. The dump trucks then transport the resource to the raw materials stockpiles and any unusable material to within exhausted pit areas. If crushing is required, this will be undertaken on the pit floor to minimise noise impacts.

Extraction during the MOP period will focus on the area to the south west of the approved extraction area that has not been previously mined. The pit floor will remain at the current depth of approximately 30 metres below the original ground level.

Topsoil stripping in new extraction area in the south west and the stockpiling area to the north of the existing western stockpiling area will be not be required as it has been previously stripped. Previously won topsoil will be reused for rehabilitation and is stored in stockpiles on the perimeter of the extraction area.

Material stockpiles will have a maximum of 250,000m^3 to be held on site. Material stockpiles will have a maximum height of 5 metres.

Photoplate 1. Western Stockpile Area

Photoplate 2. Previously Stripped Area to be Mined

5.2.1.5 Rock/Overburden Emplacement

Very little to no overburden material is expected to be generated with the final extraction stages of the pit. Overburden not required immediately for rehabilitation will be emplaced in the western stockpile area until required. Inter-burden material from previous mining activities has been stored within the pit void and a portion has been

crushed and screened and stockpiled atop the inter-burden. The remaining inter-burden and any inter-burden generated from future mining will also be processed to maximise the resource for use in brickmaking material. Any remaining inter-burden will be utilised to backfill the void.

Photoplate 3. In-Pit Inter-Burden Stockpile

5.2.1.6 Mineral Processing

No mineral processing is undertaken on the site.

5.2.1.7 Processing Residues and Tailings

No processing residues or tailings are generated on the site.

5.2.1.8 Transportation and Traffic Management

The former access road for the quarrying operations is from Elizabeth Drive, across Commonwealth land. This access is no longer available for use by the quarry due to construction of the WSA. Therefore, quarry vehicles must use the existing site access road from Adams Road.

All heavy vehicles associated with the haulage of quarry product will access and leave the site via Adams Road and the Elizabeth Drive/Adams Road intersection. No heavy vehicles associated with the haulage of quarry product will travel on Adams Road south of the site. Conditions of consent shall apply as follows;

40. Unless otherwise agreed by the Planning Secretary, the Applicant must:

(a) restrict all heavy vehicle access to the site to a maximum truck length of 19 metres;

(b) restrict all quarry-related traffic to left-in, right-out movements at the intersection of Elizabeth Drive and Adams Road; and

(c) not use the portion of Adams Road south of the site access road for any quarry-related heavy vehicle traffic.

The internal roads may be realigned and will continued to be used by quarry vehicles to accommodate the site access arrangements for the ARRC. Any road realignment will avoid areas of native vegetation on the site.

The approved maximum product truck movements a day is restricted to a maximum of 50 laden trucks despatched (100 movements) a day during operating hours. Traffic operations on the site will be in accordance with the Road Transport Protocol to be developed, as outlined in the consent conditions.

5.2.1.9 Construction Waste

No construction waste is generated on the site during mining operations. Waste from the construction activities will be collected in bins and removed by a licenced waste contractor.

5.2.1.10 Operational Waste

No operational waste is generated on the site aside from domestic waste from site activities during mining campaigns. Bins will be provided during campaigns to collect refuse and will be collected by a licenced waste contractor. Waste oils and fuels are stored in appropriately bunded areas and are to be removed by contractors. A spill kit will also be provided on site during operations.

5.2.1.11 Decommissioning and Demolition Activities

An existing disused farm shed within the footprint of the new equipment laydown area may be demolished to accommodate the equipment laydown area and demountable site shed.

5.2.1.12 Temporary Stabilisation

Very little temporary stabilisation has been undertaken. The in-pit slopes are unvegetated and generally between 1H:1.5V and 1H:1V and appear to be stable.

Out of pit areas such as the bundwalls have been stabilised with grasses.

Photoplate 4. Northern Bundwall Stabilisation

5.2.1.13 Progressive Rehabilitation and Completion

Progressive rehabilitation opportunities are limited until the resource is exhausted. There may be opportunities to commence rehabilitation on the north western high walls, as access to the highwalls is gained with a reduction in water levels in the pit sump through re-use on-site for dust suppression. As the removal of material stockpiled in the pit east is achieved, it is likely that the eastern faces of the pit will then become available for progressive rehabilitation.

Further, the infilling of the void is subject to a further development application to permit agribusiness/commercial/industrial landuses. At the cessation of mining, the Conceptual Interim Final Landform (see *Figure Eight*) will be achieved by stabilising the final slopes, as advised by a geotechnical engineer, and may include spray emulsions or other appropriate methods. The void will be permitted to accumulate surface water to a depth of approximately 10 metres.

Rehabilitation will not be completed during the MOP period but will include:

- annual inspections to monitor growth of previous revegetation within the Oaky Creek riparian corridor and presence of weeds and pests within the revegetated areas;
- management works on an as required basis, involving removal of environmental or noxious weeds growing in the revegetated areas;
- controlling pests affecting the revegetated area using appropriate pest control techniques;
- controlled mowing/slashing to manage grassed areas of the site; and
- any wildlife mitigation measure to be undertaken in consultation with the Western Sydney Airport (WSA) in accordance with the Biodiversity Management Plan (see Appendix D) and *Section 5.2.1.26.3 and Section 5.2.1.37* of this plan.

5.2.1.14 Water Management

The approved water management system includes a quarry sump to dewater the quarry void to a sedimentation dam adjacent to the pit (the Water Management Dam). Water collected in the surface water management system is used for dust suppression.

The key features of the water management system include:

- diversion of runoff from undisturbed catchments away from disturbed areas and off site;
- collection of all potentially sediment-laden runoff from disturbed areas of the site within the quarry pit and the Water Management Dam; and
- use of stored water within the quarry pit and Water Management Dam for dust suppression of unsealed roads and disturbed areas.

The Water Management Dam has not been actively maintained for at least 2 years while the quarry has been inactive and is overgrown with vegetation, impeding the capacity of the dam. This dam is planned to be cleaned out to provide a minimum capacity of 7 ML. Prior to the approval of a licensed discharge point, the Water Management Dam will be dewatered to the quarry pit as required to maintain the minimum design volume required. The Water Management Dam is to be dewatered to the quarry pit following storm events.

The surface of the final landform will be stabilised with soil stabilising polymers, temporary vegetation, or some other suitable means until the site is developed for future commercial/industrial land use.

The Soil and Water Plan has been revised to reflect the Consent Conditions (as modified).

5.2.1.15 Material Production Schedule During the MOP Period

The Modification Report estimates there is approximately 2 million tonnes of clay/shale resource remaining within the approved extraction footprint. Using 12D modelling, the current pit is estimated to contain approximately 640,000 cubic metres of material or 1,150,000 tonnes based on in-situ density conversion factor of 1.8 g / cm cubed. This includes the inter-burden material emplaced in the east of the pit and the crushed and sized in-pit stockpiles. All the inter-burden material will be processed and removed from the site as product or used as backfill in the void. At a maximum extraction rate of 300,000 tpa, the resource would be exhausted in under 4 years, depending on market demands.

Table 23. Material Production Schedule during the MOP Period

Material	Unit	2021	2022	2023	2024
Stripped topsoil	m^3	Nil	Nil	Nil	Nil
Rock/Overburden	T	Nil	Nil	Nil	Nil
Ore	T	300,000	300,000	300,000	250,000

In-situ density conversion factor of 1.8 g / cm cubed assumed.

Plan of:	Luddenham Clay/Shale Mine MOP -Conceptual Excavated Landfill Profile	**Location:**	275 Adams Road, Luddenham	**Source:**	In Situ Advisory- Mod 5 Concept Design and Filling Strategy Figure 3	**Our Ref:**	12397_LQ_RMP_RR_2022_V1_F3
Figure:	SEVEN	**Council:**	Liverpool City Council	**Survey:**	Not Applicable	**Plan By:**	TO
Version:	V1	**Tenure:**	MLA592	**Projection:**	Not Applicable	**Project Manager:**	TO
Date:	20/07/2022	**Client:**	Coombes Property Group Pty Ltd	**Contour Interval:**	Not Applicable	**Office:**	Thornton

vgt environmental compliance solutions and laboratories

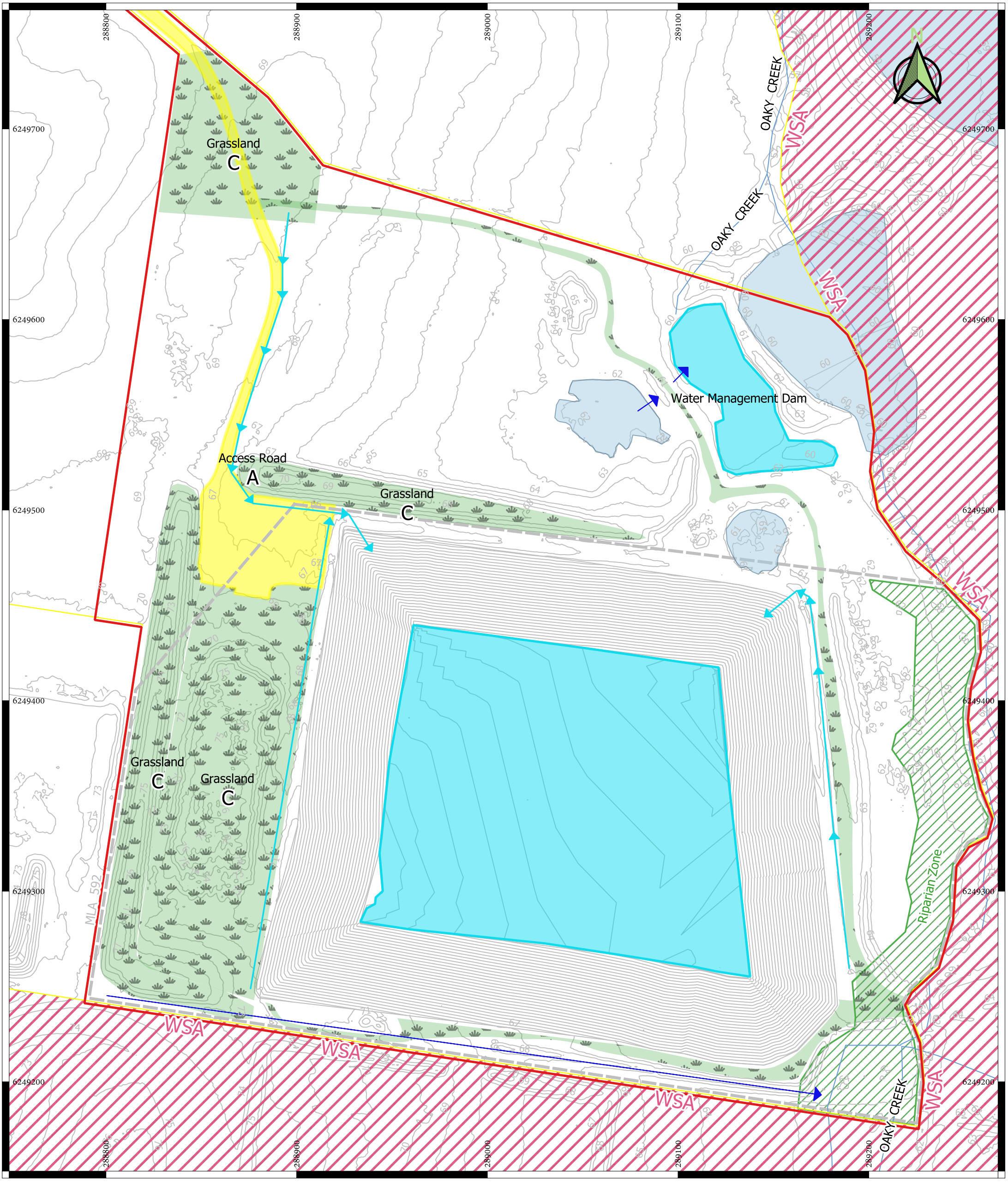
InSitu Advisory

CLIENT:	**CFT No.13 PTY LTD**
SITE:	**LUDDENHAM QUARRY**
TITLE:	**CONCEPTUAL EXCAVATED LANDFILL PROFILE**
DATE:	**16.11.2020** SCALE: **1:1,500** PAPERSIZE: **A3** DWG: **FIGURE 3**

Plan of:	Luddenham Clay/Shale Mine MOP - Conceptual Interim Final Landform	**Location:**	275 Adams Road, Luddenham NSW	**Source:**	Six Maps, MinView, Google Earth, Nearmaps (12/01/2021), ELVIS Spatial Data	**Our Ref:**	2397_QGIS_LQ_RMP_2022_Q004_V3_F8
Figure:	EIGHT	**Council:**	Liverpool City Council	**Survey:**	Elvis Spatial Data (July 2019)	**Plan By:**	TO
Version:	V3	**Tenure:**	MLA 592	**Projectio**	GDA2020 / MGA zone 56: ESPG 7856	**Project Manager:**	TO
Date:	20/07/2022	**Client:**	Coombes Property Group Pty Ltd	**Contour Interval:**	1 Metre	**Office:**	Thornton

vgt environmental compliance solutions and laboratories

This figure may be based on third party data which has not been verified by vgt and may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and vgt does not warrant its accuracy.



Legend

Features
- Property Boundary
- Lot
- Riparian Zone
- Western Sydney Aerotropolis
- Conceptual Interim Final Landform Contours

Water Management Features
- Clean Water Flow
- Dirty Water Flow
- Dams
- Creek
- Under Road Pipe

Conceptual Interim Final Landform

Secondary Domains (Post Mining Landuse)
- Infrastructure (A)
- Rehabilitation Area- Grassland (C)
- Water Mangement (B)

Mine Lease
- Mine Lease Boundary

0 20 40 60 80 100 m

VGT Environmental Compliance Solutions Pty Ltd 4/30 Glenwood Drive, Thornton NSW 2322 PO Box 2335, Greenhills NSW 2323 ph: (02) 4028 6412 email: mail@vgt.com.au www.vgt.com.au ABN: 26 621 943 888

5.2.1.16 Soils and Materials

The soil landscape unit mapped in the EIS for the site and modification area is the Blacktown soil landscape and Second Ponds Creek soil landscape.

The soils on site can be generally characterised as:

- slightly to strongly acidic;
- often hard setting with low permeability and water holding capacity;
- localised saline, sodic subsoils prone to erosion and with low chemical fertility and elevated aluminium; and
- generally low fertility.

In addition, the site is mapped in the OEH eSPADE database (OEH 2016; OEH 2017a) as Class 4 to Class 6 (Table 6.11). These classes represent land with 'moderate to severe limitations' for cropping and with agricultural land uses restricted to grazing, forestry and natural conservation. Limited options exist to improve the agricultural viability of the land without causing degradation.

No acid sulphate soils were identified on the site.

5.2.1.16.1 Topsoils

Topsoil (organic horizon) on the site is generally within the first 5cm of the soil profile. Stripping in the new extraction area in the south west and the stockpiling area to the north of the existing western stockpiling area will be not be required as it has been previously stripped. Previously won topsoil is stored in the northern and western bund wall.

~~Any further topsoil material stripped on site will be used immediately or kept on site in stockpiles for future rehabilitation. Stripping would be undertaken with care in order to maintain the integrity of the topsoil and seed bank stored within it. Stored topsoil stockpiles will not exceed 2m in height and will be revegetated with temporary ground cover species. All topsoil volumes stripped will recorded and reported annually in the Annual Rehabilitation Report (ARR). The topsoil stripping areas and stockpile locations also will be clearly marked on any plans submitted in the ARR.~~

~~At present, previously won topsoil is stored in the northern and western bund wall.~~

5.2.1.16.2 Overburden (A and B Horizons)

The A and B soil horizons are generally of a depth of 10 to 20 cm and comprise of some organic material such as root matter. Material from these horizons that are removed and not able to be reused in rehabilitation activities immediately will be stored in separate stockpiles to the topsoil. Locations and volumes of stockpiles will be recorded and reported as above.

5.2.1.16.3 Overburden (C Horizon)

The overburden from the C horizon (>20cm depth) will be minimal as it is suitable as product. It has similar fertility to the A and B horizons. Material not used as product will be mixed with the A and B horizon material and treated as described in the above section.

5.2.1.16.4 Suitability, Storage and Reuse

Once final rehabilitation faces become available they will be ripped using a dozer and the overburden material will be keyed into the surface. This will increase water retention and reduce erosion and slumping of the emplaced overburden. The organic topsoil layers will then be placed over the overburden, in the original natural horizon order, in a similar manner up to a minimum depth of 5cm.

The existing topsoil and overburden are suitable for rehabilitation but may require some amelioration with lime to increase the soil pH, depending on the vegetation species selected. Soil testing would be undertaken prior to permanent revegetation and advice from a suitably qualified specialist would be sought. Soil ameliorants would be added if recommended by soil testing results to provide a suitable soil medium for the growth of the targeted species and ecosystems.

Consideration of the erosion potential of the soils would be made in the storage of the soils and the re-use of the soils in rehabilitation. If overburden or topsoil is unable to be re-used immediately on final faces, stockpiles will be created and stabilised as soon as practicable.

All stockpiles or final landforms should have a coverage factor (C) from the Blue Book of at least 0.05 within 30 days of the completion of works. This is equivalent to a total projected foliage cover greater than or equal to 70%.

~~4.2.6 Flora and Fauna~~

5.2.1.17 Flora

No threatened or regionally significant plant species were recorded in the Modification Report- Biodiversity Development Assessment Report studies, nor are they likely to occur on the site. With the adjacent WSA development, faunal movement corridors have been further reduced. The site has a low conservation value for plant species generally and non-flying animals. Operations will be carried out in accordance with the Vegetation Management Plan (UBM Ecological Consultants 2009) (*Appendix E*) and the Biodiversity Management Plan (BMP) (EMM 2021) (*Appendix D*) which has been prepared to meet Condition 34 of the development consent.

Biodiversity on site outside of the Oaky Creek riparian zone will be managed through the following measures:

- areas containing native vegetation outside of the approved mine footprint will be flagged;
- where feasible or when required, set up tree protection zones (TPZs) around all retained trees immediately adjacent to the disturbance footprint. If required, TPZs are to be established in accordance with the Australian Standard AS 4970-2009 Protection of trees on development sites (Standards Australia Committee 2009).
- no native vegetation outside of the approved mine footprint will be cleared as part of mine operations;
- no material will be stockpiled outside of the approved mine footprint;
- mine vehicles (including light vehicles used by site personnel) will use the existing internal access roads and will not travel through areas of native vegetation;
- appropriate sediment and erosion control measures on site as outlined in the mine's Soil and Water Management Plan (EMM 2021b); and
- the weed control plan described in Section 4.3 of the BMP will be implemented.

Schedule 4, Condition 34(a) requires revegetation of the riparian zone of Oaky Creek. It was an original condition of the development consent granted in 2004. The previous mine operator has carried out the required revegetation.

Accordingly, the BMP focuses on the ongoing protection and maintenance of the riparian zone through annual monitoring of this previously revegetated area. Annual monitoring will include:

- identification of any areas of erosion within the Oaky Creek riparian zone;
- an assessment of plant health;
- an assessment of level of natural regeneration occurring; and
- identification of any weeds.

Monitoring will be carried out by an ecologist or appropriately qualified person and will generally involve a half to full day site visit. Outcomes of annual monitoring will be reported in the Annual Review (required by Schedule 5, Condition 5). Management actions will be implemented to rectify rehabilitation deficiencies identified by the monitoring.

5.2.1.18 Fauna

The site has a low conservation value for non-flying animals and with the adjacent WSA development, faunal movement corridors have been further reduced.

The mitigation measures to mitigate indirect impacts to the biodiversity values on site will include:

- a speed limit of 40 kilometres per hour (km/h) will apply on the sealed site access road and 20 km/h on unsealed internal roads; and
- roads will be regularly be maintained by managing vegetation on the shoulder to main visibility to prevent vehicle strike.

Operations will be carried out in accordance with the Biodiversity Management Plan (EMM 2021) (*Appendix D*) which has been prepared to meet Condition 34 of the development consent.

To minimise risk to WSA due to bird strike due to wildlife attraction,

- Structures, fencing and lighting will minimise areas for wildlife, especially birds, to use for breeding, roosting, or perching. This will include: no eaves or ensuring no access to the roof cavity through the eaves; and using 'bird-spikes' on roof edges, fences and lighting;
- Installation of netting or lines across water bodies with moving flags to deter birds prior to the commencement of WSA operations; and
- No new planting (e.g. for landscaping) will occur on the site that produces fruit or flowers that are likely to attract birds and wildlife.

5.2.1.19 Biodiversity

5.2.1.19.1 Landscape

The development occurs within the Sydney Basin Interim Biogeographic Regionalisation of Australia (IBRA) region, and Cumberland subregion. The subject property is located within the upper reaches of the Hawkesbury River catchment, with Oaky Creek running along the eastern boundary.

The locality is considered highly cleared and fragmented with native vegetation often occurring in isolated patches surrounded by a matrix of agricultural land. The subject property itself has previously been utilised for quarrying and agricultural land uses. The Western Sydney International (Nancy-Bird Walton) Airport (WSA) occurs immediately to the east and south of the subject property, and has, or will, remove native vegetation across the footprint of the WSA during the course of that project.

There are no areas of outstanding biodiversity value, as defined in Part 3 of the *Biodiversity Conservation Act 2016* (BC Act) within a 1,500 m buffer of the subject property.

5.2.1.19.2 Native vegetation

Survey identified that most of the subject property is dominated by open grasslands of varying condition and quality. Most of these areas have been heavily impacted by pastoral activities, particularly grazing and previous quarry activities, and are dominated by exotic plant species. The following native plant community types (PCTs) were recorded within the subject property:

- PCT 849 – Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain with is associated with the BC Act listed Cumberland Plain Woodland in the Sydney Basin Bioregion Critically Endangered Ecological Community (Cumberland Plain Woodland CEEC); and
- PCT 1800 – Cumberland Swamp Oak riparian forest, and is associated with the BC Act listed Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions Endangered Ecological Community (Swamp Oak Floodplain Forest EEC), and a portion along Oaky Creek with the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) listed Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland Endangered Ecological Community listed under the BC Act.

PCT 849 is located outside of the impact area for MOD 5, and therefore was not assessed as being impacted as part of ongoing quarrying operations.

PCT 1800 and the BC Act listed Swamp Oak Floodplain Forest EEC occurs within the approved DA NO. 315- 7-2003 (as modified), with impacts limited to two trees. These impacts were already approved under consent DA No. 315-7-2003. No new native vegetation removal will occur as a result of MOD 5.

5.2.1.19.3 Biodiversity Mitigation Measures

The development avoids sensitive biodiversity area and avoid new impacts to the Swamp Oak Floodplain Forest EEC listed under the BC Act (PCT 1800) along the eastern boundary (some vegetation in this area also meeting the listing under the EPBC Act as Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland EEC) and around a disused farm shed, and Cumberland Plain Woodland CEEC listed under the BC Act (PCT 849) that is present between the access road and the western boundary.

Key avoidance measures to be implemented by the proponent comprise:

- avoidance of direct impacts to Oaky Creek;
- no impacts to PCT 849; and
- minimisation of impacts to PCT 1800, by only impacting habitat within the existing DA NO. 315-7-2003 impact area (consisting of up to 0.08 ha in poor condition).

The development will in accordance with the Biodiversity Management Plan as outlined in the consent conditions.

5.2.1.20 Air Quality

5.2.1.20.1 Sources of Emissions

The amenity of nearby residences is a key issue arising from earth moving and rehabilitation activities at this site. Sources of operational emissions include:

- extraction of material within the pit using excavator or scraper;
- dozer pushing material in the pit;
- handling of material (loading to trucks and unloading to stockpiles);
- crushing/screening of material within the approved quarry footprint;
- movement of vehicles across paved and unpaved roads and surfaces within the site;
- rehandle of material to product stockpiles;
- loading of product to truck for dispatch;
- diesel fuel combustion by on-site plant and equipment; and
- wind erosion associated with material stockpiles and exposed ground.

The most significant source of emissions is associated with the haulage of extract material and product (includes grading of haulage routes). Material handling and wind erosion are next biggest contributors for the coarser particle fraction (TSP and PM_{10}) while the significance of diesel combustion emissions increases with decreasing particle size (diesel combustion is the next largest source of $PM_{2.5}$ after haulage). Emissions of other pollutants (including oxides of nitrogen, carbon monoxide and sulphur dioxide) associated with diesel fuel combustion are likely to be minor relative to particulate matter emissions.

5.2.1.20.2 Predicted Dust Deposition Levels

The Modification Report modelling indicated that there are no cumulative exceedances of the impact assessment criteria at any assessment location for annual average PM_{10} concentrations, annual average $PM_{2.5}$ concentrations, annual average TSP concentration and annual average dust deposition levels.

Similarly, for 24-hour average PM_{10} and $PM_{2.5}$ concentrations, when predicted project increment of paired with background, there are no additional cumulative exceedance of the impact assessment criterion at any assessment location.

5.2.1.20.3 Consent Limits

Limits stated in the consent conditions are reproduced below.

Table 24. Air Quality Criteria from DA315-7-2003 Mod 5

AIR QUALITY

Air Quality Criteria

1. The Applicant must ensure that the particulate matter emissions generated by the development do not exceed the criteria listed in Tables 1, 2, and 3 at any privately-owned land.

Table 1: Long-term air quality criteria for particulate matter

Pollutant	Averaging period	Criterion
Total suspended particulate (TSP) matter	Annual	90 µg/m³
Particulate matter <10 µm (PM_{10})	Annual	[a, c] 25 µg/m³
Particulate matter <2.5 µm ($PM_{2.5}$)	Annual	[a, c] 8 µg/m³

Table 2: Short-term air quality criteria for particulate matter

Pollutant	Averaging period	Criterion
Particulate matter <10 µm (PM_{10})	24 hour	[b] 50 µg/m³
Particulate matter <2.5 µm ($PM_{2.5}$)	24 hour	[b] 25 µg/m³

Table 3: Long-term air quality criteria for deposited dust

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
[d] Deposited dust	Annual	[b] 2 g/m²/month	[a] 4 g/m²/month

Notes:

- *[a] Total impact (i.e. incremental increase in concentrations due to the development plus background concentrations due to all other sources).*
- *[b] Incremental impact (i.e. incremental increase in concentrations due to the development on its own).*
- *[c] Excludes extraordinary events such as bushfires, prescribed burning, dust storms, fire incidents or any other activity agreed by the Planning Secretary.*
- *[d] Deposited dust is to be assessed as insoluble solids as defined by Standards Australia, AS/NZS 3580.10.1:2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulate Matter - Deposited Matter - Gravimetric Method.*

2. The air quality criteria in Tables 1, 2, and 3 do not apply if the Applicant has an agreement with the owner/s of the relevant residence or infrastructure to exceed the air quality criteria, and the Applicant has advised the Department in writing of the terms of this agreement.

Plan of:	Luddenham Clay/Shale Mine RMP Dust Monitoring Locations	**Location:**	275 Adams Road, Luddenham	**Source:**	Six Maps, Nearmaps (12/01/2021), ELVIS Spatial Data, MinView	**Our Ref:**	12397_QGIS_LQ_RMP_2022_V0_F9
Figure:	NINE	**Council:**	Livepool City Council	**Survey:**	ELVIS Spatial Data	**Plan By:**	TO
Version:	V0	**Tenure:**	MLA 592	**Projectio**	GDA2020/MGA Zone 56 EPSG: 7856	**Project Manager:**	TO
Date:	20/07/2022	**Client:**	Coombes Property Group Pty Ltd	**Contour Interval:**	1 Metre	**Office:**	Thornton

vgt environmental compliance solutions and laboratories

This figure may be based on third party data which has not been verified by vgt and may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and vgt does not warrant its accuracy.

Legend

Features

- Indicative Dust Monitoring Locations
- Property Boundary
- Lot
- Contours (1m)

Water Management Features

- Dams
- Creek

Mine Lease

- Mine Lease Boundary

5.2.1.20.4 Mitigation Measures

The ~~proposed~~ dust controls for the site are as follows:

- A water cart will operate on the internal unsealed haulage routes as required;
- The access road from Adams Road will be sealed;
- Drop heights will be minimised when loading trucks; and
- Watering will be applied to the crushing plant as required to minimise dust emissions.

Other control measures not explicitly applied as a reduction factor in the emission inventory include:

- Double handling of material will be avoided where possible;
- Site-wide vehicle speed limits will be applied (potentially different on sealed and unsealed roads);
- Disturbance of stabilised ground cover will be avoided where possible;
- Meteorological forecasts will be used to predict when the risk of dust emissions are high (due to adverse wind conditions) and preparatory measures will be implemented, that ~~may~~ will include:
    - watering surfaces so they are moist prior to hot and windy conditions;
    - planning additional water spraying during the day;
    - ceasing some activities or reducing activity levels; and
    - re-scheduling product dispatch.

These dust controls are formally documented in the Air Quality Management Plan.

5.2.1.20.5 Air Quality Monitoring

The monitoring programme will be undertaken in accordance with the Air Quality Management Plan. This encompasses dust deposition gauges. In addition, daily visual inspections of activities would be undertaken during active operations to monitor the effectiveness of dust controls and allow for reactive and corrective measures to be implemented.

The inspections will focus on the following key issues:

- inspect the sealed access road for high silt loading and clean surface using water cart/street sweeper if required;
- inspect and report on excessive dust being generated at source (wheel generated dust, excavators, FEL, wind erosion);
- inspect and report on water cart activity and effectiveness; and
- inspect and report on dust leaving the site.

5.2.1.21 Groundwater

5.2.1.21.1 Groundwater Quality

A groundwater monitoring network was installed in January 2009 prior to quarrying to understand the hydrogeology at the site and to monitor for potential impacts. Three monitoring bores were installed to a depth of approximately 30 m into the Bringelly Shale.

The most recent groundwater standing water levels (SWLs) measured in the bores were in May 2017. These ranged from 58.36 m AHD (bore BSM1) in the south-west to 46.83 m AHD to the north-east (bore BSM3), with the inferred groundwater flow direction to the north-east mirroring the prevailing topography. Quarrying activities have disrupted natural groundwater flow, with some local groundwater flows likely to be towards the pit. Groundwater quality measured at this time indicated that groundwater was near neutral, saline (total dissolved solids (TDS) of approximately 18,000 mg/L), and with elevated total nitrogen concentrations. Relatively low concentrations of metals were also reported for the bores sampled, less than the relevant guideline values.

The MOD5 Qualitative Groundwater Assessment (EMM 2020d) identified that the BSM2 bore, located to the east of the quarry adjacent to the internal road, was previously damaged resulting in unrepresentative groundwater quality results. This bore will be rehabilitated or replaced prior to the recommencement of groundwater monitoring following reactivation of the quarry.

5.2.1.21.2 Groundwater Impacts

The Bringelly Shale has low hydraulic conductivity associated with the fine-grained shale and claystone so the rate of groundwater inflow to the quarry pit will be low. The extraction activities will not significantly impact on the local groundwater system, any neighbouring bores, or GDEs and will meet the minimal impact considerations under the NSW Aquifer Interference Policy. Further, ongoing groundwater monitoring would be undertaken during quarry operations to identify any changes to the local groundwater system that may occur.

Fuel and oil from plant, machinery and haul trucks comprise the main risk to the groundwater. Refuelling and minor maintenance are therefore undertaken within bunded areas or off-site and all fuel storage is adequately bunded. Only small volumes of fuel and oil are held on site and all contractors are required to carry spill kits.

No additional groundwater mitigation measures are required as a result of the proposed modification.

5.2.1.21.3 Groundwater Inflows

Groundwater intercepted by the quarry pit was estimated to be 5 m^3/day (Douglas Nicolaisen & Associates 2003). A zero share WAL was granted on 10 November 2020 and allocation for 1.8 ML/year is being sought from the *Sydney Basin Central Groundwater Source* regulated by the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources*.

5.2.1.21.4 Groundwater Monitoring

Monitoring will be undertaken in accordance with the Ground Water Monitoring Program described in the consent conditions. It is envisaged to be undertaken annually and would include, but not restricted to, the following parameters:

- Groundwater Levels;
- pH,
- Conductivity;
- Nutrients; and
- Dissolved Metals.

Results will be reported in the Annual Rehabilitation Report.

5.2.1.22 Noise

5.2.1.22.1 Operational Noise

The site shall be operated on accordance with the consented conditions, Noise Management Plan and other approvals, including;

- Hours of operation;
- Specification of fixed and mobile plant and equipment;
- Traffic movements;
- Maintaining existing noise bunds.

5.2.1.22.2 Construction Noise

As outlined in the MOD 5 Noise and Vibration Impact Assessment (NVIA), construction works will be of short duration (estimated to be 4–6 weeks), with the noisiest works (construction of the access road) occurring over approximately 4 weeks. Construction works will be conducted during standard construction hours only.

The MOD 5 NVIA and Modification Report committed to noise monitoring during the initial stages of construction to determine if actual construction noise levels are above NMLs. If this occurs, the applicant will implement the following recommendations from the Interim Construction Noise Guideline (ICNG) (DECC 2009) to manage construction noise:

- application of feasible and reasonable work practices to minimise noise;
- inform potentially impacted residents of the nature of the works to be carried out, expected noise levels and duration and relevant contact details; and
- negotiation with the neighbours where noise from work outside standard hours is predicted to exceed the relevant NML by more than 5 dB.

5.2.1.22.3 Construction Vibration

The nearest residence is located approximately 40 metres to the closest construction activities, which is considered beyond the safe working distance for human response.

5.2.1.22.4 Road Traffic Noise

Peak daily traffic generation for operation of the quarry would be 50 trucks per day, equating to 100 movements. Predicted noise levels for Adams Road (north) confirm road noise would comply with the $L_{Aeq,\ 15hr}$ 60dBA criteria. Existing daytime traffic noise levels on Elizabeth Drive exceed the baseline criteria however, the predictions are within the <2dB allowance for Elizabeth Drive.

5.2.1.22.5 Noise Limits

Noise criteria are reproduced from the consent conditions below'

Table 25. Noise Criteria from DA315-7-2003 Mod 5

NOISE

Operational Noise Criteria

12. Except for the carrying out of construction works, the Applicant must ensure that the noise generated by the development does not exceed the criteria in Table 5 at any residence[a] on privately-owned land.

Table 5: Operational noise criteria dB(A) $L_{Aeq(15\ min)}$

Residences	Day Criteria
R3	53
R6	52
R4	46
R5	45
R2	43
R1, R7, R8	41

[a] *The Residences referred to in Table 5 are shown in Appendix 2.*

5.2.1.22.6 Noise Mitigation

Work practice methods include:

- Regular reinforcement (such as toolbox talks) of the need to minimise noise and vibration;
- Review and implementation of feasible and reasonable mitigation measures that reduce construction noise levels;
- Avoiding the use of portable radios, public address systems or other methods of site communication that ~~may~~ will unnecessarily impact upon nearby residents;
- Develop routes for the delivery of materials and parking of vehicles to minimise noise;
- Where possible, avoid the use of equipment that generates impulsive noise;
- Notify residents prior to the commencement of intensive works.
- Where possible, choose quieter plant and equipment based on the optimal power and size to most efficiently perform eh required tasks;
- Operate plant and equipment in the quietest and most efficient manner; and
- Regularly inspect and maintain plant and equipment to minimise noise and vibration levels increases, to ensure that all noise and vibration reduction devices are operating effectively.

5.2.1.22.7 Noise Monitoring

Noise Monitoring will be conducted in accordance with Noise Management Plan and reported in the Annual Rehabilitation Report required under the mine lease conditions.

5.2.1.23 Bushfire

Extraction operations will not increase the risk of bushfire. The site employs several measures such as fencing, signage and monitoring to dissuade trespassers from entering the site and deliberately lighting fires.

Communication with the Rural Fire Service and emergency services will be undertaken, when necessary, to assist them.

5.2.1.24 Public Safety

In the interest of public safety and reducing the incidence of trespassers, fences and signage have been maintained along the perimeter of the mine site.

Photoplate 5. Security Fence and Cameras

5.2.1.25 Rock and Overburden Emplacement

Very little to no overburden material is expected to be generated with the final extraction stages of the pit. Overburden not required immediately for rehabilitation will be emplaced in the western stockpile area until required. Stockpiles will be no greater than 3 metres in height with slopes no greater than 3H:1V. Inter-burden material from previous mining activities has been stored within the pit void and a portion has been crushed and screened and stockpiled atop the inter-burden. The remaining inter-burden and any inter-burden generated from future mining will also be processed to maximise the resource for use in brickmaking material. Any remaining inter-burden will be utilised to backfill the void.

5.2.1.26 Waste Management

Waste will be managed in accordance with the waste hierarchy:

- reduce waste production;
- recover resources; and
- dispose of waste appropriately.

5.2.1.26.1 General Waste

The mine will produce only produce minor quantities of construction waste during construction of new site components and minor quantities of waste during continued mine operations:

- cardboard packaging, plastic wrapping, plastic ties, wood pallets and other timber offcuts;
- general waste, including putrescible waste such as minimal food scraps;
- comingled recycling (from office activities and site employees);
- oily rags, filters and drums;
- waste batteries;
- confidential documents; and
- building and construction waste generated by construction.

These will be stored in a small, designated waste storage area within the site entry area. With the exception of bulky inert construction waste (e.g. timber offcuts), wastes will be stored in bins with a lid. Oily rags, filters, drums and waste batteries will be stored on a self-bunded pallet or similar. As such, it is not proposed to build a fully enclosed waste storage area will not be required.

5.2.1.26.2 On-Site Sewerage

Temporary demountable amenities will be established ~~are proposed~~ due to the short remaining life of the quarry (with extraction ceasing in December 2024) and because there will be a low number of site personnel (around 12 employees during normal operating conditions with a maximum of 15 employees during peak operations). Wastewater from these amenities will either be contained in a temporary chemical closet (i.e. a port-a-loo) or be discharged to a septic holding tank, which will be pumped out by an approved licensed contractor when required.

5.2.1.26.3 Waste Risks to WSA

WSA operations are not scheduled to commence until 2026, which is after the end of mining activities on 31st December 2024. Notwithstanding this, the risk of wildlife attraction to the site due to waste, will be managed via control measures outlined above and as follows:

- Waste bins that contain food waste (e.g. from staff lunches) will be made inaccessible to birds and vermin;
- Daily inspections will be undertaken, during operational periods, to identify litter and removal and disposal undertaken as required; and
- Should birds or other wildlife start using the site in numbers of concern, specialists will ~~may~~ be engaged to survey/monitor the species utilising the site to remedy the situation.

Further management measures to reduce wildlife attraction are outlined in *Section 5.2.1.18.*

5.2.1.27 Hazards

Oils and lubricants and any other hazardous materials (e.g. cleaning products) will be stored in designated bunded areas in accordance with the following Australian Standards:

- Australian Standard 1940: 2004 The Storage and Handling of Flammable and Combustible Liquids; and
- Australian Standard 1596: 2008 The Storage and Handling of LP Gas.

Site management processes will periodically review conformance with these controls and standards.

5.2.1.28 Geology and Geochemistry

The Luddenham Area lies within the central part of the Sydney sedimentary basin. This basin is a large depression that began to form in the early Permian times and gradually filled with a variety of sedimentary strata, including a thick sequence of coal measures. The Hawksbury Sandstone is a widespread and continuous sheet of sandstone that was deposited in Triassic Times. This originally horizontal expanse of sandy sediments continued to form a shallow central depression that filled with mainly fine grained sediments forming a series of shaly and silty strata named the Wianamatta group; it includes the Ashfield Shales an Bringelly Shale.

The soils on the site generally have a moderate salinity potential and management is discussed in *Section 5.2.1.32.*

5.2.1.29 Material Prone to Spontaneous Combustion

There is no material on the site that is prone to spontaneous combustion.

5.2.1.30 Material Prone to Generating Acid Mine Drainage

There is no material on the site that is prone to generating acid mine drainage.

5.2.1.31 Ore Beneficiation Waste Management

There is no ore beneficiation waste produced on the site.

5.2.1.32 Erosion and Sediment Control

5.2.1.32.1 Soil Erosion Characteristics

The catchment area and dam volumes for the site were estimated to determine the risk of sediment-laden water leaving the site. The NSW *Managing Urban Stormwater, Soil and Construction, Volume 2E Mines and Quarries* handbook, also known as the Blue Book, was used to make the determinations. Several assumptions have been made as listed below. The calculations have erred on the side of caution and should be considered a 'Worst Case Scenario'.

The Soil Hydrological Group for the soil materials is assumed to be D, very high run-off potential. Water moves into and through these soils very slowly when thoroughly wetted. They regularly shed run-off from most rainfall events.

Conservatively, sediment retention basins are designed using the Type D Soils calculations. This includes the sediment storage zone calculation using the estimated soil loss for the site over two months.

The likely soil loss is calculated with the Revised Universal Soil Loss Equation (RUSLE). The values of the other RUSLE factors are: P of 1.3 and the C is assumed to be 1.0 for bare soil. Calculations can be found in *Appendix H.*

The potential soil loss of the site has been calculated using *Managing Urban Stormwater, Soil and Construction, Volume 2E Mines and Quarries* for a 90th percentile, 5 day rainfall event (48.8mm) assuming a non-sensitive receiving environment. Important site physical characteristics are identified in the table below.

Table 26. Constraints and Characteristics

Constraint/Opportunity	Value
IFD:2 year, 6 hour storm	7.15 mm/hr (from the BOM IFD data)
Slope Gradients	Low to Moderate (out of pit) & High (in-pit) 5-10% and up to 60%
Potential Erosion Hazard	Low out of pit and moderate in-pit
Soil Erodiblity	0.038 (Bannerman and Hazelton, 1990)
Calculated Soil Loss	~170 tonnes/ha/yr out of pit to ~510 tonnes/ha/yr on in pit slopes
Soil Loss Class	2-5
Soil Texture Group	Type D
Soil Hydrological Group	D
Runoff Coefficient	0.69 (Soil Hydrological Group D)
Disturbed Site Area	10 ha approximately

5.2.1.32.2 Management of Soil and Erosion

Generally, the site is prone to moderate erosion, but this is limited to the exposed worked areas of the mine. Erosion over the disturbed area is mitigated as much as possible through the establishment of vegetation, which binds the soil and traps silt. Rainfall that occurs over the active mine site does cause some minor erosion on unfinished surfaces, but the sediments are collected on the floor of the mine within the sediment dams. Eroded soils and sediment captured within the pit sump become a part of the surface water management process.

Slopes are kept moderate where possible in the pit to reduce erosion hazard and benches are present on the site.

The following measures will be implemented as practicable:

- Soil erosion from the site will be reduced through progressive rehabilitation, where possible and the minimisation of disturbed areas;
- Pre-stripping will be kept to one or two campaigns ahead;
- Vehicles are required to remain on the designated access tracks to prevent damage to the existing vegetation and reduce surface erosion;
- A water cart regularly sprays the roads and mine floor in order to prevent dust generation and control windblown soil loss;
- Vegetation will be established as soon as practicable on stored soil stockpiles as well as rehabilitated areas; and
- Slopes on rehabilitated areas will be kept to a minimum to reduce erosion hazards or stabilised by other means.

5.2.1.32.3 Surface Water Strategy

The key features of the water management system include:

- Diversion of runoff from undisturbed catchments away from disturbed areas and off site;
- collection of all potentially sediment-laden runoff from disturbed areas of the site within the mine pit;
- use of captured runoff for dust suppression of unsealed roads and disturbed areas; and

5.2.1.32.4 Water Management Objectives

The Soil and Water Plan (see *Appendix F*) has been revised to reflect the Consent Conditions (as modified).

The water management objectives from the Modification Report are reproduced below.

Water Management Objective	Approach
Minimise the use of potable water from the public supply for purposes where non-potable water is acceptable and available.	• Water captured in the mine pit and Water Management Dam is used preferentially for dust suppression over potable water.
Maximise the separation of clean and dirty water.	• Diversion channels and drains divert clean water around disturbed areas on site as far as reasonable and feasible. • All sediment-laden runoff is directed into the internal water management system.
Minimise the risk of discharges from the site.	• Erosion and sediment control structures sized and maintained generally in accordance with Landcom (2004) and DECC (2008). • Water stored in the mine pit and Water Management Dam is used for dust suppression on site. • The Water Management Dam is to be always operated with a capacity of 1.5ML. The Water Management Dam is to be dewatered to the mine pit following storm events.
Minimise the potential for water quality impacts associated with chemical and hydrocarbon spills.	• Chemical and hydrocarbon products will be stored in bunded areas in accordance with relevant Australian Standard AS1940:2004.

5.2.1.32.5 Catchments

The site is bounded by a gentle ridge in the west and Oaky Creek to the east. In general, surface water not captured by the disturbed area is considered clean and flows overland to Oaky Creek and thence Cosgrove Creek, approximately 1 kilometre downstream. The western side of Oaky Creek forms the WSA development area and is highly disturbed.

At present all dirty surface water from the disturbed area is captured by the In-Pit Sump. As discussed previously, the Water Management Dam is to be enlarged and utilised as a water supply for dust suppression.

5.2.1.32.6 Water Storages

The Water Management Dam will be used to supply dust suppression of unsealed roads and disturbed areas, with no discharge to Oaky Creek. It will be increased in depth to provide a minimum capacity of 7 ML, which is greater than

the minimum design volume of 6.6 ML calculated in the Modification Report using the methods specified in *Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom)* and *Managing Urban Stormwater: Soils and Construction – Volume 2E Mines and Quarries (DECC* 2008) (refer Section 4.5 of the Surface Water Assessment). The Water Management Dam will maintain a minimum of 1.5 ML in the dam (equivalent to the minimum design volume required for the Water Management Dam and the sediment zone volume for the mine pit determined in *Section 4.5* of the *MOD 5 Surface Water Assessment (EMM 2020c*)). This will ensure sufficient water is available for dust suppression purposes and reduce the potential demand for potable water.

The Water Management Dam has not been actively maintained for at least 2 years while the mine has been inactive and is overgrown with vegetation, impeding the capacity of the dam. This dam is planned to be cleaned out to provide a minimum capacity of 7 ML. It is noted maintenance work on this Water Management Dam is approved under the existing mine consent and will not impact on adjacent native vegetation.

The capacity of the In-Pit Sump required to catch the design storm event, within the disturbed area as recommended by the *Managing Urban Stormwater Soils and Construction –Volume 2E Mines and Quarries* guideline, is shown in the table below. Calculations can be found in *Appendix H.*

Table 27. Catchment Volumes

Catchment	Catchment Area (Ha)	Sediment Basin Storage (soil) volume (m^3)	Sediment Basin Storage (water) volume (m^3)	Dam Volume Required for 90th percentile, 5 day rainfall event* (m^3)
Disturbed Mine Area	10	233	3,370	3,600

Assumes a 5 day management period.

As can be seen from the calculations above the In-Pit Sump, which currently has a void volume of approximately 1,400,000m^3 (from 12D modelling and ELVIS Spatial Data) and is more than sufficient to contain the design storm event.

The In-Pit Sump will routinely be maintained at a minimum level required for dust suppression purposes via transfer to the Water Management Dam and will not require a Water Access Licence during the operational phase of the mine.

5.2.1.32.7 Water Balance

The Modification Report revised water balance concluded that:

> *'The revised water balance results indicate that 100% of the demand for dust suppression can be supplied by harvested catchment runoff and the water currently stored within the quarry pit. No potable water use was modelled to be required in the revised water balance.'*

5.2.1.32.8 Water Quality

Key water quality results determined during the MOD 5 application are summarised as follows:

- Salinity (as indicated by electrical conductivity) was elevated on site (1,550µS/cm in the Sediment Dam 2 and for Oaky Creek upstream (ranging from 764µS/cm to 851µS/cm) of the but within the Default Guideline Values (DVGs). This is typical for inland watercourses in NSW that have catchments dominated by agricultural land uses.
- pH within Oaky Creek, both upstream and downstream of the mine, was within the DGV range. Water stored within the mine pit and water management dams was elevated compared to Oaky Creek.
- Total suspended solids were generally reported to be low (typically below 50 mg/L), however elevated concentrations were recorded following significant rainfall events, particularly within the water management dams and at the Oaky Creek upstream site.
- Nutrient levels were generally low, with the exception of phosphorus concentrations at the Oaky Creek upstream site that exceeded the DGVs.

- Metals were generally found to be below DGVs for all sites, with slight exceedances of the relevant DGVs for dissolved iron at the Oaky Creek upstream site; dissolved nickel and zinc within the mine pit; and copper and zinc within the water management dams.

A discharge characterisation assessment will be undertaken within 12 months of commencement of operations, providing discharges occur. This will allow more monitoring data to be collected during the initial operation of the mine to help inform ongoing water management at the mine site. The discharge characterisation assessment will address the matters recommended by the EPA submissions in the Modification Report.

5.2.1.32.9 Discharge

The Water Management Dam will be operated at a low level, with sufficient capacity to capture catchment runoff at all times. Discharges to Oaky Creek via overflow of the Water Management Dam were predicted by the water balance model to occur once over the 131 year historical rainfall record simulated. No overflows from the mine pit were modelled to occur.

If discharge activities from the water management system to Oaky Creek are planned to occur, a discharge characterisation and water pollution impact assessment will be prepared as required by the development consent. If irrigation is to occur, it will be undertaken in accordance with the Irrigation Management Plan in the consent conditions.

It should be noted that the WSA has significantly altered the Oaky Creek watercourse and upstream flows into the creek have been greatly impacted.

5.2.1.32.10 Flooding

The Modification Report flood modelling undertaken as part of the environmental impact statement for the WSA (GHD 2016) predicted that the disturbed areas of the mine site would remain above the limit of flooding along Oaky Creek for all events up to and including the probable maximum flood. As a result, there is no potential for adverse flood impacts associated with mining operations and no flood management structures are required.

5.2.1.32.11 Monitoring and Management

The Soil and Water Management Plan for the site has been updated to include the new water management strategy for the mine and to address any specific development consent or licence conditions. It will also include the following:

- baseline monitoring data results;
- objectives and performance criteria including trigger levels for investigating any potential adverse impacts associated with water management;
- details of the monitoring, inspection and maintenance programs;
- reporting procedures for the results of the monitoring program; and
- plans to respond to any exceedances of the performance criteria.
- Surface water quality monitoring will continue within Oaky Creek, upstream and downstream of the site, and within the mine pit and the Water Management Dam (see *Figure Ten*).

All monitoring will be undertaken in accordance with Approved Methods for Sampling and Analysis of Water Pollutants in New South Wales (DEC 2004) and the following parameters are recommended.

Table 28. Recommended Surface Water Quality Monitoring Parameters

Category	Parameter	Analysis Method
Physical and chemical stressors	Dissolved oxygen, electrical conductivity, pH, , turbidity Total Suspended Solids, total dissolved solids	In situ with a calibrated hand-held water quality meter Analysis undertaken at NATA accredited laboratory
Nutrients	Ammonia, nitrate, nitrite, total Kjeldahl nitrogen, total nitrogen, reactive phosphorus, total phosphorus	Analysis undertaken at NATA accredited laboratory
Dissolved Metals	Aluminium, arsenic, boron, cadmium, chromium, copper, iron, lead, manganese, nickel, zinc	Analysis undertaken at NATA accredited laboratory
Other	Total hardness, oil and grease	Analysis undertaken at NATA accredited laboratory

Inspections of water management structures and erosion and sediment control measures will be undertaken:

- periodically during active operations; and
- as soon as practicable following rainfall events that exceed 40 mm in 24 hours."

The water management structures will be visually inspected for capacity, structural integrity and effectiveness. Maintenance, such as the removal of excessive sediment accumulation or macrophyte growth from the Water Management Dam and drainage lines, will be implemented as required.

Plan of:	Luddenham Clay/Shale Mine RMP Water Monitoring Locations	**Location:**	275 Adams Road, Luddenham	**Source:**	Six Maps, Nearmaps (12/01/2021), ELVIS Spatial Data, MinView	**Our Ref:**	12397_QGIS_LQ_RMP_2022_Q005_V0_F10
Figure:	TEN	**Council:**	Livepool City Council	**Survey:**	ELVIS Spatial Data	**Plan By:**	TO
Version:	V0	**Tenure:**	MLA 592	**Projectio**	GDA2020/MGA Zone 56 EPSG: 7856	**Project Manager:**	TO
Date:	20/07/2022	**Client:**	Coombes Property Group Pty Ltd	**Contour Interval:**	1 Metre	**Office:**	Thornton

vgt environmental compliance solutions and laboratories

This figure may be based on third party data which has not been verified by vgt and may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and vgt does not warrant its accuracy.

Legend

Features

- Property Boundary
- Lot
- Contours (1m)

Water Management Features

- Groundwater Monitoring Bore
- Surface Water Monitoring
- Dams
- Creek

Mine Lease

- Mine Lease Boundary

5.2.1.33 Ongoing Management of Biological Resources for Use in Rehabilitation

5.2.1.33.1 Topsoil Management

It should be noted that there is very little, if any topsoil remaining in the proposed extraction area. Previously stripped topsoil is stored in perimeter bunds. Any further topsoil material to be stripped on site will be used immediately or kept on site in stockpiles for future rehabilitation. Stripping would be undertaken with care in order to maintain the integrity of the topsoil and seed bank stored within it. Stored topsoil stockpiles will not exceed 1.5m in height and will be revegetated with temporary ground cover species. Stockpile slopes will be no greater than 3H:1V and no stockpiles will be not constructed in areas of concentrated flows. All topsoil volumes stripped will recorded and reported annually in the Annual Rehabilitation Report (ARR). The topsoil stripping areas and stockpile locations also will be clearly marked on any plans submitted in the ARR.

Prior to reuse on rehabilitation areas, topsoil stockpiles will be tested for suitability and ameliorants applied as advised by an agronomists or similarly qualified person/s.

5.2.1.33.2 Salvage of Habitat Structures

Two trees mapped as poor condition PCT 1800 within the originally approved mine extraction and stockpile area to the west of the mine pit may require removal as part of the reactivated mine operations. No hollows or habitat features were identified in either of these trees during field work carried out for the MOD 5 Biodiversity Development Assessment Report (EMM 2020) and they are not considered to provide habitat for any threatened species.

The following procedure will be followed in the event these trees are removed to facilitate mining operations:

- Inspection by site supervisor prior to removal to confirm whether fauna is present.
- In the event fauna is observed, an ecologist would attend site prior to and during the tree removal.
- In the event fauna is observed, the trunk of the tree would be shaken by heavy machinery, with the shaking paused to allow any fauna present to escape, prior to felling the tree.
- Any injured fauna would be carefully captured by a qualified person and taken to a wildlife carer or veterinary clinic.
- As recommended by the Biodiversity Development Assessment Report (EMM 2020), sections of the trunks greater than approximately 25 cm in diameter and 3 m in length will be placed within the Oaky Creek riparian corridor to enhance habitat.

5.2.1.33.3 Methods of Propagation

There will be no propagation of native species for use in rehabilitation areas. Vegetation will consist of pasture species which will be suitable for grazing and advice will be sought from a qualified agronomist or similar on the most appropriate species and methods of seeding during the landform establishment phase.

5.2.1.34 Mine Subsidence

There are no areas of mine subsidence that require management on the site.

~~4.2.15 Heritage~~

5.2.1.35 Management of Potential Cultural and Heritage Issues

The following mitigation measures will be applied:

- AHIMS site #45-5-2280 will continue to be avoided and protected by fencing.
- The corrected coordinates for AHIMS site #45-5-2280 will be entered in the AHIMS database.
- The riparian corridor along the western bank of Oaky Creek will continue to be avoided by mining activities.
- The work will proceed with caution and the following actions will be taken in accordance with the Aboriginal Heritage Due Diligence recommendations:
    - In the event that unexpected Aboriginal objects, sites or places are discovered, DPIE will be notified as soon as practicable after they are first identified.
    - In the event that known or suspected human skeletal remains are encountered, the following procedure will 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;
        - the environmental manager 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);
        - the environmental manager or other nominated senior staff member will contact DPIE for advice on identification of the skeletal material as Aboriginal and if so, management of the material;
        - if it is determined that the skeletal material is ancestral Aboriginal remains, the Aboriginal community will be contacted, and consultative arrangements will be made to discuss ongoing care of the remains;
        - the site will be recorded in accordance with the NPW Act and DPIE guidelines; and
        - if the remains are historical and not of Aboriginal origin, the Heritage Division of DPIE will be notified for further instruction.

5.2.1.36 Exploration Activities

Exploration activities will be limited in nature and are likely to include costeaning within existing emplacement areas and the south western corner of the mine footprint. There will be no rehabilitation of exploration activities in these areas as they will be subject to extraction activities in the short term prior to final site rehabilitation.

5.2.1.37 Risks to WSA

5.2.1.37.1 Short, Medium and Long Term Risks

The short, medium and long term risks to the WSA are assessed in *Table 11* and the following excerpts from the Final Land Use Plan (EMM August 2021) discusses the risks and management measures.

> ***'4.1.2 Management measures to minimise risks to surrounding land uses – leaving a void***
>
> *The management measures to minimise the short-, medium- and long-term risks to the construction and operation of the Western Sydney Airport and other surrounding land users if the quarry void is not infilled are provided below based on the following timeframes:*
>
> - *Short-term (now to December 2024): extraction of the quarry, construction of the airport and the start of the transition of other surrounding land-uses from residential/rural to agribusiness/commercial/industrial.*
> - *Medium-term (January 2025 to about 2040): quarry rehabilitation, maintenance of the quarry void, completion of airport construction, airport operations and the continued transition of other surrounding land-uses from residential/rural to agribusiness/commercial/industrial.*
> - *Long-term (from about 2041): maintenance of the quarry void, agribusiness/commercial/industrial use of the remainder of the site, airport operations and surrounding agribusiness/commercial/industrial land-uses.*

i Short-term management measures

The short-term management measures that will be implemented during the extraction of the quarry are summarised in the mitigation measures provided in Appendix D of the Luddenham Quarry, DA 315-7-2003 MOD5 Modification Report (EMM 2020a) as reproduced below.

Table 29. Management and Mitigation Measures from MOD5 Modification Report

Key Environmental Aspects	Measures
Air Quality	Preparation and implementation of an air quality management plan, prepared following approval for the reactivation of the quarry, and including the below management and mitigation measures. • Water cart to operate on the internal unsealed haulage routes and sealing of the access road between Adams Road and the weighbridge. • Minimising drop heights when unloading from trucks. • Watering applied to the crushing plan as required to minimise dust emissions. • Sheltering factor applied for wind erosion within the established pit. • Avoid the double handling of material where possible. • Site -wide vehicle speed limits will be applied (40km/h limit on sealed and 20km/h limit on unsealed roads) • Avoiding disturbance of stabilised ground cover where possible. • Use of meteorological forecasts to predict when the risk of dust emissions may be high (due to adverse wind conditions), allowing procedures and preparatory measures to be implemented, as follows: o Aim to have surfaces moist prior to the on-set of hot and windy conditions; o Plan for additional water spraying during the day; o Cease certain activities or reduce activity levels; and o Re-schedule deliveries or product dispatch.

Noise	Construction- work practice methods: Noise monitoring during the initial stages of construction will be undertaken to determine if actual construction noise levels are above NMLs. Construction noise levels will be managed where exceedances of NMLs may occur as detailed in a constriction noise management plan. • Regular reinforcement of the need to minimise noise and vibration, such as through toolbox talks: • Review and implementation of feasible and reasonable mitigation measures that reduce construction noise levels; • Avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon nearby residents; • Develop routes for the delivery of materials and parking of vehicles to minimise noise; • Where possible, avoid the use of equipment that generates impulsive noise; and notify residents prior to the commencement of intensive works. Construction- plant and equipment: • Where possible, choose quitter plant and equipment based on the optimal power and size to most efficiently perform the required tasks; • Operate plant and equipment in the quietest and most efficient manner; and • Regularly inspect and maintain plant and equipment to minimise noise and vibration level increases, to ensure that all noise and vibration reduction devices are operating effectively. The safe working distances for cosmetic damage from vibration will be monitored throughout the construction process. If safe working distances need to be encroached, real times vibration monitoring with audibles and visual alarms will be installed at vibration sensitive structures so actual vibration levels can be monitored and managed appropriately in real-times. Operation The quarry will be generally in accordance with the quarry as previously assessed and approved including; • Hours of operation; • Traffic movements (with a small increase); and • Existing noise bunds. Following approval of the proposed modification, the quarry's noise management plan will be reviewed and updated if necessary.

Surface Water	Following approval of the proposed modification, the water management plan for the site has been updated to include the new water management strategy for the quarry and to address any specific development consent or licence conditions. It also includes the following: • Baseline monitoring data results; • Objectives and performance criteria including trigger levels for investigating any potential adverse impacts associated with water management; • Details of the monitoring, inspection and maintenance program; • Reporting procedures for the results of the monitoring program; and • Plans to respond to any exceedances of the performance criteria. Surface water quality monitoring will continue within Oakey Creek, upstream and downstream of the site, and within the quarry pit and Water Management Dam, All monitoring will be undertaken in accordance with Approved Methods for Sampling and Analysis of Water Pollutants in NEW South Wales (DEC2004). Inspections of the water management system will be undertaken informally on a regular basis and formally on a quarter basis. The water management structures will be visually inspected for capacity, structural integrity and effectiveness. Maintenance, such as the removal of excessive sediment accumulation or macrophyte growth from the Water Management Dam and drainage lines, will be implemented as required.
Groundwater	No additional groundwater mitigation measures are required as a result of the proposed modification. The quarry's water management plan will be updated to include the new water management strategy for the site and to address any specific development consent or licence conditions.
Land and Soil	Existing management plans (including the site water management plan and relevant subplans including erosion and sediment control plan required under Condition24 of the consent will also be updated to account for the proposed modification.
Traffic and Transport	Quarry trucks will only travel on the section of Adams Road between Elizabeth Drive and the site access road. No Quarry trucks will travel on Adams Road south of the quarry access road. The Road Transport Protocol, required by Schedule 4, Condition 42 of the consent, will be revised to reflect site access changes and new infrastructure layout. Existing quarry roads will be used. These tracks may receive improvements but will not encroach on areas of native vegetation.
Biodiversity	The proposed mitigation measures to mitigate indirect impacts to the biodiversity values on site will include; • Operations will be carried out in accordance with the vegetation management plan which will be revised prior to the start of quarrying operations; • A speed limit of 40 kilometres per hour (km/hr) will apply on the sealed site access road and 20km/h on unsealed internal roads; and • Roads will be regularly maintained by managing vegetation on the shoulder to main visibility to prevent vehicle strike.

Rehabilitation	The Site Rehabilitation Plan (Connacher Environmental Group 2009) will be updated to include the changes relevant to the proposed modification and subsequently implemented on accordance with Schedule 4 Condition 33 of the consent.
Visual	The site vegetation management plan will be updated prior the restart of quarrying operations. This update will consider opportunities for further vegetation screening.
Heritage	The following mitigation measures will be applied; • AHIMS Site #45-5-2280 will continue to be avoided and protected by fencing; • The corrected coordinates for AHIMS Site #45-5-2280 will be entered in the AHIMS database; • The riparian corridor along the western bank of Oakey Creek will continue to be avoided by quarrying activities; and • The work will proceed with caution and the following actions will be taken in accordance with the AHDD recommendations; o In the event that unexpected Aboriginal objects, sites or places are discovered, DPIE will be notified as soon as practicable after they are first identified; and o In the event that known or suspected human skeletal remains are encountered, the following procedure will 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; ▪ The environmental manager 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); ▪ The environmental manager or other nominated senior staff member will contact DPIE for advice on identification of skeletal material as Aboriginal and if so, management of the material; ▪ If it is determined that the skeletal material is ancestral Aboriginal remains, the Aboriginal community will e contacted, and consultative arrangements will be made to discuss ongoing care of the remains; ▪ The site will be recorded in accordance with the NPW Act and DPIE guidelines; and ▪ If the remains are historical and not of Aboriginal origin, the Heritage Division of DPIE will be notified for further instruction.

Hazards	Oils and Lubricants and any other hazardous materials (e.g. cleaning products) will be stored in designated bunded areas in accordance with the following Australian Standards; • Australian Standard 1940: 2004 The Storage and Handling of Flammable and Combustible Liquids; and • Australian Standard 1596:2008 The Storage and Handling of LP Gas. Site management processes will periodically review conformance with these controls and standards.
Waste	To encourage the efficient use of resources and reduce potential environmental impacts from the quarry, all waste will be managed in accordance with the waste hierarchy: • Reduce waste production; • Recover resources; and • Dispose of waste appropriately. General waste management measures on site will include: • Working with suppliers to reduce overall packaging as much as possible: • Storing cardboard packaging and recyclable containers until collection by a licenced recycling contractor, or dispatch to an appropriately licenced facility; and • Storing general waste in vermin proof binds until a scheduled collection from a licenced contractor. General waste management measures on site will include: • Working with suppliers to reduce overall packaging a much as possible; • Storing cardboard packaging and recyclable containers until collection by a licenced recycling contractor or dispatch to an appropriately licenced facility: and • Storage of general waste in vermin proof bins until a scheduled collection from a licenced contractor.

ii Medium-term management measures

The following management measures will be implemented during the rehabilitation of the quarry void following the completion of extraction in December 2024 and following the completion of rehabilitation to minimise impacts on WSA and other surrounding land users:

- *bird deterrents will be used to seek to deter birds from using the water accumulating in the quarry void and the Water Management Dam;*
- *dust emissions will be minimised though the vegetation of finished faces;*
- *final slopes will be stabilised, as advised by a geotechnical engineer, and may include spray emulsions or other appropriate methods;*
- *soil testing will be carried out and soil ameliorants added if required to provide a suitable growth medium for revegetation with pasture species;*
- *following stabilisation of the void walls, the void will be fenced for the safety of the public who may be accessing future agribusiness/commercial/industrial development on other areas of the subject property; and*
- *regular inspections/monitoring to ensure that the void remains safe, stable and non-polluting.*

iii Long-term management measures

The medium-term management measures described above may need to be implemented in the long-term if the void (and associated water) pose a risk to airport operations.'

5.2.1.37.2 Wildlife Management

In the event that approval is not given to infill the quarry void, there will be an ongoing wildlife hazard risk to the WSA. The Final Land Use Plan (EMM August 2021) and the Biodiversity Management Plan (EMM June 2021) outline the risks and management measures that will be implemented ~~proposed~~ to reduce the risk of wildlife hazards to the WSA with the proposed infilling of the void as well as the existing approval where the void remains. Management measures to reduce the risk to the WSA with the void remaining are outlined below.

- No new planting (e.g. for landscaping) will occur on the site that produces fruit or flowers that are likely to attract birds and wildlife.
- The existing water management dam and decommissioned sediment dam will be netted or have lines across it with moving flags to deter birds prior to the commencement of WSA operations.
- Structures, fencing and lighting will minimise areas for wildlife, especially birds, to use for breeding, roosting, or perching. This will include: no eaves or ensuring no access to the roof cavity through the eaves; and using 'bird-spikes' on roof edges, fences and lighting.
- Waste bins that contain food waste (e.g. from staff lunches) will be made inaccessible to birds and vermin.
- Should birds or other wildlife start using the site in numbers of concern, specialists will ~~may~~ be engaged to survey/monitor the species utilising the site to remedy the situation.

5.2.2 Decommissioning

5.2.2.1 Site Security

In the interest of public safety and reducing the incidence of trespassers, fences and signage have been maintained along the perimeter of the mine site.

Photoplate 6. Security Fence and Cameras

5.2.2.2 Infrastructure to be Removed or Demolished

There is no remaining infrastructure to be removed or demolished. A disused farm shed within the footprint of the new equipment laydown area has been demolished to accommodate the equipment laydown area and demountable site shed. Access roads will be maintained until the void is backfilled, subject to a separate consent.

5.2.2.3 Buildings, Structures and Fixed Plant to be Retained

There are no buildings, structure or fixed plant within the mine lease that will be retained in the final landform. The perimeter fencing installed on the perimeter of the site will be retained to maintain security of the site.

5.2.2.4 Management of Carbonaceous/Contaminated Material

There is no carbonaceous or contaminated material remaining on site.

5.2.2.5 Hazardous Materials Management

Oils and lubricants and any other hazardous materials (e.g. cleaning products) will be stored in designated bunded areas in accordance with the following Australian Standards:

- Australian Standard 1940: 2004 The Storage and Handling of Flammable and Combustible Liquids; and
- Australian Standard 1596: 2008 The Storage and Handling of LP Gas.

Site management processes will periodically review conformance with these controls and standards.

5.2.2.6 Underground Infrastructure

There is no underground infrastructure on the site.

5.2.3 Landform Establishment

5.2.3.1 Water Management Infrastructure

The void has been envisaged in each consecutive consent modification to be back-filled and be generally consistent with the original landform contours, which existed prior to the commencement of mine operations. At present however, the site does not have consent to import material to backfill the void and thus, at the cessation of mining, water will accumulate in the void to an approximate depth of around 10 metres (i.e. 20 m below ground level). Water balance modelling undertaken by EMM suggests that the void would fill to approximately RL42 metres over a period of 70 years, which is approximately 25 metres below the natural surface. . A Water Access Licence (WAL43685) has been granted for the remaining water body in the final landform.

Remaining sediment dams outside of the void will be designed to Best Practice according to the 'Blue Book' Criteria for a 5 day 90th percentile storm event. Any drains required will be designed for the 1 in 10 years design storm event and all spillways will be designed for the 1 in 100-year design storm event and do not re-entrain sediment.

5.2.3.2 Final Landform Construction: General Requirements

Out-of-pit areas will be shaped to have slopes are no greater than 3 horizontal to 1 vertical. Slope lengths shall not exceed 80 metres before being broken by earth banks or similar to reduce surface water velocity and erosion impacts.

Slopes of major tracks are to be graded to less than 10° or have cross drains/banks installed. Where unsuitable soils are present, tracks to be stabilised with crushed bricks, concrete, gravel or similar.

5.2.3.3 Final Landform Construction: Reject Emplacement Areas and Tailings Dams

There are no reject emplacement areas or tailing dams on the site.

5.2.3.4 Final Landform Construction: Final Voids, Highwalls and Low Walls

Slopes to the final water body are stable but will be assessed by a geotechnical engineer and appropriate treatment to be implemented as recommended. The pit is surrounded by an earth berm and chain wire fence which will be retained to reduce the risk of vehicles and personnel accidentally falling into the void.

The surface of the final landform will be stabilised with soil stabilising polymers, temporary vegetation, or some other suitable means until the site is developed for future commercial/industrial land use.

Future development application to backfill the site will necessitate a review of the final landform construction.

Photoplate 7. In-Pit Slope Stability

Photoplate 8. Pit Perimeter Safety Berms

5.2.3.5 Construction of Creek/ River Diversion Works

There are no creek or river diversion on the site.

5.2.4 Growth Medium Development

As described in *Section 5.2.1.16,* once final rehabilitation faces become available they will be ripped using a dozer and the overburden material will be keyed into the surface. This will increase water retention and reduce erosion and slumping of the emplaced overburden. The organic topsoil layers will then be placed over the overburden, in the original natural horizon order, in a similar manner up to a minimum depth of 5cm.

The existing topsoil and overburden are suitable for rehabilitation but may require some amelioration with lime to increase the soil pH, depending on the vegetation species selected. Soil testing would be undertaken prior to permanent revegetation and advice from a suitably qualified specialist would be sought. Soil ameliorants would be added if recommended by soil testing results to provide a suitable soil medium for the growth of the targeted species and ecosystems.

Slopes will be kept to the minimum possible to reduce erosion impacts and sediment entrainment. Drainage will be established to direct surface water in to the final water body which, according to the water balance calculations, will take a number of decades to reach equilibrium. Surface water outside the void catchment will be directed to the Water Management Dam where possible. Exposed surfaces may be roughened to minimise erosion and maximise rainfall infiltration. Where required, surfaces may be stabilised by spray emulsions whilst vegetation establishes such that final landforms should have a coverage factor (C), from the Blue Book, of at least 0.05 within 30 days of the completion of works. This is equivalent to a total projected foliage cover greater than or equal to 70%.

Establishment of the growth medium is preferable in late winter early spring to enable planting to occur during spring to give the vegetation the optimum growing conditions. Weed control measure will continue to be undertaken as required.

5.2.5 Ecosystem and Land Use Establishment

Reseeding of the final landform with suitable pastoral species will be undertaken by direct seeding where terrain permits or spray emulsion. Consideration will be given to short lived sterile grasses to establish ground cover and stabilising of soil whilst the target pasture species establish. Advice from an agronomist will be sought to determine the most suitable species. Watering of the rehabilitated areas may be undertaken via the use of a water cart if required i.e. prolonged dry periods. Once established the pasture species should not require continued watering. Regular monitoring and control for weeds will continue and should be of a similar frequency requirement to neighbouring pastures. Grazing will not be permitted until vegetation is established and only then under controlled conditions to minimise damage.

5.2.6 Ecosystem and Land Use Development

- Weed monitoring will continue and will confirm that after 2 years the non-target species (weeds) represents less than 20%of projected foliage cover or equivalent to surrounding vegetation not disturbed by mining activities;
- Inspection of dams, drains and other water management structures will be undertaken monthly for the first six months then six monthly until completion criteria are achieved. Repairs will be undertaken as required;
- Inspections to identify any land instability such as mass movement to be undertaken and if identified, advice from geotechnical experts to be sought and repairs effected;
- Monitoring of Oaky creek will continue for water quality parameters and trigger values as developed in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence. Analysis includes:
    - pH, Conductivity, Turbidity, Oil and Grease, Ammonia, oxidised nitrogen, total nitrogen, reactive phosphorous, total phosphorus, dissolved metals (Al, As, B, Cd, Cr, Cu, Fe, Mn, Ni, Pb & Zn);
- Monitoring of groundwater will continue for water quality parameters and trigger values as developed in the Soil and Water Management (EMM 2021 and as updated from time to time) and or Environment Protection Licence. Analysis includes:

    - pH, Conductivity, Turbidity, Oil and Grease, Ammonia, oxidised nitrogen, total nitrogen, reactive phosphorous, total phosphorus, dissolved metals (Al, As, B, Cd, Cr, Cu, Fe, Mn, Ni, Pb & Zn);
- Vegetation will be monitored and areas where establishment has failed will be identified and assessed by an agronomist or similar. Remediation will be undertaken as advised. Remediation may include application of ameliorants, reseeding, mulching etc;
- Assessment of land capability will be undertaken to ensure the land meets the requirements of the final land use;
- Monitoring of soil parameters to determine continued suitability for developing ecosystem. Application of ameliorants to be undertaken, including fertilisation if required. Routine Soil Test (bulked soil sample 0-10 cm) includes but no limited to;
    - Total Carbon (TC), Total Nitrogen (TN), Organic Matter, TC/TN Ratio; Bray I and II Phosphorus; Colwell Phosphorus; Available cations (Calcium, Magnesium, Potassium, Ammonium, Nitrate, Phosphate, Sulphur); Available Micronutrients (Zinc, Manganese, Iron, Copper, Boron, Silicon); Exchangeable (Sodium, Potassium, Calcium, Magnesium, Hydrogen, Aluminium, Cation Exchange Capacity); pH and EC (1:5 water); Basic Colour, Basic Texture;
- Grazing may be undertaken on a controlled basis once vegetation is well established to encourage regrowth and resilience of plant species;
- Inspection and repair of fencing as appropriate;
- Inspection and repair of access tracks as appropriate;
- Wildlife deterrents to be inspected and repaired/replaced as required; and
- Bushfire controls are to continue and monitored for effectiveness.

5.3 REHABILITATION OF AREAS AFFECTED BY SUBSIDENCE

There are no areas affected by subsidence on the site.

6 Rehabilitation Quality Assurance Process

Table 30. Rehabilitation Quality Assurance Process

Key Actions	Responsibilities	Records	Review
Active Mining (Land Clearing)			
No land clearing is required on the site due to previous site activities			
Active Mining (Production)			
Topsoil Stockpile Management • Slopes no greater than 3H:1V. • Stockpile height no greater than 1.5 metres. • No stockpiles to be constructed in areas of concentrated flows. • Record volumes and locations of topsoil stockpiles. • volume of material, topsoil and subsoil required for application to current and future disturbance areas • Chronology of treatments (e.g. weed control, application of cover crop) undertaken on the stockpile. • Achieve groundcover factor of at least 0.05 (70% coverage) on stockpiles with long term inactivity. • Estimate of the volume of suitable alternative material required to be imported onto site to supplement potential material, topsoil and subsoil deficits.	Mine Manager Surveyor	Survey data of topsoil stockpiles. GIS data and plans. Soil inventory. Reports from weed contractors. Photography and site inspections reports.	Annual Rehabilitation Report Section 7.3 See Section 10
Overburden Stockpile Management • Slopes no greater than 3H:1V. • Stockpile height no greater than 3 metres. • No stockpiles to be constructed in areas of concentrated flows. • Record volumes and locations of overburden stockpiles. • volume of material, overburden required for application to current and future disturbance areas • Chronology of treatments (e.g. weed control, application of cover crop) undertaken on the stockpile. • Achieve groundcover factor of at least 0.05 (70% coverage) on stockpiles with long term inactivity. • Estimate of the volume of suitable alternative material required to be imported onto site to supplement potential material deficits.	Mine Manager Surveyor	Survey data of overburden stockpiles. GIS data and plans. Soil inventory. Reports from weed contractors. Photography and site inspections reports.	Annual Rehabilitation Report Section 7.3 See Section 10
Flora and Fauna • Bird-spikes, fencing or other measures are installed as appropriate to minimise risk to WSA due to bird strike. • Installation of netting or lines across water bodies with moving flags to deter birds prior to the commencement of WSA operations. • Maintain riparian zone offset of 40 metres from Top of Bank of Oaky Creek.	Mine Manager	Photography and site inspections reports.	Annual Rehabilitation Report Section 7.3 See Section 10

Key Actions	Responsibilities	Records	Review
Waste • Waste will be stored in a small, designated waste storage area within the site entry area. • Wastes will be stored in bins with a lid. • Oily rags, filters, drums and waste batteries will be stored on a self-bunded pallet or similar. • Wastes will be removed by licenced contractor.	Mine Manager	Photography and site inspections reports.	Annual Rehabilitation Report Section 7.3 See Section 10
Erosion • Slopes to be reduced to a maximum of 3H:1V in out of pit areas. • Consider benched mining design on highwalls. • Slope Lengths shall not exceed 80 metres before being broken by earth banks or similar in out of pit areas. • Slopes of major tracks are to be <10 degrees or have cross drains/banks installed. • Where unsuitable soils are present, tracks are to be stabilised with crushed bricks, concrete, gravel or similar. • Track walk or lightly rip exposed surfaces to encourage infiltration of rainwater. • Achieve ground coverage factor of at least 0.05 (70%) via vegetation, mulch or similar within 30 days of completion of works.	Mine Manager	Survey data. GIS data and plans. Photography and site inspections reports.	Annual Rehabilitation Report Section 7.3 See Section 10

Sediment
• Sediment dams designed for 90th % 5-day storm event.
• Capacity of sediment dams to be monitored for available capacity.
• Drains to be designed for 1 in 10-year design storm.
• Spillways to be designed for 1 in 100-year design storm.
• Receiving capacity of sediment dams to be maintained by;
  o Reuse of water on-site for dust suppression; and
  o Water to be pumped to pit sump if capacity not sufficient to contain design storm prior to storm events.
• Pit maintained to have capacity to contain a volume greater than the design storm.
• Drains to be installed to direct dirty surface water to sediment dams.
• Installation of silt fences around disturbed area as appropriate.
• No silt fences to be constructed in areas of concentrated flows.
• Upstream clean water to be diverted via diversion drains or bunds as far as possible.
	Mine Manager	Survey data.
		GIS data and plans.
		Photography and site inspections reports.
			Annual Rehabilitation Report
			Section 7.3
			See Section 10

Key Actions	Responsibilities	Records	Review
Wind Erosion • Water cart to be engaged during mining, hauling and rehabilitation activities. During adverse conditions: • Cease mining or hauling activities in adverse wind conditions: and • Increase water cart frequency	Mine Manager	Weather data. Watercart usage/pumping volumes. Photography and site inspections reports.	Annual Rehabilitation Report Section 7.3 See Section 10
Water Quality • Water quality discharged from rehabilitated mining operation meet specifications in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence. • Groundwater quality monitored from rehabilitated mining operation meet specifications in the Soil and Water Management Plan (EMM 2021 and as updated from time to time).	Mine manager NATA Accredited laboratory	Water testing reports	Annual Rehabilitation Report Section 7.3 See Section 10

Key Actions	Responsibilities	Records	Review
Decommissioning			
Infrastructure (Retained) • Damage to access tracks has been repaired and stabilised. • Slopes of major tracks <10° or have cross drains/banks installed. Where unsuitable soils are present, tracks to be stabilised with crushed bricks, concrete, gravel or similar. • Roads reduced in width to that suitable for final land use. • Where applicable, necessary approvals are in place (e.g. development consent under the Environmental Planning and Assessment Act 1979) where buildings and infrastructure are to be retained as part of final land use. • The structural integrity of the infrastructure is suitable and safe for use as part of the intended final land use.	Mine Manager Structural Engineer Surveyor	Survey data. Structural reports Photography and site inspections reports.	Annual Rehabilitation Report Decommissioning Report See Section 10 Section 7.3
Infrastructure (Removed) • Removal of all services (power, water, communications) that have been connected on the site as part of the operation. • Removal of all plant, equipment and associated infrastructure including processing facilities, stockpile areas, and loading facilities, , office complex, portable offices, exploration core samples, camp facilities, storage racks, samples. • Removal of all water management infrastructure (including pumps, pipes and power).	Mine Manager	Utility service disconnection record / notification. Photography and site inspections reports.	Annual Rehabilitation Report Decommissioning Report See Section 10 Section 7.3
Overburden and Stockpile Areas • All overburden stockpiles are removed and or incorporated into the final landform.	Mine Manager	Survey data. Photography and site inspections reports.	Annual Rehabilitation Report Decommissioning Report See Section 10 Section 7.3
Waste • All rubbish/ waste materials removed from site. • Contamination will be appropriately remediated so that appropriate guidelines for land use are met, e.g. Health Investigation Level of the National Environment Protection (Assessment of Site Contamination) Measure (1999). • Excess sludge/material has been removed from surface water dams.	Mine Manager Land Contamination Consultant EPA Accredited Auditor	Contamination Remediation Report Site Contamination Audit Report Site Audit Statement (where required) Photography and site inspections reports.	Annual Rehabilitation Report Decommissioning Report See Section 10 Section 7.3

Key Actions	Responsibilities	Records	Review
Landform Establishment			
• Slopes outside the final void are no greater than 3 horizontal to 1 vertical and slope lengths shall not exceed 80 metres before being broken by earth banks or similar. • Sediment dams designed for 90th % 5-day storm event. • Capacity of sediment dams to be monitored for available capacity. • Drains to be designed for 1 in 10-year design storm. • Spillways to be designed for 1 in 100-year design storm. • Drains to be installed to direct dirty surface water to sediment dams prior to vegetation establishment. • Installation of silt fences around disturbed area as appropriate. • No silt fences to be constructed in areas of concentrated flows. • High risk landforms (such as steep slopes, high walls) have been constructed in accordance with geotechnical design. • Final landform conforms to the approved final landform. • Overburden material stored on site has been utilised to achieve the final landform. • Imported VENM (if required to achieve final landform) conforms to consent conditions and is certified in accordance with EPA requirements. • Water quality discharged from rehabilitated mining operation meet specifications in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence. • Groundwater quality monitored from rehabilitated mining operation meet specifications in the Soil and Water Management Plan (EMM 2021 and as updated from time to time).	Mine Manager Earth moving contractor CPESC Surveyor NATA Accredited laboratory	Engineering drawings Survey data. Photography and site inspections reports. Topsoil and overburden material inventory Water testing results VENM certificates	Annual Rehabilitation Report Decommissioning Report See Section 10 Section 7.3

Key Actions	Responsibilities	Records	Review
Growth Medium Development			
• The re-established topsoil / subsoil substrate is capable of supporting the targeted pasture / cropping regime on a sustained basis. Analysis to determine suitability includes: o Total Carbon (TC), Total Nitrogen (TN), Organic Matter, TC/TN Ratio; Bray I and II Phosphorus; Colwell Phosphorus; Available cations (Calcium, Magnesium, Potassium, Ammonium, Nitrate, Phosphate, Sulphur); Available Micronutrients (Zinc, Manganese, Iron, Copper, Boron, Silicon); Exchangeable (Sodium, Potassium, Calcium, Magnesium, Hydrogen, Aluminium, Cation Exchange Capacity); pH and EC (1:5 water); Basic Colour, Basic Texture. • Ameliorants to be applied to topsoil material if required as identified by testing. • A topsoil established of at least 100 millimetres thick and comprising clean soils, which can include compost to help with vegetation establishment and growth. • Imported topsoil (if required) conforms to consent conditions and is certified in accordance with EPA requirements. • Track walk or lightly rip exposed surfaces to encourage infiltration of rainwater.	Mine Manager Earth moving contractor NATA Accredited laboratory Agronomist or similar	Photography and site inspections reports. Topsoil and overburden material inventory Soil testing results VENM certificates	Annual Rehabilitation Report Decommissioning Report See Section 10 Section 7.3
Ecosystem and Landuse Establishment			
• Advice from an agronomist will be sought to determine the most suitable species. • Seeds for use in rehabilitation will be certified where possible. • Reseeding of the final landform with suitable pastoral species will be undertaken by direct seeding where terrain permits or spray emulsion • Watering of the rehabilitated areas may be undertaken via the use of a water cart if required i.e. prolonged dry periods. • Regular monitoring and control for weeds will continue and should be of a similar frequency requirement to neighbouring pastures.	Mine Manager Agronomist or similar Weed/pest control contractor	Photography and site inspections reports. Water testing results Seed viability certificates Water cart volumes and frequency Weather data	Annual Rehabilitation Report Decommissioning Report See Section 10 Section 7.3
Ecosystem and Landuse Development			
• Total foliage cover is greater than or equal to 70%. • Monitoring confirms that after 2 years the non-target species (weeds) represents less than 20%of projected foliage cover or equivalent to surrounding vegetation not disturbed by mining activities. • Rural fences and gates installed around disturbed area to allow controlled grazing of domestic stock. • Feral animal controls will be implemented if required. • Monitoring reports indicate the level of grazing is appropriate. • Bird-spikes, fencing or other measures are installed as appropriate to minimise risk to WSA due to bird strike. • Installation of netting or lines across water bodies with moving flags to deter birds prior to the commencement of WSA operations. • Minimal erosion or land instability evident that would not require moderate to significant ongoing management and maintenance works. • Surface water management structures are functioning as designed. • Water quality discharged from rehabilitated mining operation meet specifications in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence. • Groundwater quality monitored from rehabilitated mining operation meet specifications in the Soil and Water Management Plan (EMM 2021 and as updated from time to time).	Mine Manager NATA Accredited laboratory Agronomist or similar Weed/pest control contractor	Photography and site inspections reports. Water testing results	Annual Rehabilitation Report Decommissioning Report See Section 10 Section 7.3

7 Rehabilitation Monitoring Program

~~9 Rehabilitation Monitoring and Research~~

~~9.1 REHABILIATION MONITORING~~

~~The success of the rehabilitation activities described in *Section 6* will be monitored by measuring the progress towards the objectives and completion criteria outlined Table 27 in *Section 7*. Monitoring methods, frequency and responsibility has been included in that table. The progress towards these objectives and criteria will be reported annually in an Annual Rehabilitation Report (ARR).~~

~~9.2 USE OF ANALOGUE SITES~~

7.1 ANALOGUE SITE BASELINE MONITORING

Control analogue sites will be identified in consultation with a MEG representative and person(s) suitably qualified in flora and landform assessment. It is expected that these sites will be used as a comparison to assist in determining whether the objectives relating to slope stability and vegetation coverage have been achieved. Progress towards identifying these sites will be reported in the annual review.

7.2 REHABILITATION ESTABLISHMENT MONITORING

This section summarises monitoring to be undertaken during the commencement of Ecosystem and Landuse Establishment phase of rehabilitation.

Table 31. Rehabilitation Establishment Inspection Regime

Monitoring	Frequency	Records
Topsoil/Subsoil suitability testing for key parameters.	6 monthly for the first 12 months. Yearly for the next 2 years.	NATA laboratory results.
Topsoil/Subsoil depth measurements to ensure sufficient depth emplaced and maintained.	6 monthly for the first 12 months. Yearly for the next 2 years.	Photography and/or inspection checklist. Soil sampling reports.
Purchased seed viability certification.	Prior to purchase.	Seed viability certificate or similar.
Seed coverage on rehabilitated areas.	Post spreading on topsoil.	Photography and/or inspection report.
Soil moisture.	Weekly for the first month after seeds are spread. Monthly for the next 12 months whilst vegetation establishes. 3 monthly for the next 2 years.	Photography and/or inspection report.
Weed numbers.	6 monthly.	Photography and/or inspection checklist. Weed control contractor reports if spraying undertaken.

Monitoring	Frequency	Records
Access restrictions/fencing of rehabilitation areas.	6 monthly.	Photography and/or inspection checklist.
Evidence of Erosion.	Monthly for the first 12 months whilst vegetation establishes. 3 monthly for the next 2 years.	Photography and/or inspection checklist.
Risk minimisation measures to WSA from bird strike.	6 monthly.	Photography and/or inspection checklist.
Surface water management structures.	Monthly for the first 12 months. 3 monthly for the next 2 years.	Photography and/or inspection checklist.
Surface water quality.	Monthly for the first 12 months. 3 monthly for the next 2 years.	NATA laboratory results. Trend data/graphs
Groundwater quality	3 monthly for the first 12 months. 6 monthly for the next 2 years.	NATA laboratory results. Trend data/graphs
Vegetation coverage	Monthly for the first 12 months whilst vegetation establishes. 3 monthly for the next 2 years.	Photography and/or inspection checklist.

7.3 MEASURING PERFORMANCE AGAINST REHABILITATION OBJECTIVES AND REHABILITATION COMPLETION CRITERIA

The performance of the site rehabilitation will be measured against the rehabilitation objectives and completion criteria outlined in *Section 4.*

Table 32. Rehabilitation Objectives and Completion Criteria Inspection Regime

Performance Indices	Monitoring	Frequency	Records	Assessment of Trends	Trigger Thresholds to Identify Emerging Risks to Achieving Final Land Use
Decommissioning Phase					
Retention of infrastructure: All infrastructure that is to remain as part of the final land use is safe and does not pose any hazard to the community.	Inspection/s by suitably qualified engineer or similar.	At completion of decommissioning phase.	Site decommissioning inspection report. Statement provided by suitably qualified engineer or similar. Photography.	Not applicable.	Inspection indicates that not all hazards are isolated and secured.
Damage to access tracks has been repaired and stabilised.	Inspection/s by suitably qualified engineer or similar of repairs and stabilisation.	At completion of decommissioning phase.	Site decommissioning inspection report. Statement provided by suitably qualified engineer or similar. Photography.	Not applicable.	Inspection reveals that access track repairs have not been undertaken or have been ineffective.
Tracks suitable for private access or pedestrian usage.	Inspection/s by suitably qualified engineer or similar for grade of <10º,and suitable width of access track, cross drains /banks installed. Inspect for presence of erosion gullies or rills. Inspect for installation of suitable all weather material on access tracks.	At completion of decommissioning phase.	Site decommissioning inspection report. Statement provided by suitably qualified engineer or similar. Photography. Survey by registered surveyor.	Not applicable.	Inspection reveals that the access tracks are not suitable for light vehicle access or pedestrians
Final landform considers advice from relevant Government Agency whether sufficient licence shares are available in the water source to account for water stored in voids and dams in the proposed final landform.	Determination of approval requirements from responsible authority for remaining building or infrastructure. Obtain evidence of approvals as required.	Seek approvals prior to commencement of decommissioning activities and obtain documentary evidence of approvals prior to completion of site rehabilitation.	Site decommissioning inspection report. Development consents or other responsible authority documentation and approvals.	Not applicable.	Required approvals have not been sought or approved.
The structural integrity of the infrastructure is suitable and safe for use as part of the intended final land use.	The structural integrity of the infrastructure has been inspected by a suitably qualified engineer and determined to be suitable and safe as part of the intended final land use.	At completion of decommissioning phase.	Site decommissioning inspection report. Statement provided by suitably qualified engineer or similar. Photography. Survey by registered surveyor.	Not applicable.	Inspection by engineer finds the structural integrity of remaining infrastructure is not safe and suitable for the intended final land use.
Infrastructure is in a condition (e.g. structural, electrical, other hazards) that is suitable for the intended final land use.	Obtain evidence of acceptance from landowner that infrastructure is in a condition that is suitable for the intended final land use in accordance with formal agreement.	At completion of decommissioning phase	Site decommissioning inspection report. Formal acceptance from landowner.	Not applicable.	No acceptance of landowner obtained.

Performance Indices	Monitoring	Frequency	Records	Assessment of Trends	Trigger Thresholds to Identify Emerging Risks to Achieving Final Land Use
Removal of Infrastructure: Removal of all services (power, water, communications) that have been connected on the site as part of the operation.	Inspection of site to confirm removal of all services (power, water, communications) that have been connected on the site as part of the operation.	At completion of decommissioning phase	Site decommissioning inspection report. Statement provided, utility service disconnection record / notification.	Not applicable.	Services to be removed are still connected.
Removal of all plant, equipment and associated infrastructure including processing facilities, stockpile areas, rail infrastructure and loading facilities, underground hydrocarbon storage tanks, office complex, portable offices, exploration core samples, camp facilities, storage racks, samples.	Inspection of the site to confirm all plant, equipment and associated infrastructure including, stockpile areas, loading facilities, office complex, portable offices, exploration core samples, camp facilities, storage racks, samples have been removed.	At completion of decommissioning phase	Site decommissioning inspection report. Statement provided by suitably qualified engineer or similar. Photography. Survey by registered surveyor.	Not applicable.	Infrastructure not removed from the site.
Removal of all water management infrastructure (including pumps, pipes and power) not required for site rehabilitation works or retained in final landform.	Inspection of site confirms that water management infrastructure not required for site rehabilitation works or in the final landform is removed.	At completion of decommissioning phase	Site decommissioning inspection report. Photography.	Not applicable.	Water management infrastructure not removed from the site.
No waste material and/or visible contamination areas on site surface.	There are no visible signs of contamination following the removal of plant, equipment and materials. All rubbish/ waste materials removed from site.	At completion of decommissioning phase	Site decommissioning inspection report. Photography.	Not applicable.	Waste or potential contamination present on site.
Soil testing for contaminants of concern as listed by Health Investigation Level of the National Environment Protection (Assessment of Site Contamination) Measure (1999) applicable to land use type.	Site inspection and risk assessment of site to determine potential contamination issues. If potential risks identified in risk assessment then a contamination assessment is to be undertaken by suitably qualified person/s. Remediation measures, if required, to be assessed by Land Contamination Consultant or EPA Accredited Auditor.	At commencement of decommissioning phase.	Contamination Remediation Report prepared by Land Contamination Consultant Site Contamination Audit Report and Site Audit Statement prepared by EPA Accredited Auditor (where required).	Not applicable.	Soil testing indicates that sites does not meet Health Investigation Level of the National Environment Protection (Assessment of Site Contamination) Measure (1999) applicable to land use type.

Performance Indices	Monitoring	Frequency	Records	Assessment of Trends	Trigger Thresholds to Identify Emerging Risks to Achieving Final Land Use
Landform Establishment Phase					
Measured survey of rehabilitated landform to verify final landform construction in accordance with Final Landform and Rehabilitation Plan.	Survey verifies final landform complies with final landform construction in accordance with Final Landform and Rehabilitation Plan.	On construction completion.	Survey data and plans. Photography.	Not applicable.	Slopes outside the final void footprint are greater than 3 horizontal to 1 vertical Slope lengths exceed 80 metres before being broken by earth banks or similar.
	Verify high risk landforms (such as steep slopes, high walls) have been constructed in accordance with geotechnical design.	On construction completion.	Survey data and plans	Not applicable.	High risk landforms (such as steep slopes, high walls) have not been constructed in accordance with geotechnical design.
	Verify overburden material stored on site has been utilised to achieve the final landform.	On construction completion.	Survey data and plans. Photography.	Not applicable.	Overburden stockpiles identified as remaining on the site.
	Verify material stockpiles have been removed from the site or utilised to achieve the final landform.	On construction completion.	Survey data and plans. Photography.	Not applicable.	Material stockpiles identified as remaining on the site.
Significant surface water management structures (e.g. spillways, drop structures, and major drains) have been constructed in accordance with Managing Urban Stormwater 'Blue Book' DECC 2008 requirements.	Verify sediment dams are designed for 90th % 5-day storm event. Monitor available capacity of sediment dams. Verify drains are designed for 1 in 10-year design storm. Verify spillways are designed for 1 in 100-year design storm. Verify drains installed to direct dirty surface water to sediment dams. Verify installation of silt fences around disturbed areas as appropriate.	On construction completion.	Assessment Report undertaken by a suitably qualified person. Survey	Not applicable.	Sediment dams not designed for 90th % 5-day storm event. Drains not designed for 1 in 10-year design storm. Spillways not designed for 1 in 100-year design storm.
Measured survey/monitoring of rehabilitated landform to specifically monitor settlement and/or material loss via erosion.	Survey verifies that settlement and/or material loss is within predicted limits and will not compromise final landform drainage via differential settlement.	12 months after completion of construction.	Survey data and plans	Not applicable.	Settlement or material loss results in pooling of water, changes in surface water flow directions and velocities and function of water management structures.
Structures, fencing and lighting will minimise areas for wildlife, especially birds, to use for breeding, roosting, or perching. This will include: no eaves or ensuring no access to the roof cavity through the eaves; and using 'bird-spikes' on roof edges, fences and lighting	Visual inspection to confirm installation of bird deterrent devices.	On construction completion.	Photography. Site inspection reports/checklists.	Not applicable.	Bird deterrents not installed.

Performance Indices	Monitoring	Frequency	Records	Assessment of Trends	Trigger Thresholds to Identify Emerging Risks to Achieving Final Land Use
Installation of netting or lines across final water bodies with moving flags to deter birds prior to the commencement of WSA operations.	Visual inspection to confirm installation of bird deterrent devices.	On construction completion.	Photography. Site inspection reports/checklists.	Not applicable.	Bird deterrents not installed.
Imported VENM (if required to achieve final landform) conforms to consent conditions and is certified in accordance with EPA requirements.	VENM material is certified in accordance with EPA waste exemption requirements.	Prior to receipt of VENM	VENM certificate Haulage records/tonnage received	Not applicable	No VENM certificate provided by supplier
Growth Medium Development Phase					
Track walk or lightly rip/scarify exposed surfaces to encourage infiltration of rainwater	Visual inspection to confirm the surface to which topsoil is to be applied is roughened.	Prior to topsoil application	Photography. Site inspection reports/checklists.	No applicable.	Surface is noted to be compacted.
Growth medium/topsoil testing (bulked soil samples 0-10 cm) meets suitable criteria as determined by final landuse.	Routine Soil Test (bulked soil sample 0-10 cm). Includes but no limited to: Total Carbon (TC), Total Nitrogen (TN), Organic Matter, TC/TN Ratio; Bray I and II Phosphorus; Colwell Phosphorus; Available cations (Calcium, Magnesium, Potassium, Ammonium, Nitrate, Phosphate, Sulphur); Available Micronutrients (Zinc, Manganese, Iron, Copper, Boron, Silicon); Exchangeable (Sodium, Potassium, Calcium, Magnesium, Hydrogen, Aluminium, Cation Exchange Capacity); pH and EC (1:5 water); Basic Colour, Basic Texture.	Topsoil to be tested prior to spreading.	Soil testing reports.	Not applicable.	Soil testing indicates soil not within recommended criteria as advised by Soil Specialist/Agronomist.
Ameliorants applied to topsoil material if required as identified by testing.	Visual observation of ameliorant application, including photography, to ensure even application at specified rate.	Post topsoil spreading	Photography. Site inspection reports/checklists. Contractor invoices.	Not applicable.	Ameliorants not applied or applied evenly or applied at below the specified rate.
Topsoil established of at least 100 millimetres thick and comprising clean soils, which can include compost to assist with vegetation establishment and growth.	Test pits dug to confirm depth of topsoil application. Verify even application of topsoil and that no bare surfaces remain.	Post topsoil spreading	Photography. Site inspection reports/checklists	Not applicable.	Average depth of topsoil less than 50mm. Bare patches evident.
Imported topsoil or mulch (if required) conforms to consent conditions and is certified in accordance with EPA requirements.	Topsoil/mulch material is certified in accordance with any EPA waste exemption requirements.	Prior to receipt of topsoil/mulch	VENM/mulch certificate Haulage records/tonnage received.	Not applicable	No VENM/mulch certificate provided by supplier

Performance Indices	Monitoring	Frequency	Records	Assessment of Trends	Trigger Thresholds to Identify Emerging Risks to Achieving Final Land Use
Ecosystem and Land Use Establishment Phase					
Visual indicators of erosion and land instability.	Visual inspections for identification of erosion that would require moderate to significant ongoing management and maintenance works. Visual inspection for signs of land instability such as mass movement. Visual inspection for areas of active gully erosion. Visual inspection for evidence of tunnel erosion.	Weekly for the first month after landform establishment and then monthly for the next five years.	Photography. Erosion surveys- measurements of depths and numbers of rills, gullies, mass movements, tunnel erosion if present. Site inspection reports/checklists. Independent geotechnical reports (where required) Surveys	Compare photography and measurements to identify if erosion impacts are increasing.	Rills/gullies greater than 10cm in depth. Rills/gullies are showing an increasing trend in size for a period of at least 6 months. Any evidence of mass movement/slumping. Any evidence of tunnel erosion.
	Ground cover within plotted test quadrants. Vegetation size, survival rates and variety of species within plotted quadrants.	Monthly for the year after ecosystem and landform establishment and then 6 monthly for the next five years.	Photography. Reports on the estimates of ground coverage, vegetation size, survival rates and variety of species. Site inspection reports/checklists.	Compare photography and measurements of groundcover to determine if it is trending towards or away from a coverage factor of 70% (Blue Book C -factor equivalent of 0.05). Compare measurements of vegetation size, survival rates and variety of species to determine if on an increasing or decreasing trend and maturation rate.	Average loss of more than 20% of species within test quadrants. Ground coverage remains the same or is decreasing with regards to the final target of 70% over any 6 month period.
	Validate seeds for use in rehabilitation are certified where possible.	Prior to purchase	Certificates and purchase records.	Not applicable	No seed certification available.
	Visual observation of soil moisture of the rehabilitated areas to determine if watering is required i.e. prolonged dry periods.	Weekly for the first month after seeding and then monthly for the next 12 months.	Site inspection reports/checklists. Weather data	Review weather data and long term outlooks for rainfall to determine if more frequent watering is required.	Failure of vegetation due to prolonged dry conditions.
	Visual – no evidence of active scour likely to compromise surface water management structures such as drains, spillways etc.	Monthly for the first 6 months after landform establishment and then 6 monthly for the next five years.	Photography. Site inspection reports/checklists.	Compare photography and site inspection reports to determine if scouring is occurring and increasing in impact.	Surface water management structures are the source of sediment entrainment.

Performance Indices	Monitoring	Frequency	Records	Assessment of Trends	Trigger Thresholds to Identify Emerging Risks to Achieving Final Land Use
Soil testing (bulked soil samples 0-10 cm) meets suitable criteria as determined by final landuse.	Routine Soil Test (bulked soil samples 0-10 cm). Includes but no limited to: Total Carbon (TC), Total Nitrogen (TN), Organic Matter, TC/TN Ratio; Bray I and II Phosphorus; Colwell Phosphorus; Available cations (Calcium, Magnesium, Potassium, Ammonium, Nitrate, Phosphate, Sulphur); Available Micronutrients (Zinc, Manganese, Iron, Copper, Boron, Silicon); Exchangeable (Sodium, Potassium, Calcium, Magnesium, Hydrogen, Aluminium, Cation Exchange Capacity); pH and EC (1:5 water); Basic Colour, Basic Texture.	6 monthly after initial emplacement.	Soil testing reports.	Compare soil parameters to identify if soil fertility is decreasing or increasing.	Soil testing indicates soil fertility is decreasing according to criteria as advised by Soil Specialist/Agronomist.
No new planting (e.g. for landscaping) will occur on the site that produces fruit or flowers that are likely to attract birds and wildlife.	Confirmation that no new planting (e.g. for landscaping) will occur on the site that produces fruit or flowers that are likely to attract birds and wildlife.	Prior to and during seeding	Photography. Site inspection reports/checklists. Seed purchase records	Not applicable	Identification of fruiting or flowering plants.
Ecosystem and Land Use Development Phase					
Resilience demonstrated by the effects of drought and fire on composition, structure and other function attributes of pasture and cropping lands.	Ground cover within plotted test quadrants. Vegetation size, survival rates and variety of species within plotted quadrants.	6 monthly	Photography. Reports on the estimates of ground coverage, vegetation size, survival rates and variety of species. Site inspection reports/checklists.	Compare photography and measurements of groundcover to determine if it is trending towards or away from a coverage factor of 70% (Blue Book C -factor equivalent of 0.05). Compare measurements of vegetation size, survival rates and variety of species to determine if on an increasing or decreasing trend and maturation rate.	Average loss of more than 20% of species within test quadrants. Ground coverage remains the same or is decreasing with regards to the final target of 70% over any 6 month period.
Grazing by native and domestic fauna not adversely impacting on pasture development.	Verify rural fences and gates installed around disturbed area to allow controlled grazing of domestic stock. Feral animal controls have been implemented as required. Monitoring reports indicate the level of grazing is appropriate.	6 monthly	Photography. Site inspection reports/checklists.	Review groundcover and pasture regrowth rates.	Evidence of erosion or bare patches in rehabilitated areas due to stock or feral animals
All Phases					
No further active weed control required beyond that considered necessary at analogue sites.	Monitoring confirms the non-target species (weeds) represent less than 10% of projected foliage cover or equivalent to surrounding vegetation not disturbed by mining activities.	6 monthly	Site inspection reports/checklists Weed contractor reports/invoices	Comparison of weed inspection reports overtime to determine if weed numbers are increasing.	Non-target species (weeds) represent greater than 10% of foliage cover.
Presence of waste/litter that may attract birds and vermin to be removed from the site.	Monitoring indicates no waste/litter remaining on site.	Monthly	Photography. Site inspection reports/checklists.	Review monthly inspections to determine if the presence of waste or litter is increasing.	Evidence of excessive levels of litter causing bird attraction.

Performance Indices	Monitoring	Frequency	Records	Assessment of Trends	Trigger Thresholds to Identify Emerging Risks to Achieving Final Land Use
Soil inventory to be maintained to assess requirements to achieve the final landform.	Topsoil and overburden inventory to be maintained, included volumes stripped, stored in stockpiles and spread over rehabilitation areas.	Annually	Annual report to RR.	Identify possible deficits in future rehabilitation requirements	Projected topsoil volumes available for rehabilitation indicate less than 100mm depth over the entire rehabilitation area can be achieved.
Water quality parameters and trigger values for Oaky Creek as developed in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence. Analysis includes: pH, Conductivity, Turbidity, Ammonia, oxidised nitrogen, total nitrogen, reactive phosphorous, total phosphorus, dissolved metals (Al, As, B, Cd, Cr, Cu, Fe, Mn, Ni, Pb & Zn).	Water quality discharged from rehabilitated mining operation meet specifications in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence.	Quarterly As soon as practicable following rainfall events that exceed 40 mm in 24 hours.	Water Testing Reports	Review trends in results compared with trigger values in the Soil and Water Management Plan.	Continued exceedance of trigger values over a 6 month period.
Water quality parameters and trigger values for groundwater as developed in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence. Analysis includes: pH, Conductivity, Turbidity, Ammonia, oxidised nitrogen, total nitrogen, reactive phosphorous, total phosphorus, dissolved metals (Al, As, B, Cd, Cr, Cu, Fe, Mn, Ni, Pb & Zn).	Groundwater quality monitored from rehabilitated mining operation meet specifications in the Soil and Water Management Plan (EMM 2021 and as updated from time to time).	Quarterly	Water Testing Reports	Review trends in results compared with trigger values in the Soil and Water Management Plan.	Continued exceedance of trigger values over a 6 month period.
Appropriate bushfire hazard controls (where required) have been implemented on the advice from the NSW Rural Fire Service.	Bushfire controls implemented.	12 monthly	Slashing records. Liaison with NSW RFS. Photography.	Not applicable	Vegetation during periods of high fire danger at risk of bushfire.
Rehabilitation is consistent with the Biodiversity Management Plan (EMM 2021).	Confirm maintenance of riparian zone offset of 40 metres from Top of Bank of Oaky Creek.	At all times	Photography. Site inspection reports/checklists.	Not applicable	Fencing/ barrier around riparian zone removed or damaged

8 Rehabilitation Research, Modelling and Trials

8.1 CURRENT REHABILITATION RESEARCH, MODELLING AND TRIALS

There are no current rehabilitation research , modelling or trials being undertaken.

8.2 FUTURE REHABILITATION RESEARCH, MODELLING AND TRIALS

Future rehabilitation research will likely involve selection of suitable species and when final surfaces become available, trials may be undertaken to determine the best approach to establishing revegetation. The results of any trial will be used to address any knowledge gaps in relation to:

- the control or management of risks identified in the rehabilitation risk assessment
- the development and further refinement of rehabilitation completion criteria and
- the achievement of rehabilitation objectives and rehabilitation completion criteria.

This report will be updated as the development of research, modelling and trials are investigated.

10 Intervention and Adaptive Management

10.1 THREATS TO REHABILITATION

A summary of hazards or threats identified for the rehabilitation objectives is given below, along with a risk assessment. For risks deemed higher than acceptable (namely I to III in *Table 32*), a Trigger Action Response Plan (TARP) has been developed. A TARP identifies proposed contingency strategies in the event of unexpected variations in rehabilitation outcomes. These risks have been determined on the assumption that procedures and mitigation measures outlined in this report and other standard procedures that could be reasonably expected have been undertaken.

Table 32 Analysis of Rehabilitation Threats

Rehabilitation Threat	Potential Adverse Outcome	Likelihood	Consequence	Risk
Failure to remove infrastructure and services not suitable for the final landuse.	Unable to complete rehabilitation or establish the identified final landuse.	Rare	Insignificant	V
Failure to remove all roads and hardstand areas (except those to be retained for the final landuse) and reduce the width/size to that suitable for the final landuse.	Unable to complete rehabilitation or establish the identified final landuse.	Rare	Insignificant	V
Domain is not free from hazardous materials.	Unable to complete rehabilitation or establish the identified final landuse.	Rare	Moderate	IV
Water discharged from the site is not consistent with the baseline ecological, hydrological and geomorphic conditions of the surrounding environment.	The final landform is a source of pollution.	Unlikely	Minor	IV
Final landform does not conform to approved final landform	Unable to complete rehabilitation or establish the identified final landuse.	Possible	Moderate	III
Domain landform is not safe, stable and secure, fit for the purpose of the intended final land use.	Geotechnical instability of the final open cut void.	Unlikely	Moderate	III
Domain landform is not properly protected from erosion.	The final landform is a source of pollution.	Rare	Moderate	IV
	Vegetation is unable to be established due to erosion.	Rare	Major	III
Access tracks to be retained are not retained.	Unable to complete rehabilitation or establish the identified final landuse.	Rare	Insignificant	V
Incorrect species established on final landform	Vegetation community does not become established on final	Unlikely	Moderate	III

Rehabilitation Threat	Potential Adverse Outcome	Likelihood	Consequence	Risk
	landform affecting final land use and ecosystem			
Failure to establish soil/growing medium suitable for establishment of grassland or woodland vegetation community	Insufficient soil available for rehabilitation.	Possible	Moderate	III
	Inadequate soil thickness applied to final landform	Possible	Moderate	III
	Soil not capable of sustaining vegetation community	Possible	Moderate	III
Weed or pest management fails	Weeds and pests become established and require significant resources to manage	Possible	Minor	IV
Vegetation community is not self-sustaining	Final landform requires significantly more management than analogue sites.	Possible	Moderate	III
Vegetation community not receiving adequate rainfall to establish/self-sustain	Failure of vegetation community	Possible	Moderate	III
Public access to open cut void possible	Damage to rehabilitation areas	Possible	Moderate	III

9 Intervention and Adaptive Management

Table 33 Trigger Action Response Plan

TARP Ref No	Rehabilitation Threat	Potential Adverse Outcome	Trigger level	Actions to be implemented	Evidence / Reference
1	Final landform does not conform to approved final landform	Stockpiles not removed/used in the establishment of the final landform.	Inventory indicates stockpiles are not removed/reused. Slopes required by the final landform are not obtained due to material deficits.	Stockpile material is to be removed from the site or incorporated into the rehabilitation of the final landform.	Survey plan
		Overburden not used in the establishment of the final landform	Inventory indicates stockpiles are not removed/reused. Slopes required by the final landform are not obtained due to material deficits.	Overburden material is to be removed from the site or incorporated into the rehabilitation of the final landform.	Survey plan
		Slopes too steep to be rehabilitated as planned	Field slope measurements taken during land forming activities indicate slope do not meet the completion criteria.	Slopes to be reduced until all slopes meet approved final landform unless final landform considered stable by geotechnical review and vegetation establishment success meets completion criteria- subject to approval by MEG	Survey plan prepared by surveyor indicates that final slopes meet approved final landform.
2	Domain landform is not safe, stable and fit for the purpose of the intended final land use.	Geotechnical instability of the final open cut void.	Monitoring or final closure geotechnical assessment identifies instability/unacceptable movement (actual or potential) in final face of open cut void.	Suitably qualified geotechnical engineer engaged to assess the instability and provide a range of recommendations to remediate the instability. Recommendation to be implemented in consultation with the DRE.	Geotechnical Report

TARP Ref No	Rehabilitation Threat	Potential Adverse Outcome	Trigger level	Actions to be implemented	Evidence / Reference
3	Domain landform is not properly protected from erosion.	Vegetation is unable to be established due to erosion.	Projected total foliage cover is less than 70%	Mine personnel identify site of erosion and remediate through additional earthworks, soil works including addition of ameliorants, supplementary revegetation or other stabilisation method. If the above is unsuccessful, a suitably qualified professional in sediment and erosion control will be engaged to prepare and assessment report and recommendations to be implemented.	Managing Urban Stormwater 'Blue Book' 2004 CPESC Report
		Final landform is a source of pollution.	Surface water monitoring records indicate that water quality levels are outside the completion criteria. Visual inspection indicates that the final landform is the source of unacceptable levels of sedimentation or is actively eroding.	Mine personnel identify site of erosion and remediate through additional earthworks, soil works including addition of ameliorants, supplementary revegetation or other stabilisation method. If the above is unsuccessful, a suitably qualified professional in sediment and erosion control will be engaged to prepare and assessment report and recommendations to be implemented.	Managing Urban Stormwater 'Blue Book' 2004 CPESC Report

TARP Ref No	Rehabilitation Threat	Potential Adverse Outcome	Trigger level	Actions to be implemented	Evidence / Reference
4	Incorrect species established on final landform	Vegetation community does not become established on final landform affecting final land use and ecosystem.	Monitoring indicates that endemic species represent less than 80% of the total species number and projected foliage cover after 2 years from planting and less than 90% after 5 years from planting.	Suitably qualified ecologist or revegetation expert engaged to assess reasons for divergence of failure of endemic species establishment and recommend actions to ensure that the final vegetation community corresponds as closely as possible to the approved community. Additional actions will may include: Sowing of additional seed mix for targeted species or additional species endemic to the pre-disturbance community; Use of Tubestock, seed and mulch mix or other application techniques; Soil amelioration works such as addition of fertiliser; and Additional weed control activities (mechanical and/or chemical).	Ecologist Report

TARP Ref No	Rehabilitation Threat	Potential Adverse Outcome	Trigger level	Actions to be implemented	Evidence / Reference
5	Failure to establish soil/growing medium suitable for establishment of grassland or woodland vegetation community.	Insufficient soil available for rehabilitation.	Soil inventory prior to rehabilitation (particularly stockpile volumes) indicates a deficit of soil material.	Suitable sources of additional soil material to be identified, including the need for importation of soils from off-site. Investigation into measures that will may be implemented to ameliorate other materials to make them suitable for use as a growth medium.	MOP
		Inadequate soil thickness applied to final landform	Test pits following placement of soil material identifies placed soil thickness not consistent with final approved soil thickness	Additional soil material spread on the final landform.	MOP
		Soil not capable of sustaining vegetation community	Topsoil parameters not within the identified criteria (see Table 27).	Suitably qualified agronomist or soil scientist engaged to prepare a report including a range of recommendations to ensure that the identified criteria are achieved/soil is suitable for sustaining the vegetation community.	Soil analysis reports and interpretation by qualified specialist.

TARP Ref No	Rehabilitation Threat	Potential Adverse Outcome	Trigger level	Actions to be implemented	Evidence / Reference
6	Vegetation community is not self-sustaining	Final landform requires significantly more management than analogue sites.	Monitoring indicates that: Established vegetation is not replacing itself through successive generations; or Weed growth is increasing above a projected foliage cover of 10%	Suitably qualified ecologist or revegetation expert engaged to assess reasons for additional management requirements and recommend actions to align management required with that of the analogue sites. Additional actions (to be undertaken in targeted areas) will may include: Sowing of additional seed mix for targeted species or additional species endemic to the pre-disturbance community; Use of Tubestock, seed and mulch mix or other application techniques; Soil amelioration works such as addition of fertiliser; and Additional weed control activities (mechanical and/or chemical) and/or pest management as required (especially of rabbits).	Ecologist Report
7	Vegetation community not receiving adequate rainfall to establish/self-sustain	Failure of vegetation community	Rainfall below the lowest 10% of records for greater than 3 months	Water cart to be utilised over revegetated areas.	BOM website
8	Public access to open cut void possible	Damage to rehabilitation areas	Monitoring indicates evidence of trespassing and/or damage to rehabilitation areas.	Appropriate fencing, signage and bunding is to be repaired and maintained.	MOP

Table 33. Trigger Action Response Plan

Rehabilitation Threat	Trigger levels	Actions to be implemented	Evidence / Reference
Infrastructure that is to remain as part of the final land use is not safe and poses a hazard to the community.	Inspection indicates that not all hazards are isolated and secured.	Suitably qualified professional or utilities provider to be engaged to isolate/remove hazards and render safe.	Site decommissioning inspection report. Statement provided by suitably qualified engineer or similar. Photography. Survey by registered surveyor. Statement provided, utility service disconnection record / notification. Formal acceptance from landowner.
	Inspection reveals that access track repairs have not been undertaken or have been ineffective.	Track repairs to be undertaken.	
	Inspection reveals that the access tracks are not suitable for light vehicle access or pedestrians	Tracks to be rendered suitable for light vehicle access or pedestrians.	
	Inspection by engineer finds the structural integrity of remaining infrastructure is not safe and suitable for the intended final land use.	Suitably qualified engineer or similar to be engaged to assess remaining infrastructure and advise on rectifying structural integrity.	
	Infrastructure not removed from the site.	Infrastructure to be removed from the site.	
	Water management infrastructure not removed from the site.	Water management infrastructure to be removed from the site.	
Harm to rehabilitation areas due to presence of contaminants of concern.	Soil testing indicates that sites does not meet Health Investigation Level of the National Environment Protection (Assessment of Site Contamination) Measure (1999) applicable to land use type.	Engage a contamination professional to assess the site and advise on remediation measures.	Contamination Remediation Report prepared by Land Contamination Consultant. Site Contamination Audit Report Site Audit Statement prepared by EPA Accredited Auditor (where required).
Waste material visible on site surface.	Waste present on site.	Waste to be removed from the site.	Site decommissioning inspection report. Photography.
Harm to WSA due to presence of wildlife.	Bird deterrents not installed. Evidence of excessive levels of litter causing bird attraction.	Install bird deterrents. Waste to be removed from the site.	Photography. Site inspection reports/checklists.

Rehabilitation Threat	Trigger levels	Actions to be implemented	Evidence / Reference
Harm to rehabilitation works due to erosion impacts.	Slopes outside the final void are greater than 3 horizontal to 1 vertical Slope lengths exceed 80 metres before being broken by earth banks or similar.	Suitably qualified professional to assess the landform to determine if erosion impacts evident and advise on mitigation measures, if required. Mitigation may include reshaping the landform or installing additional erosion controls.	Managing Urban Stormwater 'Blue Book' DECC 2008. Survey data and plans. Photography. Assessment Report undertaken by a suitably qualified person i.e. CPESC.
	Overburden stockpiles identified as remaining on the site.	Overburden material is to be removed from the site or incorporated into the rehabilitation of the final landform.	
	Material stockpiles identified as remaining on the site.	Stockpile material is to be removed from the site or incorporated into the rehabilitation of the final landform.	
	Sediment dams not designed for 90th % 5-day storm event. Drains not designed for 1 in 10-year design storm. Spillways not designed for 1 in 100-year design storm.	A suitably qualified professional in sediment and erosion control will be engaged to prepare and assessment report and recommendations to be implemented.	
	Settlement or material loss results in pooling of water, changes in surface water flow directions and velocities and function of water management structures.	A suitably qualified professional in sediment and erosion control will be engaged to prepare and assessment report and recommendations to be implemented.	
	Rills/gullies greater than 10cm in depth. Rills/gullies are showing an increasing trend in size for a period of at least 6 months. Any evidence of mass movement/slumping. Any evidence of tunnel erosion.	A suitably qualified professional in sediment and erosion control will be engaged to prepare and assessment report and recommendations to be implemented. Mitigation may include reshaping the landform or installing additional erosion controls.	
	Ground coverage remains the same or is decreasing with regards to the final target of 70% over any 6-month period.	A suitably qualified professional in sediment and erosion control and/or ecologist will be engaged to prepare and assessment report and recommendations to be implemented. Mitigation may include reseeding exposed areas, applying mulch, applying soil binder, watering and fertilising etc	
	Evidence of erosion or bare patches in rehabilitated areas due to stock or feral animals.	Fencing to be inspected and repaired as required. Removal of stock from rehabilitation areas. Engagement of animal control professional to remove pests.	
	Evidence of rehabilitation areas impacted by wind erosion.	A suitably qualified professional in sediment and erosion control will be engaged to prepare and assessment report and recommendations to be implemented. Mitigation may include installing additional erosion controls.	

Rehabilitation Threat	Trigger levels	Actions to be implemented	Evidence / Reference
Limited biological resources available on site for rehabilitation.	On-site topsoil/growth medium deficit projected in achieving desired coverage (100mm) on the final landform is noted in annual reporting.	Investigate the use of overburden material, if sufficient volumes available, to replace the topsoil deficit. This may include soil analysis and application of ameliorants to manufacture suitable topsoil material. Investigate the importation of suitable topsoil material.	Survey data and plans. Photography. Soil Inventory reported in AR.
Domain landform is not safe, stable and fit for the purpose of the intended final land use.	High risk landforms (such as steep slopes, high walls) have not been constructed in accordance with geotechnical design.	Suitably qualified geotechnical engineer to assess the landform to determine if the landform is stable or requires modification other structural repairs are required.	Survey data and plans. Photography. Geotechnical reports
	Slopes required by the final landform are not obtained due to material deficits.	Suitably qualified geotechnical engineer to assess the landform to determine if the landform is stable or requires modification other structural repairs are required, including investigation of importation of VENM material to effect the final landform contours.	
Failure to establish soil/growing medium suitable for establishment of vegetation community.	Surface is noted to be compacted.	Surface to be ripped to promote surface water and air infiltration and reseeding undertaken if required.	Photography. Site inspection reports/checklists. Contractor invoices. Soil testing reports.
	Soil testing indicates soil not within recommended criteria as advised by Soil Specialist/Agronomist.	Ameliorants to be applied as advised by soil specialist/agronomist.	
	Ameliorants not applied or applied evenly or applied at below the specified rate.	Advice to be sought from soil specialist/agronomist to determine whether reapplication required or other methods to be employed to ensure the growth medium is suitable.	
	Average depth of topsoil less than 50mm. Bare patches evident.	Advice to be sought from soil specialist/agronomist to determine whether reapplication required or if the topsoil depth is suitable for target species. This may include evidence from rehabilitation trials.	

Rehabilitation Threat	Trigger levels	Actions to be implemented	Evidence / Reference
Vegetation community establishment unsuccessful.	Average loss of more than 20% of species within vegetation test quadrants. Ground coverage remains the same or is decreasing with regards to the final target of 70% over any 6-month period.	Advice to be sought from agronomist/ecologist to determine the causes of the vegetation losses and possible remediation measures. Remediation measures may include reseeding, application of mulch, application of fertiliser or other ameliorants, watering etc.	Reports on the estimates of ground coverage, vegetation size, survival rates and variety of species. Site inspection reports/checklists. Photography. Seed certificates and purchase records. Weather data Soil testing reports.
	No seed certification available.	Alternative seed supplier to be sought. If no other supplier available for target species, advice to be sought from agronomist/ecologist to determine suitability of the available seed or determine alternative species.	
	Failure of vegetation due to prolonged dry conditions.	Review weather data and long term outlooks for rainfall to determine if more frequent watering is required. Investigate installing/upgrading irrigation systems. If additional watering is not feasible, investigate alternative means of stabilising the soil i.e. binders until conditions improve. Reseed bare areas once dry conditions have been alleviated.	
	Soil testing indicates soil fertility is decreasing according to criteria as advised by Soil Specialist/Agronomist.	Advice to be sought from agronomist/ecologist to determine why fertility is decreasing and determine remediation measures.	
	Non-target species (weeds) represent greater than 10% of foliage cover.	Weed control contractor to be engaged to spray or mechanically remove weeds. Selective herbicides should be used where possible to protect target species.	
Decrease in downstream water quality.	Continued exceedance of trigger values, over a 6 month period, for water quality, as defined in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence.	Discharge to Oaky Creek is to cease until the water held on site is treated, if required, and found to be within the trigger values. Surface water quality monitoring results within Oaky Creek, upstream and downstream of the site to be reviewed to determine if there are any impacts and their significance. Source of the pollution to be investigated and remediated if the source of the pollution is on-site. This may include erosion and sediment controls in the case of elevated total suspended solids, spills and leaks of hydrocarbons to be investigated if detected etc. Management procedures to be reviewed and amended as required in accordance with the results of any investigations. Reports to be prepared and provided to EPA or DPIE as required in any consent or licence conditions.	Water Testing Reports ANZECC Guidelines. EPL

Rehabilitation Threat	Trigger levels	Actions to be implemented	Evidence / Reference
Decrease in groundwater quality and changes in flows	Continued exceedance of trigger values, over a 6 month period, for groundwater quality, as defined in the Soil and Water Management Plan (EMM 2021 and as updated from time to time) and or Environment Protection Licence.	Source of the pollution to be investigated and remediated if the source of the pollution is on-site. This may include spills and leaks of hydrocarbons to be investigated if detected etc. Changes in groundwater depth will be investigated to determine if related to rainfall/drought conditions or site activities. Management procedures to be reviewed and amended as required in accordance with the results of any investigations. Reports to be prepared and provided to EPA or DPIE as required in any consent or licence conditions.	Water Testing Reports ANZECC Guidelines. EPL
Harm to rehabilitation areas due to bushfire.	Excessive vegetation height during periods of high to extreme fire danger.	Fire breaks, where they exist, to be maintained by slashing. Reduce fuel loads in vegetated areas by slashing or grazing where vegetation is sufficiently established to support such activities.	Site inspection reports/checklists. Photography. Weather data
Harm to Riparian Zone.	Fencing/ barrier around riparian zone removed or damaged.	Fencing/ barrier to be repaired. Engage ecologist to assess any damage to riparian zone and implement any recommendations	Site inspection reports/checklists. Photography.

10 Review, Revision and Implementation

~~12 Review and Implementation of the Plan~~

10.1 REVIEW OF THE PLAN

The operations outlined within this document will be reviewed annually. Should activities differ significantly from those outlined, an amended or updated Plan will be submitted and tracked in accordance with ESG3 guidelines.

Prior to recommencing quarrying operations approved under Modification 5, or other timeframe agreed by the Planning Secretary, Luddenham Operations Pty Ltd will review and update the Site Rehabilitation Plan, Biodiversity Management Plan, and Final Land Use Plan in consultation with EPA, DITRDC and WSA, and to the satisfaction of the Planning Secretary.

The updated plan will be consistent with any related approvals that provide for filling the final void, while also providing contingency rehabilitation activities in the event that such approvals are not obtained. It will also include measures to minimise the short, medium and long term risks to the construction and operation of the Western Sydney Airport and other surrounding land users.

If necessary, to either improve the environmental performance of the development, cater for a modification or comply with a direction, this plan must be revised, to the satisfaction of the Planning Secretary and submitted to the Planning Secretary for approval within six weeks of the review.

10.2 IMPLEMENTATION

All strategies, plans and programs required under this consent as approved by the Planning Secretary will be implemented.

The person responsible for individual monitoring components of the objectives and closure criteria has been included in Table 27. Additional roles and responsibilities are given below.

Table 34. Roles and Responsibilities for Plan Implementation

Role	Responsibility
Mine Manager	Accountable for all operations, outcomes and performance criteria. Ensure that employees are competent through training and awareness programs.
Environmental Officer	Ensure that monitoring and review are implemented as given in *Section 7 and 10.* Review monitoring against trigger levels and implement action plans as required.
Site Contractor and all employees	Undertake operations according to the plan. Report any significant deviations immediately to the Mine Manager

Table 35. Triggers for Review of the Rehabilitation Management Plan

Triggers	Process	Timing	Responsibility	Implementation/ Records
Mining Regulation- Clause 11 of Schedule 8A The holder of a mining lease must amend the rehabilitation management plan for the mining lease as follows—				
(a) to substitute the proposed version of a rehabilitation outcome document with the version approved by the Secretary—within 30 days after the document is approved,	The approved rehabilitation outcome document i.e. Rehabilitation Objective Statement, Rehabilitation Completion Criteria Statement or the Final Landform and Rehabilitation Plan (spatial data) will replace any proposed (and unapproved) documents. The Rehabilitation Management Plan (RMP) will be reviewed and amended to ensure it is consistent with the approved rehabilitation outcome document.	Within 30 days after the document is approved.	Mine Manager/ Environmental Manager	The amended RMP will be include a record of document versions, dates amended and a brief summary of the amendments.
(b) as a consequence of an amendment made under clause 14 to a rehabilitation outcome document—within 30 days after the amendment is made,	The RMP will be reviewed and amended within 30 days if a rehabilitation outcome document is amended to ensure it is consistent with the approved rehabilitation outcome document.	Within 30 days after the amendment is made.	Mine Manager/ Environmental Manager	The amended RMP will be include a record of document versions, dates amended and a brief summary of the amendments.
(c) to reflect any changes to the risk control measures in the prepared plan that are identified in a rehabilitation risk assessment—as soon as practicable after the rehabilitation risk assessment is conducted,	The RMP will be reviewed and amended as soon as practicable if a rehabilitation risk assessment determines that risk control measures must be changed.	As soon as practicable	Mine Manager/ Environmental Manager	The amended RMP will be include a record of document versions, dates amended and a brief summary of the amendments.

Triggers	Process	Timing	Responsibility	Implementation/ Records
(d) whenever given a written direction to do so by the Secretary—in accordance with the direction.	The RMP will be reviewed and amended as soon as practicable if directed by the Secretary.	As soon as practicable	Mine Manager/ Environmental Manager	The amended RMP will be include a record of document versions, dates amended and a brief summary of the amendments.
Mining Regulation- Clause 13 of Schedule 8A- **Forward Program and Annual Reporting**	The RMP will be reviewed and amended as soon as practicable if the Annual Review identifies changes to the processes, risks, mining progress etc that are inconsistent with the current RMP.	As soon as practicable	Mine Manager/ Environmental Manager	The amended RMP will be include a record of document versions, dates amended and a brief summary of the amendments.
Modification to Development Consent DA No. 315-7-2003 Mod 5	The RMP will be reviewed and amended as soon as practicable after the approval of any modification to the development consent and be consistent with and requirements under the amended consent.	As soon as practicable	Mine Manager/ Environmental Manager	The amended RMP will be include a record of document versions, dates amended and a brief summary of the amendments.
Amendment to the Rehabilitation Management Plan	The amended RMP will be provided to staff and relevant contractors and acknowledgement of the changes from staff will be recorded.	As soon as practicable after document is amended.	Environmental Manager/ Site staff and contractors.	The amended RMP will be include a record of document versions, dates amended and a brief summary of the amendments. Records of staff training and inductions are to be updated to include the amended RMP.

11 Calculation of Security Deposit

Schedule 4 Condition 37 requires prior to the initial commencement of operations on site following the granting of the original development approval, the applicant was required to provide a rehabilitation bond to the Planning Secretary.

It is understood this bond was paid to the Planning Secretary by the former operator of the quarry prior to the commencement of original quarry operations in 2009. It is also noted that at the time, the quarry was not required to have a mining lease and therefore was not subject to a security bond under Mining Lease conditions.

As the quarry now has a mining lease, operation and rehabilitation of the quarry is now regulated by the Resources Regulator under the Mining Lease. Accordingly a Security Bond is required under the mining lease. The Rehabilitation Cost Estimate (RCE) was estimated in the Mine Lease Application and set at $468,000 on grant. It is reviewed with the submission of the ~~Mine Operation Plan~~ Forward Plan for approval and annually thereafter.

~~13.1 INFRASTRUCTURE~~

~~This domain consists of the Office and Weighbridge area, internal haul roads and the western stockpile area. The Access Road will remain in the final landform to provide site access. The Water Management Dam will be made safe and stable and the site office buildings will be removed.~~

~~There is sufficient top soil stored in the perimeter bunds to provide the growth medium required in this domain.~~

~~The security for this domain is therefore estimated to be $132,338.~~

~~13.2 TAILINGS AND REJECTS~~

~~There are no tailings or rejects on the site.~~

~~13.3 OVERBURDEN AND WASTE~~

~~This domain consists of the perimeter topsoil bundwalls to the north and west of the pit. The volume of material held in the bundwalls is approximately 29,000 cubic metres (12D modelling) and will be reused on site to provide growth medium over reshaped areas.~~

~~The security for this domain is therefore estimated to be zero.~~

~~13.4 ACTIVE MINE AND VOIDS~~

~~At its maximum extent during the MOP period, the void will be approximately 1,360,000 cubic metres in volume (from 12D modelling). The Conceptual Interim Final Landform is a water filled void.~~

~~There is estimated to be sufficient growth medium material in the topsoil bundwall to cover the outer void area not covered by water.~~

~~The security for this domain is therefore estimated to be $62,900.~~

~~13.5 MANAGEMENT OPERATIONS~~

~~These activities include the preparation of an unplanned closure plan, maintenance of non-disturbed lands , tender preparation, mobilisation and demobilisation of equipment and site security.~~

~~The security for this domain is therefore estimated to be $165,000.~~

~~**The total security for the site, including contingencies, is estimated to be $468,000.**~~

~~*Figure 9 RCE Domains*~~

12 References

Ref 1 DECC (2008) *Managing Urban Stormwater Soils and Construction V1*

Ref 2 DECC (2009) *Managing Urban Stormwater Soils and Construction V2E Mines and Quarries*

Ref 3 EMM (2020) *Luddenham Quarry Modification Report DA 315-7-2003 Mod 5*

Ref 4 EMM (2021) *Luddenham Quarry Air Quality Management Plan*

Ref 5 EMM (2021) *Luddenham Quarry Biodiversity Management Plan*

Ref 6 EMM (2021) *Luddenham Quarry Soil and Water Management Plan*

Ref 7 NSW Resource Regulator (2021) *Form and Way:: Rehabilitation Management Plan for Large Mines*

Ref 8 NSW Resource Regulator (2021) *Guideline: Rehabilitation Risk Assessment*

Ref 9 UBM Ecological Consultants Pty Ltd (2009) *Vegetation Management Plan for a Clay Shale Quarry, Adams Road Luddenham*

Appendix A
DA No. 315-7-2003 Mod 5
Available at
http://luddenhamquarry.com.au

Appendix B
Mine Lease Conditions

Instrument of Grant

Section 63 of the *Mining Act 1992*

I, **Jamie Tripodi, Executive Director Assessments and Systems,** as delegate of the Minister administering the *Mining Act 1992* for the State of New South Wales, pursuant to section 63 of the *Mining Act 1992*, have determined to grant a Mining Lease in satisfaction of **Mining Lease Application 592 (Act 1992)**, as described in Schedule 1, to **Luddenham Operations Pty. Limited, ACN 643 874 211**, subject to the conditions:

1. prescribed in the *Mining Act 1992* and the Mining Regulation 2016*;* and
2. set out in Schedule 2.

Jamie Tripodi
Executive Director Assessments and Systems
Regional NSW – Mining, Exploration and Geoscience
As delegate for the Minister administering the *Mining Act 1992*
Delegation dated: 14 May 2018

Dated this 14th day of October 2021

SCHEDULE 1

Description of Lease

Mining lease number:	**1816 (Act 1992)**
Grant date:	**14 October 2021**
Term:	**Twenty-one (21) years**
Term ending (expiry date):	**14 October 2042**
Lease Holder(s)	**Luddenham Operations Pty. Limited** **ACN 643 874 211**
Area:	**11.9 hectares**
Surface Exception:	**Nil**
Depth Restriction:	**Nil**
Mineral(s):	**Clay / Shale** **Structural Clay**
Method:	**Quarrying**
Land:	The lease area includes all land described in the attached lease plan titled **M27570** and approved on **21 September 2021**.

ADAMS ROAD

'X' PM 25501 FD

PM 43336 FD

'Y' PM 43337 FD

62°35'28" - 343.93 (MGA GRND)
62°35'44" - 343.957 (SURVEY)

50°09'14.8" - 406.308 (MGA GRND)
50°09'40" - 406.396 (SURVEY)

235°51'31" - 745.861 (MGA GRND)
235°51'31" - 745.97 (SURVEY)

52°58'45"
13.325

310°
22'
138.145
310°
21'
185.58
30"
30"

281
DP 571171

141°07'
45.81
10"
106°
43'
276.64 (BANK OF CREEK)
10"

MGA

40"
24'
300.085
8°

1
DP 623799

3
DP 623799

CONNECTIONS

LINE	BEARING	DISTANCE
PM 25501-CNR 100	158°30'50"	562.024
PM 43336-CNR 101	152°13'20"	364.645
PM 43336-CNR 114	168°26'40"	429.521
PM 43337-CNR 115	130°58'10"	494.388
PM 43337-CNR 116	115°42'20"	899.555

101

(97°
01'
(343.85 BANK OF CREEK)
15")

100

278°36'
24.76

(CHORD: 40° 31' - 129.155)
(ARC 131.51 RAD: 200)

114

36' - 199.675
(165.54)
8°

2
DP 623799

ML4
LEASE AREA: 11.9 HA (APPROXIMATE)

2
DP 1260971

(DP623799)
CREEK
CREEK
OF
OAKY
BANK

115

278°
442.195 (BANK OF CREEK)
36'

116

COORDINATE SCHEDULE						
MARK	MGA CO-ORDINATES		CLASS	PU	ORIGIN	STATE
	EASTING	NORTHING				
PM 25501	289 033.622	6 249 985.591	B	0.02	SCIMS	FOUND
PM 43336	288 728.258	6 249 827.245	B	0.02	SCIMS	FOUND
PM 43337	288 416.221	6 249 566.928	B	-	SCIMS	FOUND
DATE OF SCIMS COORDINATES: 13-07-2021 MGA ZONE: 56 MGA DATUM: GDA2020						
COMBINED SCALE FACTOR 1.000137						

NOTES:

1. THE MINING LEASE BOUNDARY IS INTENDED TO COINCIDE WITH THE EXISTING CADASTRAL BOUNDARIES THAT COME LOT 1 IN DP 623799

PARISH OF KERTNE
COUNTY OF WINDEYER

PLAN OF PORTION ML 4

PARISH: KERTNE

COUNTY: WINDEYER

MAP SHEET No.9030-3-N PENRITH & 9030-3-S WARRAGAMBA

REDUCTION RATIO 1: 1250

MINING LEASE APPLICATION No.M592 (ACT 1992)

MINING DIVISION: SYDNEY

APPLICANT: LUDDENHAM OPERATIONS PTY LTD

APPLICATION DATE: 21-AUG-2020

MINING LEASE No.1816 (ACT 1992)

STATUS:

METHOD: QUARRYING

SURFACE EXCEPTION / DEPTH RESTRICTION

☐ EMBRACES THE SURFACE AND SOIL BELOW THEREOF TO AN UNLIMITED DEPTH

NOTES:

Azimuth:
AS APPROPRIATE

Plans used in the course of this survey/compilation
.....
.....

Survey declared on this plan for lines
.....

I HUY DUC XUAN THAI
of RGM PROPERTY SURVEYS PTY LTD
a surveyor registered under the Surveying and Spatial Information Act 2002, hereby certify that the survey /compilation represented in this plan is accurate and has been completed in accordance with the Surveying and Spatial Information Regulation 2017 and the **Surveyor General's Direction for Mining Surveys and** was completed on .....15-07-2021..

Signature : .....

BOSSI Identification No : .....8258.....

FORM 11

Survey Calcs : .....
Plan Investigated : B.BHATIA. 20/9/21
Plan Approved : 21/9/21
Paper No : TMS-APP217.... R00033426 D006295500

M 27570

SCHEDULE 2

Mining Lease Conditions

(Version as at July 2021)

Definitions

Words used in this mining lease have the same meaning as defined in the *Mining Act 1992* except where otherwise defined below:

Term	Definition
Act	means the *Mining Act 1992.*
Landholder	for the purposes of these conditions: • does not include a secondary landholder • includes, in the case of exempted areas, the controlling body for the exempted area.
Minister	means the Minister administering the Act.

Note:

1. The rights and duties of the Lease Holder(s) are those prescribed by the *Mining Act 1992* and the Mining Regulation 2016, subject to the terms and conditions of this Mining Lease.
2. This Mining Lease does not override any obligation on the Lease Holder(s) to comply with the requirements of other legislation and regulatory instruments which may apply (including all relevant development approvals) unless specifically provided in the *Mining Act 1992* or other legislation or regulatory instruments.

MINING LEASE CONDITIONS

Prescribed standard conditions

NOTE TO HOLDERS: The prescribed standard conditions in the Mining Regulation 2016, Schedule 8A, Part 2 apply in addition to the conditions in this Schedule 2 (but have not been replicated in this Lease). The conditions imposed by the Mining Regulation 2016 prevail to the extent of any inconsistency with the conditions in this Schedule 2.

Standard conditions

1. Notice to Landholders

(a) Within 90 days from the date of grant/renewal of this mining lease, the lease holder must serve on each landholder a notice in writing to notify that this mining lease has been granted/renewed and whether the lease includes the surface. A plan identifying each landholder and individual land parcel subject to the lease area, and a description of the lease area must accompany the notice.

(b) If there are ten or more landholders, the lease holder may serve the notice by publication in a newspaper circulating in the region where the lease area is situated. The notice must indicate that this mining lease has been granted/renewed; state whether the lease includes the surface and must contain a plan and description of the lease area. If a notice is made under condition 1(b), compliance with condition 1(a) is not required.

2. Security

The lease holder is required to provide and maintain a security deposit to secure funding for the fulfilment of obligations under the mining lease, including obligations under the mining lease that may arise in the future.

The amount of the security deposit to be provided has been assessed by the Minister at **$468,000**.

3. Cooperation Agreement

The lease holder must make every reasonable attempt, and be able to demonstrate its attempts, to enter into a cooperation agreement with the holder(s) of any overlapping title(s). The cooperation agreement should address but not be limited to issues such as:

- access arrangements
- operational interaction procedures
- dispute resolution
- information exchange
- well location

- timing of drilling
- potential resource extraction conflicts; and
- rehabilitation issues.

4. Assessable Prospecting Operations

(a) The lease holder must not carry out any assessable prospecting operation on land over which this lease has been granted unless:

(i) it is carried out in accordance with any necessary development consent; or

(ii) if development consent is not required, the prior written approval of the Minister has been obtained.

(b) The lease holder must comply with the approval granted to the holder.

(c) The Minister may require the lease holder to provide such information as required to assist the Minister consider an application for approval.

(d) An approval granted under this condition may be granted subject to terms.

Exploration Reporting

Note: *Exploration Reports (Geological and Geophysical)*

The lease holder must lodge reports to the satisfaction of the Secretary in accordance with section 163C of the Mining Act 1992 and in accordance with clauses 59, 60 and 61 of the Mining Regulation 2016.

Reports must be prepared in accordance with Exploration Reporting: A guide for reporting on exploration and prospecting in New South Wales.

Special conditions

Nil

Note: The standard conditions apply to all mining leases. The Department reserves the right to impose special conditions, based on individual circumstances, where appropriate.

Appendix C
EPA Licence
Available at http://luddenhamquarry.com.au

Appendix D
Biodiversity Management Plan
Available at http://luddenhamquarry.com.au

Appendix E
Vegetation Management Plan
Available at http://luddenhamquarry.com.au

Appendix F
Soil and Water Management Plan
Available at http://luddenhamquarry.com.au

Appendix G
Air Quality Management Plan
Available at http://luddenhamquarry.com.au

Appendix H
Blue Book Calculations

1. Erosion Hazard and Sediment Basins

Site Name: Luddenham Quarry

Site Location: Luddenham

Precinct/Stage:

Other Details:

Site area	Sub-catchment or Name of Structure						Notes
	Out pit	In Pit	Tot Dis				
Total catchment area (ha)	6.4	1.9	10				in pit water not included in area
Disturbed catchment area (ha)	6.4	1.9	10				for out of and in pit

Soil analysis (enter sediment type if known, or laboratory particle size data)

Sediment Type (C, F or D) if known:	D	D	D				From Appendix C (if known)
% sand (fraction 0.02 to 2.00 mm)							Enter the percentage of each soil fraction. E.g. enter 10 for 10%
% silt (fraction 0.002 to 0.02 mm)							
% clay (fraction finer than 0.002 mm)							
Dispersion percentage							E.g. enter 10 for dispersion of 10%
% of whole soil dispersible							See Section 6.3.3(e). Auto-calculated
Soil Texture Group	D	D	D				Automatic calculation from above

Rainfall data

Design rainfall depth (no of days)	5	5	5				See Section 6.3.4 and, particularly, Table 6.3 on pages 6-24 and 6-25.
Design rainfall depth (percentile)	90	90	90				
x-day, y-percentile rainfall event (mm)	48.8	48.8	48.8				
Rainfall R-factor (if known)							Only need to enter one or the other here
IFD: 2-year, 6-hour storm (if known)	7.15	7.15	7.15				

RUSLE Factors

Rainfall erosivity (*R* -factor)	1300	1300	1300				Auto-filled from above
Soil erodibility (*K* -factor)	0.038	0.038	0.038				RUSLE LS factor calculated for a high rill/interrill ratio.
Slope length (m)	150	25	170				
Slope gradient (%)	7	60	7				
Length/gradient (*LS* -factor)	2.61	7.93	2.83				
Erosion control practice (*P* -factor)	1.3	1.3	1.3	1.3	1.3	1.3	
Ground cover (*C* -factor)	1	1	1	1	1	1	

Sediment Basin Design Criteria (for Type D/F basins only. Leave blank for Type C basins)

Storage (soil) zone design (no of months)	2	2	2	2	2	2	Minimum is generally 2 months
Cv (Volumetric runoff coefficient)	0.69	0.69	0.69				See Table F2, page F-4 in Appendix F

Calculations and Type D/F Sediment Basin Volumes

Soil loss (t/ha/yr)	168	509	182				
Soil Loss Class	2	5	2				See Table 4.2, page 4-13
Soil loss (m^3/ha/yr)	129	392	140				Conversion to cubic metres
Sediment basin storage (soil) volume (m^3)	138	124	233				See Sections 6.3.4(i) for calculations
Sediment basin settling (water) volume (m^3)	2155	640	3367				See Sections 6.3.4(i) for calculations
Sediment basin total volume (m^3)	2293	764	3600				

NB for sizing of Type C (coarse) sediment basins, see Worksheet 3 (if required).

MATERIALS

ROCK: 150 TO 300mm NOMINAL DIAMETER, HARD, EROSION RESISTANT ROCK. SMALLER ROCK MAY BE USED IF SUITABLE LARGE ROCK IS NOT AVAILABLE.

SANDBAGS: GEOTEXTILE BAGS (WOVEN SYNTHETIC, OR NON-WOVEN BIODEGRADABLE) FILLED WITH CLEAN COARSE SAND, CLEAN AGGREGATE, STRAW OR COMPOST.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. PRIOR TO PLACEMENT OF THE CHECK DAMS, ENSURE THE TYPE AND SIZE OF EACH CHECK DAMS WILL NOT CAUSE A SAFETY HAZARD OR CAUSE WATER TO SPILL OUT OF THE DRAIN.

3. LOCATE THE FIRST CHECK DAM AT THE DOWNSTREAM END OF THE SECTION OF CHANNEL BEING PROTECTED. LOCATE EACH SUCCESSIVE CHECK DAM SUCH THAT THE CREST OF THE IMMEDIATE DOWNSTREAM DAM IS LEVEL WITH THE TOE OF THE CHECK DAM BEING INSTALLED.

4. ENSURE THE CHANNEL SLOPE IS NO STEEPER THAN 10:1 (H:V). OTHERWISE CONSIDER THE USE OF A SUITABLE CHANNEL LINER INSTEAD OF THE CHECK DAMS.

5. CONSTRUCT THE CHECK DAM TO THE DIMENSIONS AND PROFILE SHOWN WITHIN THE APPROVED PLAN.

6. WHERE SPECIFIED, THE CHECK DAMS SHALL BE CONSTRUCTED ON A SHEET OF GEOTEXTILE FABRIC USED AS A DOWNSTREAM SPLASH PAD.

7. EACH CHECK DAM SHALL BE EXTENDED UP THE CHANNEL BANK (WHERE PRACTICABLE) TO AN ELEVATION AT LEAST 150mm ABOVE THE CREST LEVEL OF THE DAM.

MAINTENANCE

1. INSPECT EACH CHECK DAM AND THE DRAINAGE CHANNEL AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. CORRECT ALL DAMAGE IMMEDIATELY. IF SIGNIFICANT EROSION OCCURS BETWEEN ANY OF THE CHECK DAMS, THEN CHECK THE SPACING OF DAMS AND WHERE NECESSARY INSTALL INTERMEDIATE CHECK DAMS OR A SUITABLE CHANNEL LINER.

3. CHECK FOR DISPLACEMENT OF THE CHECK DAMS

4. CHECK FOR SOIL SCOUR AROUND THE ENDS OF EACH CHECK DAM. IF SUCH EROSION IS OCCURRING, CONSIDER EXTENDING THE WIDTH OF THE CHECK DAM TO AVOID SUCH PROBLEMS.

5. IF SEVERE SOIL EROSION OCCURS EITHER UNDER OR AROUND THE CHECK DAMS, THEN SEEK EXPERT ADVICE ON AN ALTERNATIVE TREATMENT MEASURE.

6. REMOVE ANY SEDIMENT ACCUMULATED BY THE CHECK DAMS, UNLESS IT IS INTENDED THAT THIS SEDIMENT WILL REMAIN WITHIN THE CHANNEL.

7. DISPOSE OF COLLECTED SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN CONSTRUCTION WORK WITHIN THE DRAINAGE AREA ABOVE THE CHECK DAMS HAS BEEN COMPLETED, AND THE DISTURBED AREAS AND THE DRAINAGE CHANNEL ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, ALL TEMPORARY CHECK DAMS MUST BE REMOVED.

2. REMOVE THE CHECK DAMS AND ASSOCIATED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

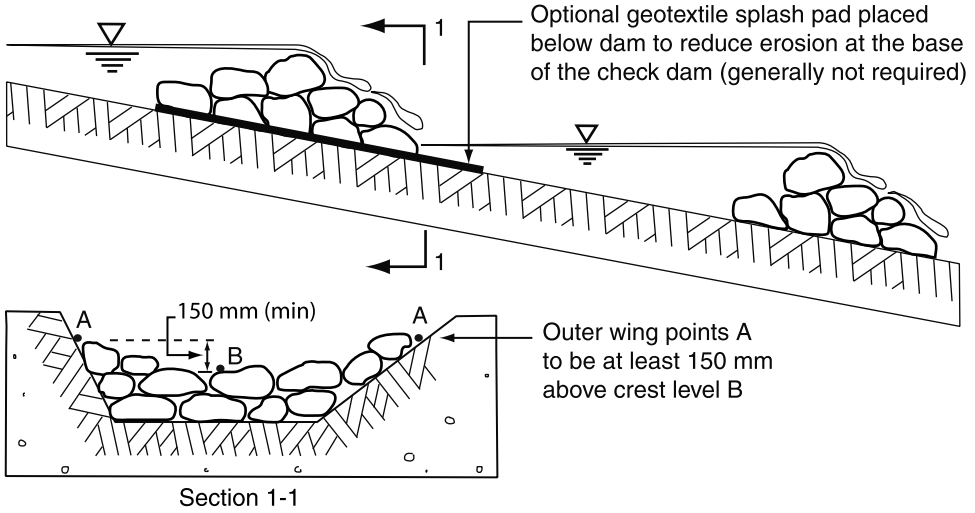


Figure 1 - Layout and profile of check dams (rock check dams shown)

Drawn:	Date:		
GMW	Dec-09	Check Dams	RCD-01

MATERIALS

FABRIC: POLYPROPYLENE, POLYAMIDE, NYLON, POLYESTER, OR POLYETHYLENE WOVEN OR NON-WOVEN FABRIC, AT LEAST 700mm IN WIDTH AND A MINIMUM UNIT WEIGHT OF 140g/m^2. ALL FABRICS TO CONTAIN ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE (ULTRAVIOLET STABILITY EXCEEDING 70%).

FABRIC REINFORCEMENT: WIRE OR STEEL MESH MINIMUM 14-GAUGE WITH A MAXIMUM MESH SPACING OF 200mm.

SUPPORT POSTS/STAKES: 1500mm^2 (MIN) HARDWOOD, 2500mm^2 (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND REQUIRED TYPE OF FABRIC (IF SPECIFIED). IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, FABRIC TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. TO THE MAXIMUM DEGREE PRACTICAL, AND WHERE THE PLANS ALLOW, ENSURE THE FENCE IS LOCATED:
(i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;
(ii) ALONG A LINE OF CONSTANT ELEVATION WHEREVER PRACTICAL;
(iii) AT LEAST 2m FROM THE TOE OF ANY FILLING OPERATIONS THAT MAY RESULT IN SHIFTING SOIL/FILL DAMAGING THE FENCE.

3. INSTALL RETURNS WITHIN THE FENCE AT MAXIMUM 20m INTERVALS IF THE FENCE IS INSTALLED ALONG THE CONTOUR, OR 5 TO 10m MAXIMUM SPACING (DEPENDING ON SLOPE) IF THE FENCE IS INSTALLED AT AN ANGLE TO THE CONTOUR. THE 'RETURNS' SHALL CONSIST OF EITHER:
(i) V-SHAPED SECTION EXTENDING AT LEAST 1.5m UP THE SLOPE; OR
(ii) SANDBAG OR ROCK/AGGREGATE CHECK DAM A MINIMUM 1/3 AND MAXIMUM 1/2 FENCE HEIGHT, AND EXTENDING AT LEAST 1.5m UP THE SLOPE.

4. ENSURE THE EXTREME ENDS OF THE FENCE ARE TURNED UP THE SLOPE AT LEAST 1.5m, OR AS NECESSARY, TO MINIMISE WATER BYPASSING AROUND THE FENCE.

5. ENSURE THE SEDIMENT FENCE IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE FENCE, AND THE UNDESIRABLE DISCHARGE OF WATER AROUND THE ENDS OF THE FENCE.

6. IF THE SEDIMENT FENCE IS TO BE INSTALLED ALONG THE EDGE OF EXISTING TREES, ENSURE CARE IS TAKEN TO PROTECT THE TREES AND THEIR ROOT SYSTEMS DURING INSTALLATION OF THE FENCE. DO NOT ATTACH THE FABRIC TO THE TREES.

7. UNLESS DIRECTED BY THE SITE SUPERVISOR OR THE APPROVED PLANS, EXCAVATE A 200mm WIDE BY 200mm DEEP TRENCH ALONG THE PROPOSED FENCE LINE, PLACING THE EXCAVATED MATERIAL ON THE UP-SLOPE SIDE OF THE TRENCH.

8. ALONG THE LOWER SIDE OF THE TRENCH, APPROPRIATELY SECURE THE STAKES INTO THE GROUND SPACED NO GREATER THAN 3m IF SUPPORTED BY A TOP SUPPORT WIRE OR WEIR MESH BACKING, OTHERWISE NO GREATER THAN 2m.

9. IF SPECIFIED, SECURELY ATTACH THE SUPPORT WIRE OR MESH TO THE UP-SLOPE SIDE OF THE STAKES WITH THE MESH EXTENDING AT LEAST 200mm INTO THE EXCAVATED TRENCH. ENSURE THE MESH AND FABRIC IS ATTACHED TO THE UP-SLOPE SIDE OF THE STAKES EVEN WHEN DIRECTING A FENCE AROUND A CORNER OR SHARP CHANGE OF DIRECTION.

10. WHEREVER POSSIBLE, CONSTRUCT THE SEDIMENT FENCE FROM A CONTINUOUS ROLL OF FABRIC. TO JOIN FABRIC EITHER:
(i) ATTACH EACH END TO TWO OVERLAPPING STAKES WITH THE FABRIC FOLDING AROUND THE ASSOCIATED STAKE ONE TURN, AND WITH THE TWO STAKES TIED TOGETHER WITH WIRE; OR
(ii) OVERLAP THE FABRIC TO THE NEXT ADJACENT SUPPORT POST.

11. SECURELY ATTACH THE FABRIC TO THE SUPPORT POSTS USING 25 X 12.5mm STAPLES, OR TIE WIRE AT MAXIMUM 150mm SPACING.

12. SECURELY ATTACH THE FABRIC TO THE SUPPORT WIRE/MESH (IF ANY) AT A MAXIMUM SPACING OF 1m.

13. ENSURE THE COMPLETED SEDIMENT FENCE IS AT LEAST 450mm, BUT NOT MORE THAN 700mm HIGH. IF A SPILL-THOUGH WEIR IS INSTALLED, ENSURE THE CREST OF THE WEIR IS AT LEAST 300mm ABOVE GROUND LEVEL.

14. BACKFILL THE TRENCH AND TAMP THE FILL TO FIRMLY ANCHOR THE BOTTOM OF THE FABRIC AND MESH TO PREVENT WATER FROM FLOWING UNDER THE FENCE.

ADDITIONAL REQUIREMENTS FOR THE INSTALLATION OF A SPILL-THROUGH WEIR

1. LOCATE THE SPILL-THROUGH WEIR SUCH THAT THE WEIR CREST WILL BE LOWER THAN THE GROUND LEVEL AT EACH END OF THE FENCE.

2. ENSURE THE CREST OF THE SPILL-THROUGH WEIR IS AT LEAST 300mm THE GROUND ELEVATION.

3. SECURELY TIE A HORIZONTAL CROSS MEMBER (WEIR) TO THE SUPPORT POSTS/ STAKES EACH SIDE OF THE WEIR. CUT THE FABRIC DOWN THE SIDE OF EACH POST AND FOLD THE FABRIC OVER THE CROSS MEMBER AND APPROPRIATELY SECURE THE FABRIC.

4. INSTALL A SUITABLE SPLASH PAD AND/OR CHUTE IMMEDIATELY DOWN-SLOPE OF THE SPILL-THROUGH WEIR TO CONTROL SOIL EROSION AND APPROPRIATELY DISCHARGE THE CONCENTRATED FLOW PASSING OVER THE WEIR.

MAINTENANCE

1. INSPECT THE SEDIMENT FENCE AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR ANY TORN SECTIONS WITH A CONTINUOUS PIECE OF FABRIC FROM POST TO POST.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. IF THE FENCE IS SAGGING BETWEEN STAKES, INSTALL ADDITIONAL SUPPORT POSTS.

5. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 1/3 THE HEIGHT OF THE FENCE.

6. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

7. REPLACE THE FABRIC IF THE SERVICE LIFE OF THE EXISTING FABRIC EXCEEDS 6-MONTHS.

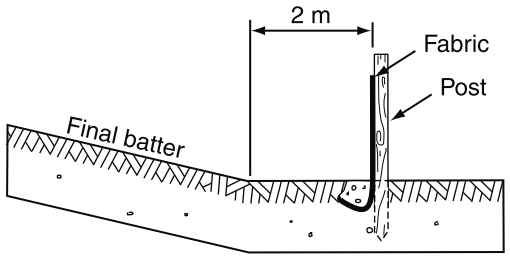
REMOVAL

1. WHEN DISTURBED AREAS UP-SLOPE OF THE SEDIMENT FENCE ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE FENCE MUST BE REMOVED.

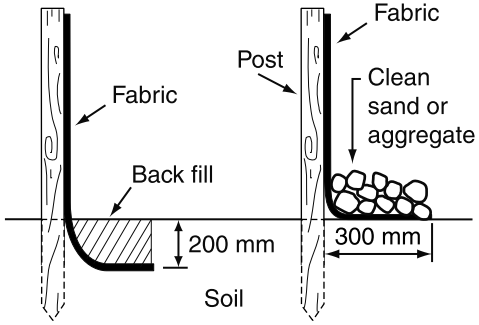
2. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.

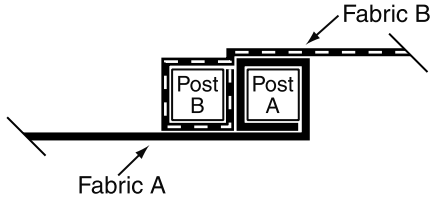
Drawn:	Date:		
GMW	May-10	Sediment Fence	ESC-05



(a) Location of fence relative to base of slope

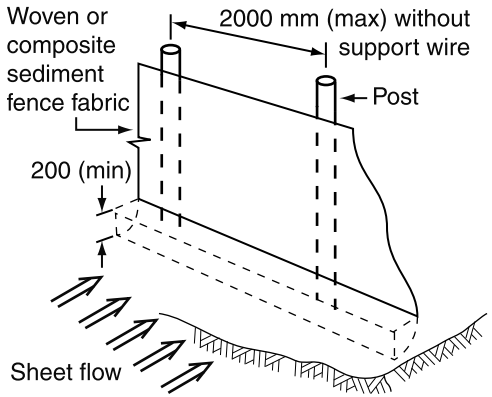


(b) Anchoring base of fabric

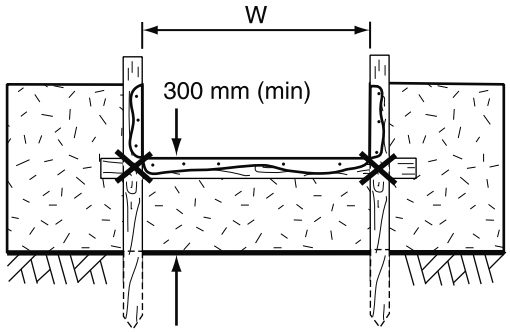


Fabric to fold around each stake one full turn.
Stake B to be drive tightly against Stake A.
The tops of both stakes to be secured with wire.

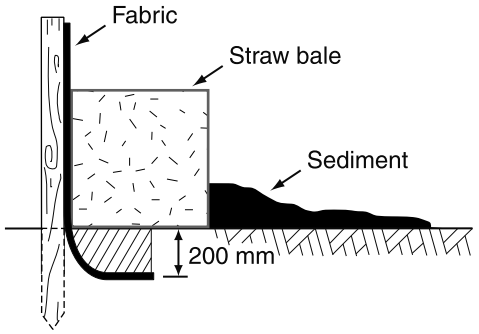
(c) Joining fabric - Method 1



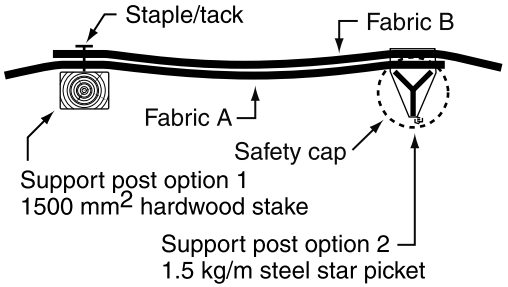
(d) Installation without backing support



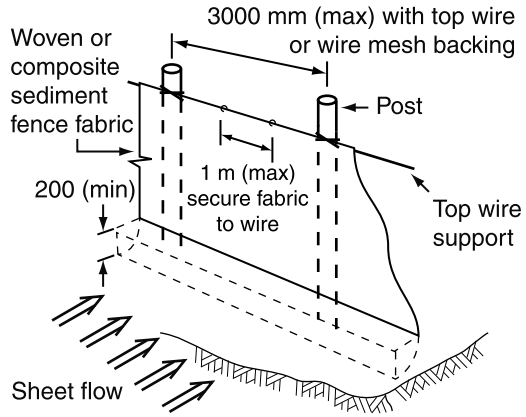
(e) Spill-through weir



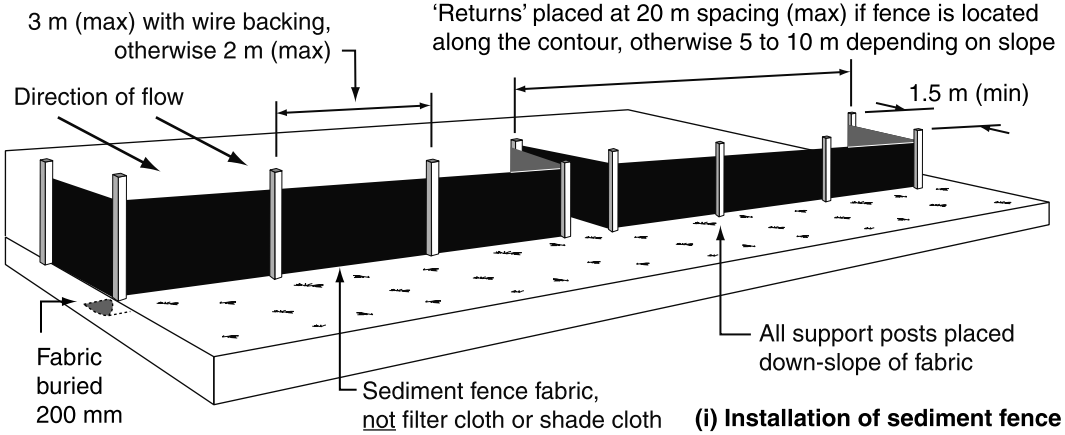
(f) Placement of up-slope straw bale



(g) Joining fabric - Method 2



(h) Installation with top wire support



(i) Installation of sediment fence

Notes:

1. Sediment fence to be installed along a line of constant ground elevation wherever practical.
2. Both end of the sediment fence to extend up the slope at least 1m.
3. Support post to be spaced a maximum 2m unless the fence is supported by a top wire or wire mesh backing, in which case 3m maximum spacing.
4. Fence 'returns' shall be installed at maximum 20m spacing if fence is installed along the contour, otherwise 5 to 10m maximum spacing.
5. Minimum 4 staples or tie wires per stake.

Drawn:	Date:		
GMW	Dec-09	Sediment Fence	ESC-04

CONSTRUCTION

1. THE SPILLWAY MUST BE EXCAVATED AS SHOWN ON THE PLANS, AND THE EXCAVATED MATERIAL IF CLASSIFIED AS SUITABLE, MUST BE USED IN THE EMBANKMENT, AND IF NOT SUITABLE IT MUST BE DISPOSED OF INTO SPOIL HEAPS.

2. ENSURE EXCAVATED DIMENSIONS ALLOW ADEQUATE BOXING-OUT SUCH THAT THE SPECIFIED ELEVATIONS, GRADES, CHUTE WIDTH, AND ENTRANCE AND EXIT SLOPES FOR THE EMERGENCY SPILLWAY WILL BE ACHIEVED AFTER PLACEMENT OF THE ROCK OR OTHER SCOUR PROTECTION MEASURES AS SPECIFIED IN THE PLANS.

3. PLACE SPECIFIED SCOUR PROTECTION MEASURES ON THE EMERGENCY SPILLWAY. ENSURE THE FINISHED GRADE BLENDS WITH THE SURROUNDING AREA TO ALLOW A SMOOTH FLOW TRANSITION FROM SPILLWAY TO DOWNSTREAM CHANNEL.

4. IF A SYNTHETIC FILTER FABRIC UNDERLAY IS SPECIFIED, PLACE THE FILTER FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN 1 SHEET OF FILTER FABRIC IS REQUIRED, OVERLAP THE EDGES BY AT LEAST 300mm AND PLACE ANCHOR PINS AT MINIMUM 1m SPACING ALONG THE OVERLAP. BURY THE UPSTREAM END OF THE FABRIC A MINIMUM 300mm BELOW GROUND AND WHERE NECESSARY, BURY THE LOWER END OF THE FABRIC OR OVERLAP A MINIMUM 300mm OVER THE NEXT DOWNSTREAM SECTION AS REQUIRED. ENSURE THE FILTER FABRIC EXTENDS AT LEAST 1000mm UPSTREAM OF THE SPILLWAY CREST.

5. TAKE CARE NOT TO DAMAGE THE FABRIC DURING OR AFTER PLACEMENT. IF DAMAGE OCCURS, REMOVE THE ROCK AND REPAIR THE SHEET BY ADDING ANOTHER LAYER OF FABRIC WITH A MINIMUM OVERLAP OF 300mm AROUND THE DAMAGED AREA. IF EXTENSIVE DAMAGE IS SUSPECTED, REMOVE AND REPLACE THE ENTIRE SHEET.

6. WHERE LARGE ROCK IS USED, OR MACHINE PLACEMENT IS DIFFICULT, A MINIMUM 100mm LAYER OF FINE GRAVEL, AGGREGATE, OR SAND MAY BE NEEDED TO PROTECT THE FABRIC.

7. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER FABRIC. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE DESIRED DISTRIBUTION OF ROCK THROUGHOUT THE MASS MAY BE OBTAINED BY SELECTIVE LOADING AT THE QUARRY AND CONTROLLED DUMPING DURING FINAL PLACEMENT.

8. THE FINISHED SLOPE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.

9. ENSURE THAT THE FINAL ARRANGEMENT OF THE SPILLWAY CREST WILL NOT PROMOTE EXCESSIVE FLOW THROUGH THE ROCK SUCH THAT THE WATER CAN BE RETAINED WITHIN THE SETTLING BASIN AN ELEVATION NO LESS THAN 50mm ABOVE OR BELOW THE NOMINATED SPILLWAY CREST ELEVATION.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT THE SPILLWAY PRIOR TO FORECAST RAINFALL, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORM EVENTS, OR OTHERWISE ON A WEEKLY BASIS. MAKE REPAIRS AS NECESSARY.

2. CHECK FOR MOVEMENT OF, OR DAMAGE TO, THE SPILLWAY'S LINING, INCLUDING SURFACE CRACKING.

3. CHECK FOR SOIL SCOUR ADJACENT THE SPILLWAY. INVESTIGATE THE CAUSE OF ANY SCOUR, AND REPAIR AS NECESSARY.

4. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SPILLWAY TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED.

REMOVAL

1. TEMPORARY SPILLWAYS SHOULD BE REMOVED WHEN AN ALTERNATIVE, STABLE, DRAINAGE SYSTEM IS AVAILABLE.

2. REMOVE ALL MATERIALS AND DEPOSITED SEDIMENT, AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA IN PREPARATION FOR STABILISATION, THEN STABILISE THE AREA AS SPECIFIED IN THE APPROVED PLAN.

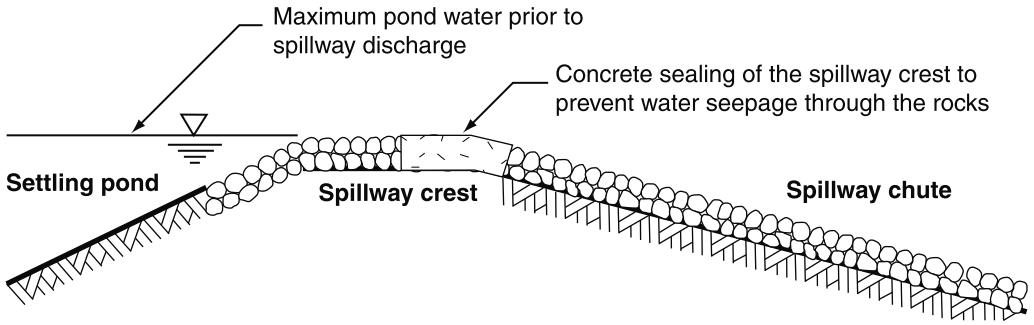


Figure 1 - Example of seepage control on the spillway crest

Drawn:	Date:		
GMW	Dec-09	Emergency Spillways	ES-1

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) AND ANALYSIS HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED PRIOR TO PLANTING.

3. CLEAR THE LOCATION FOR THE CHANNEL, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND CONSTRUCTION EQUIPMENT.

4. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD ANY ASSOCIATED EMBANKMENTS.

5. EXCAVATE THE DIVERSION CHANNEL TO THE SPECIFIED SHAPE, ELEVATION AND GRADIENT. THE SIDES OF THE CHANNEL SHOULD BE NO STEEPER THAN A 2:1 (H:V) IF CONSTRUCTED IN EARTH, UNLESS SPECIFICALLY DIRECTED WITHIN THE APPROVED PLANS.

6. STABILISE THE CHANNEL AND BANKS IMMEDIATELY UNLESS IT WILL OPERATE FOR LESS THAN 30 DAYS. IN EITHER CASE, TEMPORARY EROSION PROTECTION (MATTING, ROCK, ETC.) WILL BE REQUIRED AS SPECIFIED WITHIN THE APPROVED PLANS OR AS DIRECTED.

7. ENSURE THE CHANNEL DISCHARGES TO A STABLE AREA.

ADDITIONAL REQUIREMENTS FOR TURF PLACEMENT:

1. TURF SHOULD BE USED WITHIN 12 HOURS OF DELIVERY, OTHERWISE ENSURE THE TURF IS STORED IN CONDITIONS APPROPRIATE FOR THE WEATHER CONDITIONS (e.g. A SHADED AREA).

2. MOISTENING THE TURF AFTER IT IS UNROLLED WILL HELP MAINTAIN ITS VIABILITY.

3. TURF SHOULD BE LAID ON A MINIMUM 75mm BED OF ADEQUATELY FERTILISED TOPSOIL. RAKE THE SOIL SURFACE TO BREAK THE CRUST JUST BEFORE LAYING THE TURF.

4. DURING THE WARMER MONTHS, LIGHTLY IRRIGATE THE SOIL IMMEDIATELY BEFORE LAYING THE TURF.

5. ENSURE THE TURF IS NOT LAID ON GRAVEL, HEAVILY COMPACTED SOILS, OR SOILS THAT HAVE BEEN RECENTLY TREATED WITH HERBICIDES.

6. ENSURE THE TURF EXTENDS UP THE SIDES OF THE DRAIN AT LEAST 100mm ABOVE THE ELEVATION OF THE CHANNEL INVERT, OR AT LEAST TO A SUFFICIENT ELEVATION TO FULLY CONTAIN EXPECTED CHANNEL FLOW.

7. ON CHANNEL GRADIENTS OF 3:1(H:V) OR STEEPER, OR IN SITUATIONS WHERE HIGH FLOW VELOCITIES (i.e. VELOCITY >1.5m/s) ARE LIKELY WITHIN THE FIRST TWO WEEK FOLLOWING PLACEMENT, SECURE THE INDIVIDUAL TURF STRIPS WITH WOODEN OR PLASTIC PEGS.

8. ENSURE THAT INTIMATE CONTACT IS ACHIEVED AND MAINTAINED BETWEEN THE TURF AND THE SOIL SUCH THAT SEEPAGE FLOW BENEATH THE TURF IS AVOIDED.

9. WATER UNTIL THE SOIL IS WET 100mm BELOW THE TURF. THEREAFTER, WATERING SHOULD BE SUFFICIENT TO MAINTAIN AND PROMOTE HEALTHY GROWTH

MAINTENANCE

1. DURING THE SITE'S CONSTRUCTION PERIOD, INSPECT THE DIVERSION CHANNEL WEEKLY AND AFTER ANY INCREASE IN FLOWS WITHIN THE CHANNEL. REPAIR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD.

2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE CHANNEL. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

3. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN THE CONSTRUCTION WORK ABOVE A TEMPORARY DIVERSION CHANNEL IS FINISHED AND THE AREA IS STABILISED, THE AREA SHOULD BE APPROPRIATELY REHABILITATED.

2. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA AS SPECIFIED IN THE APPROVED PLAN.

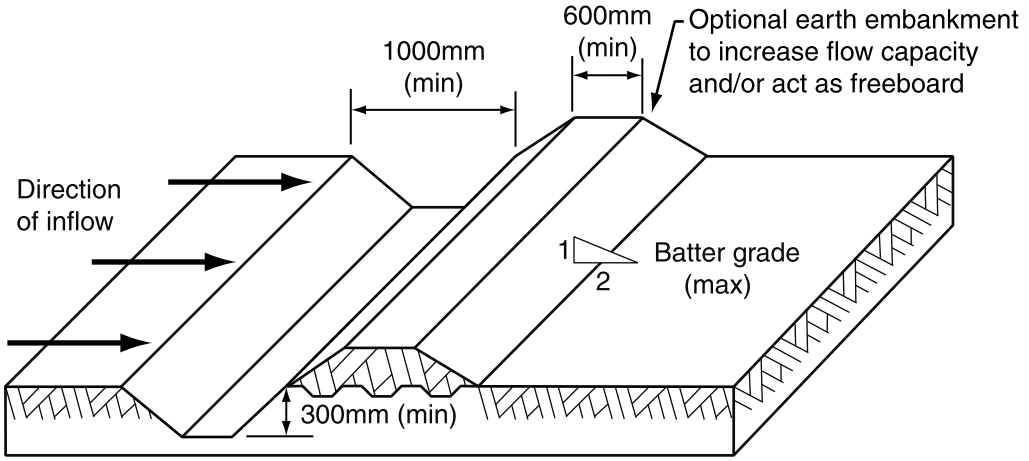


Figure 1 - Typical profile of diversion channel with bank

Drawn:	Date:		
GMW	Dec-09	Diversion Channels	DC-01

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION FOR THE BANK, CLEARING ONLY THE AREA THAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT.

3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK.

4. FORM THE BANK FROM THE MATERIAL, AND TO THE DIMENSION SPECIFIED IN THE APPROVED PLANS.

5. IF EARTH IS USED, THEN ENSURE THE SIDES OF THE BANK ARE NO STEEPER THAN A 2:1 (H:V) SLOPE, AND THE COMPLETED BANK MUST BE AT LEAST 500mm HIGH.

6. IF FORMED FROM SANDBAGS, THEN ENSURE THE BAGS ARE TIGHTLY PACKED SUCH THAT WATER LEAKAGE THROUGH THE BAGS IS MINIMISED.

7. CHECK THE BANK ALIGNMENT TO ENSURE POSITIVE DRAINAGE IN THE DESIRED DIRECTION.

8. THE BANK SHOULD BE VEGETATED (TURFED, SEEDED AND MULCHED), OR OTHERWISE STABILISED IMMEDIATELY, UNLESS IT WILL OPERATE FOR LESS THAN 30 DAYS OR IF SIGNIFICANT RAINFALL IS NOT EXPECTED DURING THE LIFE OF THE BANK.

9. ENSURE THE EMBANKMENT DRAINS TO A STABLE OUTLET, AND DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT FLOW DIVERSION BANKS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. INSPECT THE BANK FOR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD. MAKE REPAIRS AS NECESSARY.

3. CHECK THAT FILL MATERIAL OR SEDIMENT HAS NOT PARTIALLY BLOCKED THE DRAINAGE PATH UP-SLOPE OF THE EMBANKMENT. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

4. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

5. REPAIR ANY PLACES IN THE BANK THAT ARE WEAKENED OR IN RISK OF FAILURE.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE BANK IS FINISHED AND THE AREA IS STABILISED, THE FLOW DIVERSION BANK SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED IN THE APPROVED PLAN.

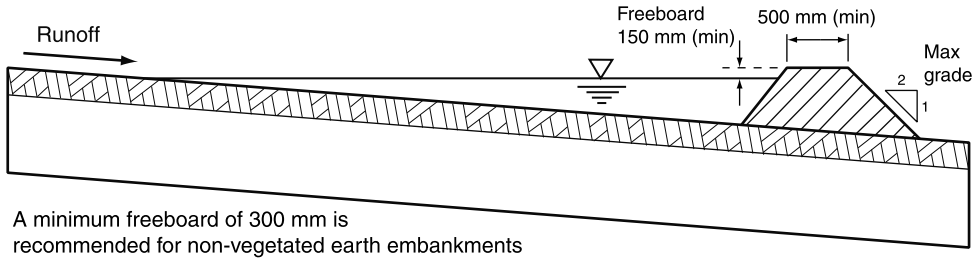


Figure 1 - Typical profile of flow diversion bank formed from earth

Table 1 - Recommended dimensions of flow diversion banks

Parameter	Earth banks	Vegetated banks	Compost berms	Sandbag berms
Height (min)	500 mm	500 mm	300 mm	N/A
Top width (min)	500 mm	500 mm	100 mm	N/A
Base width (min)	2500 mm	2500 mm	600 mm	N/A
Side slope (max)	2:1 (H:V)	2:1 (H:V)	1:1 (H:V)	N/A
Freeboard	300 mm	150 mm	100 mm	50 mm

Drawn:	Date:		
GMW	Dec-09	Flow Diversion Banks	DB-01

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) AND ANALYSIS HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED PRIOR TO PLANTING.

3. CLEAR THE LOCATION FOR THE CATCH DRAIN, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION.

4. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK.

5. GRADE THE DRAIN TO THE SPECIFIED SLOPE AND FORM THE ASSOCIATED EMBANKMENT WITH COMPACTED FILL. NOTE THAT THE DRAIN INVERT MUST FALL 10cm EVERY 10m FOR EACH 1% OF CHANNEL GRADIENT.

6. ENSURE THE SIDES OF THE CUT DRAIN ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE AND THE EMBANKMENT FILL SLOPES NO STEEPER THAN 2:1.

7. ENSURE THE COMPLETED DRAIN HAS SUFFICIENT DEEP (AS SPECIFIED FOR THE TYPE OF DRAIN) MEASURED FROM THE DRAIN INVERT TO THE TOP OF THE EMBANKMENT. WHERE NECESSARY, CUT THE DRAIN SLIGHTLY DEEPER THAN THAT SPECIFIED ON THE PLANS SUCH THAT THE CORRECT CHANNEL DIMENSIONS ARE ACHIEVED FOLLOWING PLACEMENT OF THE TURF.

8. ENSURE THE DRAIN HAS A CONSTANT FALL IN THE DESIRED DIRECTION FREE OF OBSTRUCTIONS.

9. TURF SHOULD BE USED WITHIN 12-HOURS OF DELIVERY, OTHERWISE ENSURE THE TURF IS STORED IN CONDITIONS APPROPRIATE FOR THE WEATHER CONDITIONS (e.g. A SHADED AREA).

10. MOISTENING THE TURF AFTER IT IS UNROLLED WILL HELP MAINTAIN ITS VIABILITY.

11. TURF SHOULD BE LAID ON A MINIMUM 75mm BED OF ADEQUATELY FERTILISED TOPSOIL. RAKE THE SOIL SURFACE TO BREAK THE CRUST JUST BEFORE LAYING THE TURF.

12. DURING THE WARMER MONTHS, LIGHTLY IRRIGATE THE SOIL IMMEDIATELY BEFORE LAYING THE TURF.

13. ENSURE THE TURF IS NOT LAID ON GRAVEL, HEAVILY COMPACTED SOILS, OR SOILS THAT HAVE BEEN RECENTLY TREATED WITH HERBICIDES.

14. FOR WIDE DRAINS AND HIGH VELOCITY CHUTES, LAY THE FIRST ROW OF TURF IN A STRAIGHT LINE DIAGONAL TO THE DIRECTION OF FLOW. STAGGER SUBSEQUENT ROWS IN A BRICK-LIKE (STRETCHER BOND) PATTERN. THE TURF SHOULD NOT BE STRETCHED OR OVERLAPPED. USE A KNIFE OR SHARP SPADE TO TRIM AND FIT IRREGULARLY SHAPED AREAS.

15. FOR NARROW DRAINS, LAY THE TURF ALONG THE DIRECTION OF THE DRAIN, ENSURING, WHEREVER PRACTICABLE, THAT A LONGITUDINAL JOINT BETWEEN TWO STRIPS OF TURF IS NOT POSITIONED ALONG THE INVERT OF THE DRAIN.

16. ENSURE THE TURF EXTENDS UP THE SIDES OF THE DRAIN AT LEAST 100mm ABOVE THE ELEVATION OF THE CHANNEL INVERT, OR AT LEAST TO A SUFFICIENT ELEVATION TO FULLY CONTAIN EXPECTED CHANNEL FLOW.

17. ON CHANNEL GRADIENTS OF 3:1(H:V) OR STEEPER, OR IN SITUATIONS WHERE HIGH FLOW VELOCITIES (i.e. VELOCITY >1.5m/s) ARE LIKELY WITHIN THE FIRST 2-WEEKS FOLLOWING PLACEMENT, SECURE THE INDIVIDUAL TURF STRIPS WITH WOODEN OR PLASTIC PEGS.

18. ENSURE THAT INTIMATE CONTACT IS ACHIEVED AND MAINTAINED BETWEEN THE TURF AND THE SOIL SUCH THAT SEEPAGE FLOW BENEATH THE TURF IS AVOIDED.

19. WATER UNTIL THE SOIL IS WET 100mm BELOW THE TURF. THEREAFTER, WATERING SHOULD BE SUFFICIENT TO MAINTAIN AND PROMOTE HEALTHY GROWTH.

20. ENSURE THE DRAIN DISCHARGES TO A STABLE OUTLET SUCH THAT DOWN-SLOPE SOIL EROSION WILL BE PREVENTED FROM OCCURRING. ENSURE THE DRAIN DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT ALL CATCH DRAINS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING STORM EVENTS AND REPAIR ANY SLUMPS, BANK DAMAGE, OR LOSS OF FREEBOARD.

2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE DRAIN. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

3. DISPOSE OF ANY SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE CATCH DRAIN IS FINISHED AND THE AREA IS STABILISED, THE DRAIN AND ANY ASSOCIATED BANKS SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED WITHIN THE APPROVED PLAN.

Drawn:	Date:		
GMW	Dec-09	Catch Drains - Grass Lined	CD-03

INSTALLATION (EARTH-LINED)

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION FOR THE CATCH DRAIN, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION.

3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK.

4. GRADE THE DRAIN TO THE SPECIFIED SLOPE AND FORM THE ASSOCIATED EMBANKMENT WITH COMPACTED FILL. NOTE THAT THE DRAIN INVERT MUST FALL 10cm EVERY 10m FOR EACH 1% OF REQUIRED CHANNEL GRADIENT.

5. ENSURE THE SIDES OF THE CUT DRAIN ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE AND THE EMBANKMENT FILL SLOPES NO STEEPER THAN 2:1.

6. ENSURE THE COMPLETED DRAIN HAS SUFFICIENT DEEP (AS SPECIFIED FOR THE TYPE OF DRAIN) MEASURED FROM THE DRAIN INVERT TO THE TOP OF THE EMBANKMENT.

7. ENSURE THE DRAIN HAS A CONSTANT FALL IN THE DESIRED DIRECTION FREE OF OBSTRUCTIONS.

8. ENSURE THE DRAIN DISCHARGES TO A STABLE OUTLET SUCH THAT SOIL EROSION WILL BE PREVENTED FROM OCCURRING. SPECIFICALLY, ENSURE THE DRAIN DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT ALL CATCH DRAINS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING STORM EVENTS AND REPAIR ANY SLUMPS, BANK DAMAGE, OR LOSS OF FREEBOARD.

2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE DRAIN. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

3. DISPOSE OF ANY SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

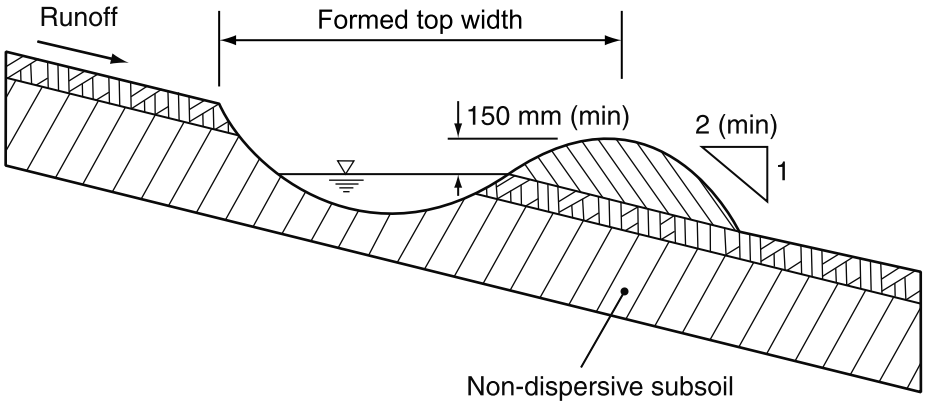
1. WHEN THE SOIL DISTURBANCE ABOVE THE CATCH DRAIN IS FINISHED AND THE AREA IS STABILISED, THE TEMPORARY DRAIN AND ANY ASSOCIATED BANKS SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

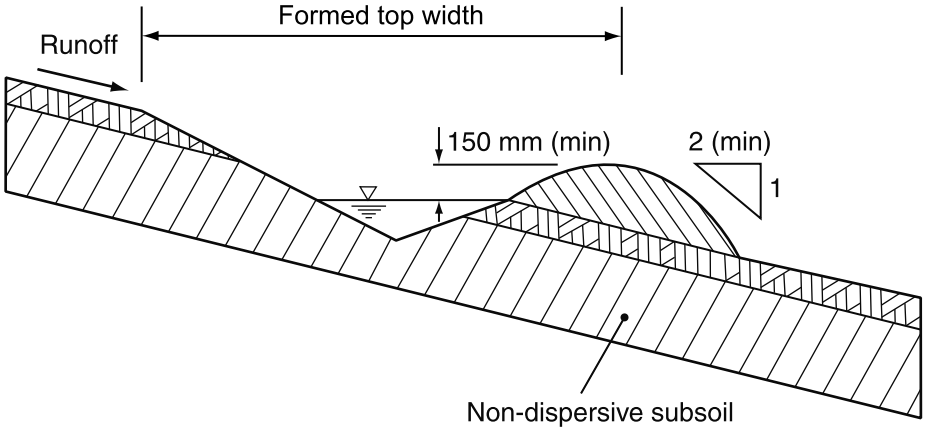
3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED WITHIN THE APPROVED SITE REHABILITATION PLAN.

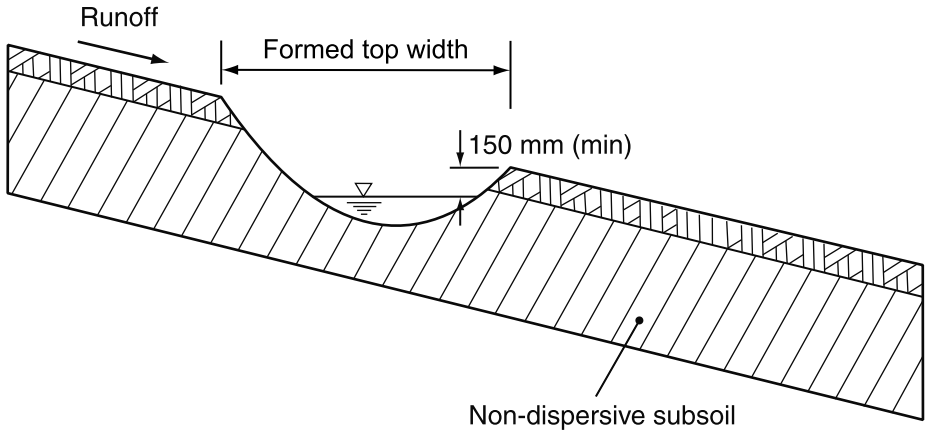
Drawn:	Date:		
GMW	Dec-09	Catch Drains - Earth Lined	CD-02



(a) Parabolic catch drain with down-slope bank



(b) Triangular V-drain with down-slope bank



(c) Parabolic catch drain without bank

Constructed dimensions of parabolic catch drains		
Drain type	Formed top width with or without bank	Formed depth with or without bank
Type-A	1.6 m	0.30 m
Type-B	2.4 m	0.45 m
Type-C	3.6 m	0.65 m

Constructed dimensions of triangular V-drains		
Drain type	Formed top width with or without bank	Formed depth with or without bank
Type-AV	2.0 m	0.30 m
Type-BV	2.7 m	0.45 m
Type-CV	3.9 m	0.65 m

NOT TO SCALE

Drawn:	Date:		
GMW	Dec-09	Catch Drains	CD-01

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION FOR THE BERM, CLEARING ONLY THE AREA THAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT.

3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY.

4. FORM THE BERM FROM THE MATERIAL, AND TO THE DIMENSION SPECIFIED IN THE APPROVED PLANS.

5. IF FORMED FROM SANDBAGS, THEN ENSURE THE BAGS ARE TIGHTLY PACKED SUCH THAT WATER LEAKAGE THROUGH THE BAGS IS MINIMISED.

6. CHECK THE ALIGNMENT OF THE BERM TO ENSURE POSITIVE DRAINAGE IN THE DESIRED DIRECTION.

7. ENSURE THE BERM DISCHARGES TO A STABLE OUTLET.

8. ENSURE THE BERM DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT FLOW CONTROL BERMS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. INSPECT THE BERM FOR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD. MAKE REPAIRS AS NECESSARY.

3. CHECK THAT FILL MATERIAL OR SEDIMENT HAS NOT PARTIALLY BLOCKED THE DRAINAGE PATH UP-SLOPE OF THE EMBANKMENT. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

4. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

5. REPAIR ANY PLACES IN THE BERM THAT ARE WEAKENED OR IN RISK OF FAILURE.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE BANK IS FINISHED AND THE AREA IS STABILISED, THE FLOW CONTROL BERM SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

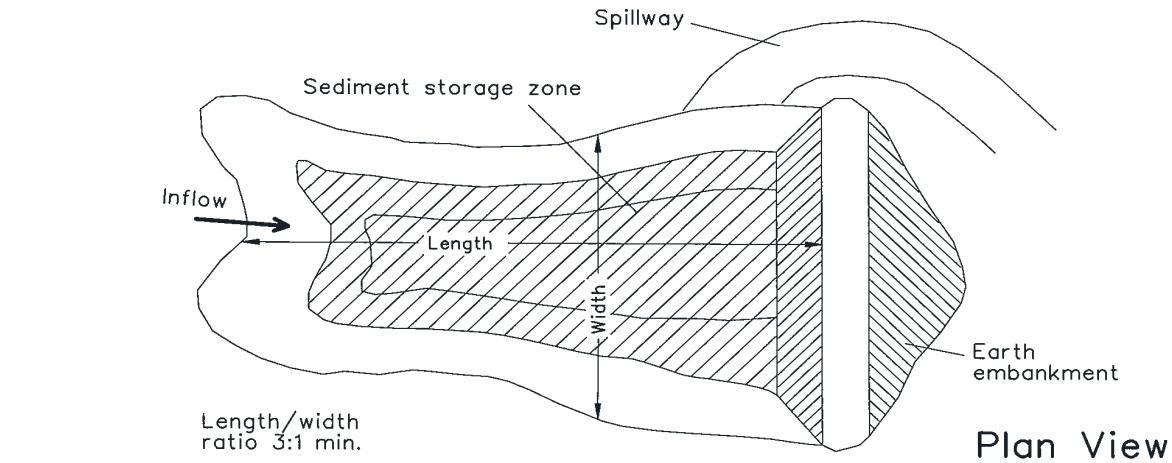
2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

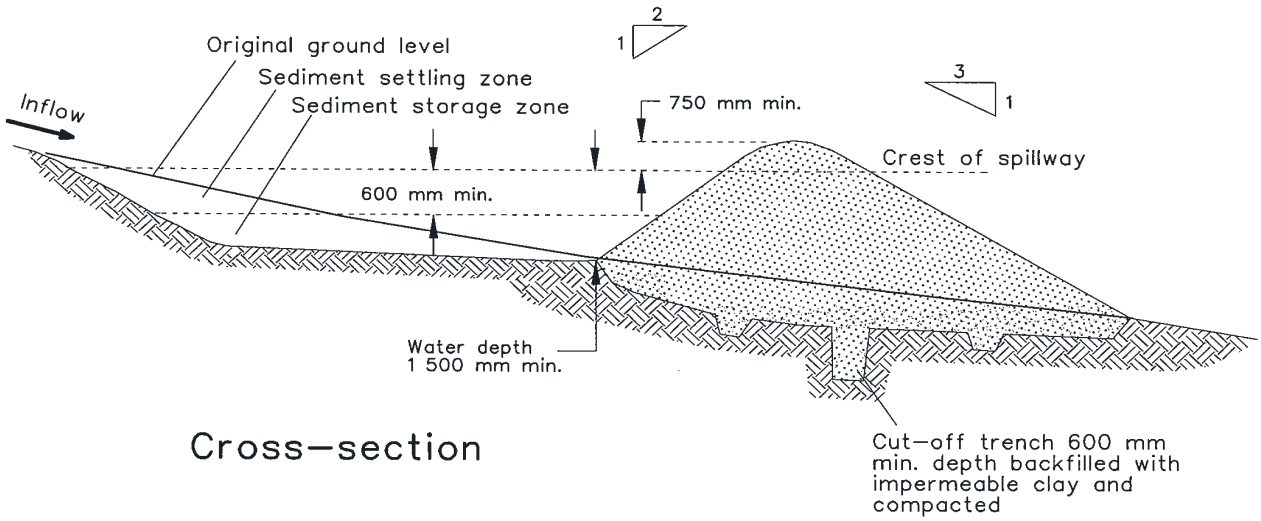
4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED IN THE APPROVED PLAN.

Table 1 - Recommended dimensions of flow control berms

Parameter	Earth banks	Vegetated banks	Compost berms	Sandbag berms
Height (min)	500 mm	500 mm	300 mm	N/A
Top width (min)	500 mm	500 mm	100 mm	N/A
Base width (min)	2500 mm	2500 mm	600 mm	N/A
Side slope (max)	2:1 (H:V)	2:1 (H:V)	1:1 (H:V)	N/A
Freeboard	300 mm	150 mm	100 mm	50 mm

Drawn:	Date:		
GMW	Dec-09	Flow Control Berms	CB-01





Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET

(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

SD 6-4

vgt environmental compliance solutions and laboratories

Beyond Compliance

VGT Environmental Compliance Solutions Pty Ltd
ABN 26 621 943 888

Unit 4, 30 Glenwood Drive Thornton NSW 2322
PO Box 2335, Greenhills NSW 2323

Ph: (02) 4028 6412
E: mail@vgt.com.au

www.vgt.com.au