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Boral Dunmore Operations

Dunmore Lakes Sand Project
Rehabilitation Management Plan

June 2024



Document control

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1	27/04/2016	Peter Rand (Arcadis)	Brad Searle (Arcadis)	Draft Rehabilitation Management Plan
2	19/05/2016	Peter Rand (Arcadis)	Brad Searle (Arcadis)	Draft 2 Rehabilitation Management Plan
3	03/06/2016	Peter Rand (Arcadis)	Brad Searle (Arcadis)	Final Rehabilitation Management Plan
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5	17/03/2017	Peter Rand (Arcadis)	Brad Searle (Arcadis)	Final Rehabilitation Management Plan – DPE Further Comments Addressed
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10	14/06/2024	Matt Bray (Boral)	S Makin	Updated following independent Environmental Audit

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Abbreviations

AEMR	Annual Environmental Management Report
BCD	Biodiversity & Conservation Division within the Department
CAA	Controlled Activity Approval
CoA	Condition of Approval
DLSP	Dunmore Lakes Sand Project
DPI&E	Department of Planning, Investment & Environment
EEC	Endangered Ecological Community
EPA	Environment Protection Authority
FFMP	Flora and Fauna Management Plan
HTE	High Threat Exotic
MCP	Mine Closure Plan
MOP	Mine Operations Plan
PCT	Plant Community Type
PIRMP	Pollution Incident Response Management Plan
RAMP	Riparian Areas Management Plan
SECP	Sediment and Erosion Control Plan
SEPP	State Environmental Planning Policy
RMP	Rehabilitation Management Plan
VENM	Virgin excavated natural material
WMP	Water Management Plan

1 INTRODUCTION

1.1 BACKGROUND

The Dunmore Lakes Sand Project (DLSP) is a sand dredging and processing operation producing a range of sand and landscaping products into the local and Sydney markets. The Project is located on the Princess Highway approximately seven kilometres north of Kiama on the NSW South Coast.

Development Consent (DA 195-8-2004) as modified in 2020 for Stage 5 requires the preparation and maintenance of a range of management plans to guide the environmental management of the development throughout its operational life.

DLSP currently rehabilitates the site in accordance with an approved Rehabilitation Management Plan (RMP) prepared by Arcadis (2017). This RMP incorporated a Riparian Area Management Plan. The Consolidated Consent as modified in 2020, Schedule 3, Condition of Approval 43, requires the RMP to be updated. The RMP has been updated by Mark Nolan and Dr Emilie Mascarenhas Cambium Group, who have been endorsed by the Planning Secretary (Appendix A).

1.2 PROJECT DESCRIPTION

The DLSP is owned and operated by Boral Resources (NSW) Pty Ltd. The site is located at Tabbita Road, Dunmore within the Shellharbour Local Government Area.

The existing site (Stages 2, 3 and 4) covers 88 hectares and is bound by the Princes Motorway (Kiama Bypass) to the east and private property, predominantly agricultural grazing land, to the south, north and west. Operation of the quarry involves the sequential dredging and excavation of approximately 8 million tonnes of sand and soil from Stage 2, 3 & 4 and 1.35 million tonnes of sand and soil from stage 5.

Stage 5 is located approximately 1.1 km south- south east of the existing site, covers approximately 38 ha and is located on an alluvial coastal flood plain, adjacent to the tidal reaches of the Minnamurra River. The northern portion of the extraction area has been partially cleared and has historically been used for grazing. Stage 5 is bound by Riverside Drive to the north and Princes Highway to the west.

The method of extraction of these resources includes both sand and soil extraction by excavator and dredge sand extraction, followed by washing, processing and material blending.

During and post the completion of sand extraction, progressive backfilling of each stage with virgin excavated natural materials (VENM) will be undertaken, to progressively reconstruct and rehabilitate the site. The reconstructed landform will ultimately support lakes, wetlands and revegetated Endangered Ecological Communities and grazing land.

1.3 PURPOSE AND OBJECTIVES OF THE PLAN

The purpose of this Rehabilitation and Management Plan (RMP) is to meet the requirements of summary environmental management measures and DA conditions of consent applicable to rehabilitation. Additionally, this RMP provides a single operational document that clearly identifies key management issues, management objectives and actions to be implemented, the proposed schedule for implementation or the monitoring and review of commitments. This RMP will also include a set of clear and concise maps and diagrams showing the locations of management areas.

This RMP includes a Riparian Areas Management Plan (Appendix B), which describes and details the methods concerning work involving construction/rehabilitation of riparian areas and within 3m of an existing riparian area.

1.4 CONSULTATION

The previous version of the RMP (Arcadis 2017) was prepared in consultation with the NSW Department of Planning and Infrastructure, Shellharbour Council, Kiama Council DEC, DPI, and the CCC.

Shellharbour Council, Kiama Council and the Biodiversity and Conservation Division (BCD) have been consulted in the development of this updated plan (supplied with version 06 in June 2021) and their comments were addressed in version 07 of the RMP. The Department of Planning, Investment & Environment (DPIE) has also been consulted in the development of this updated plan (supplied with version 07 in July 2021) and their comments addressed in this version 08 of the RMP. Evidence of correspondence with these agencies is provided in Appendix G and responses to their comments are provided in Table 1 below.

Table 1 Response to comments from Kiama Council, Shellharbour Council, BCD and DPIE

Comment	Response	Update to FFMP
Kiama Council		
Why Bangalay Sand Forest vegetation community is not included in the 5B replanting/rehabilitation, only freshwater fringing wetland.	Fringing freshwater wetland species were chosen as only the fringing edge of the Stage 5B pond is being revegetated. This replanting is done for stability and at the landowner request. Banagaly Sand Forest Vegetation will be offset via retiring the biodiversity credit (71) of PCT659 as detailed in Condition 37A of the consent proir to vegetation clearing in Stage 5B.	Required detail entered into the document.
Whether Kiama Council had a position on the Consultative Committee	Mark Miller (Manager of Compliance and Regulation) currently attends on behalf of SHCC. We would be happy to invite the KCC equivalent to the meeting	No proposed changes to the document. An email reply with an answer to the comments given provided KCC had no concern on the plan. This is included in the KCC correspondence.
Shellharbour Council		
Page 6- 2.4.2 Fisheries Permit Application, should include reference to 'any impacts on a Saltmarsh vegetation community will require the Fisheries Permit Application'	Disturbance area is outside the salt marsh area. If any impacts are observed then the Fisheries Permit Application will be completed	Required detail entered into the document.
Page 28- 5.6 Maintenance, replace the word phrase 'additional planting will be considered' to 'will be replanted to achieve 80% native coverage'	Acknowledged	Required detail entered into the document.
Biodiversity and Conservation Division (BCD)		
We have reviewed the above document and support the proposed approach to rehabilitation overall.	Acknowledged	Required detail entered into the document.

Department of Planning, Investment & Environment (DPIE)		
Section 1.1 and Appendix A. This section should state names of persons from Cambium who were endorsed by the Planning Secretary to prepare the Rehabilitation Management Plan (RMP) and the date of endorsement. It was not the entire Cambium Group that was endorsed.	Acknowledged	Required detail entered into the document.
Section 1.4 – update with recommended edits / comments included in the draft Rehabilitation MP pdf.	Acknowledged	Required detail entered into the document.
Address the minor edits / clarification included throughout the draft RMP pdf document.	Acknowledged	Required detail entered into the document.

1.5 DOCUMENT STRUCTURE

The structure of this RMP is outline in Table 2.

Table 2 Structure of the Rehabilitation Management Plan

Section	Content
1	Provides an overview of the project, previous environmental assessments of the Project, and the purpose and scope of this plan.
2	Details of the statutory requirements for the Plan as outlined in the Conditions of Approval issued by the NSW Department of Planning and Infrastructure and other legislative requirements.
3	Describes the existing environment of the study area and significant biodiversity values contained within the project.
4	Describes the management actions to be undertaken to effectively implement and manage the rehabilitation values of the project.
5	Outlines the monitoring, reporting and review requirements pertaining to rehabilitation management within the project.
6	Specifies the environmental induction training delivered to all staff and subcontractors involved in the Project.
7	Outlines the requirement pertaining to contingency planning, including emergency incident reporting and management.
8	Lists the references used in the preparation of this plan

2 RELEVANT LEGISLATION, GUIDELINES AND PLANS

2.1 LEGISLATION AND PLANNING INSTRUMENTS

Key environmental legislation relating to rehabilitation management includes:

- *Commonwealth Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act)
- *NSW Environment Planning and Assessment Act 1979* (EP&A Act)
- *NSW Environment Planning and Assessment Regulation 2000*
- *NSW Fisheries Management Act 1994* (FM Act)
- *NSW Protection of the Environment and Operations Act* 1997
- *NSW Biosecurity Act 2015* (BS Act)
- *NSW Biodiversity Conservation Act 2016* (BC Act)
- *NSW Water Management Act 2000* (WM Act)
- *Mining Act 1992*
- *Illawarra Regional Environmental Plan No. 1*
- *Shellharbour Local Environmental Plan 2013*
- *Shellharbour Rural Local Environmental Plan 2004*
- *State Environmental Planning Policy (Coastal Management) 2018* (Coastal SEPP)
- *State Environmental Planning Policy (SEPP*) (Mining, Petroleum Production and Extractive Industries) 2007

2.2 GUIDELINES

Department of Industry Resources and Energy *EDG03 Mining, Rehabilitation and Environmental Management Process Guideline* provides guidance in the preparation of Mine Operations Plans (MOP), Mine Closure Plans (MCP) and Annual Environmental Management Reports (AEMR). The guideline document aims to enable mining activities throughout NSW to proceed safely, efficiently extract resources, protect the environment and deliver a rehabilitated landform at the completion of mining activities. This Rehabilitation Management Plan aligns with the intent of this Guideline document.

The rehabilitation process requires the establishment of a performance framework in order to measure the success of the rehabilitation process and to facilitate a consistent approach. The ANZMEC (Australian and New Zealand Minerals and Energy Council) Strategic Framework (2000) provides a framework for rehabilitation and performance assessment for mining operations.

The performance framework should cover the following:

- Rehabilitation principles and objectives, including final land use;
- Decommissioning requirements;
- Community objectives and criteria;
- Consent criteria;
- Standards and issues related to whole-of-life considerations;
- Financial costing and provisioning;
- Legal requirements;
- Environmental and social management requirements; and
- Safety considerations.

This plan has been prepared in accordance with the Constructed Wetlands Manual, Volumes 1 & 2 and the Shellharbour Visual Management plan User Manual.

2.3 CONDITIONS OF APPROVAL

The quarry operates under Development Application DA 195-8-2004 first granted on 29 June 2005 which has been modified three times. The latest modification occurred in 2020 (MOD 2 Consolidated Consent).

A number of the Conditions of Approval (CoA) from MOD 2 Consolidated Consent are relevant to this Plan and have been considered in its preparation (Table 3).

Table 3 Conditions of Approval

Condition of Approval	Condition Requirements	Where addressed in this document
Rehabilitation		
42	The Applicant must progressively rehabilitate the site to the satisfaction of the Planning Secretary, in a manner that is generally consistent with the concept final landform in the documents listed in condition 2(c) of Schedule 2 (see Appendix 2), and in accordance with the conditions of this consent	Whole document
Rehabilitation Management Plan		
43	Prior to commencing extraction in Stage 5, the Applicant must update the Rehabilitation Management Plan for the development to the satisfaction of the Planning Secretary: This plan must:	Whole document
	a) be prepared: (i) by suitably qualified consultants, including a specialist hydrologist, wetlands ecologist and landscape architect, whose appointments have been approved by the Planning Secretary; (ii) in consultation with Shellharbour Council, Kiama Council, BCD and the Department; and (iii) in accordance with extant guidelines including the *Constructed Wetlands Manual, Volumes 1 & 2 and the Shellharbour Visual Management Plan User Manual*;	Section 1.1 Section 1.4
	b) provide detailed plans of the final landform based on current backfill estimates;	Section 3 &4
	c) set detailed performance indicators and completion criteria for the rehabilitation of all areas disturbed by the development;	Section 5.9
	d) describe the measures that would be implemented to achieve the criteria in paragraph (c) and triggers for remedial actions;	Section 4, 5, 7 Section 6.4
	e) include detailed design plans and scheduling for progressive rehabilitation to be initiated, undertaken and/or completed in the next 5 years;	Section 5
	f) include a program to monitor, independently audit and report on progress against the criteria in paragraph (c) and the effectiveness of the measures in paragraph (d); and	Section 5.7
	g) include any Riparian Area Management Plan/s prepared in accordance with condition 45 for those riparian areas to be disturbed/rehabilitated in the next 5 years.	Appendix B

Riparian Area Management Plan		
45	The Applicant must prepare a Riparian Area Management Plan in consultation with BCD and to the satisfaction of the Planning Secretary. For works involving:	Appendix B
	a) disturbance within 3m of an existing riparian area, the plan must: • describe the broader extraction staging and justify the need for extraction in the Riparian Area; • describe in detail the methods and timing for extraction within the Riparian Area; • provide for construction and stabilisation of appropriate diversion channels to divert the waterbody around the disturbance area, unless otherwise approved by BCD and the Planning Secretary; and • describe the methods for rehabilitation of the Riparian Area and diversion channels; and	Appendix B
	b) construction/rehabilitation of Riparian Areas, the plan must: • detail proposed channel/bed designs, including scour protection measures; • Include hydraulic modelling supporting the proposed design; • where applicable, include measures to replicate pre-existing tidal-estuarine conditions; • include detailed plans for rehabilitation and revegetation of the Riparian Area using locally endemic species; • describe measures for the protection, enhancement and integration with adjacent threatened communities, including *Freshwater Wetlands on Coastal Floodplains, Swamp Oak Floodplain Forest* and *Bangalay Sand Forest of the Sydney Basin and South East Corner Bioregions.*	Appendix B

2.4 LICENCES AND PERMITS

2.4.1 Environmental Protection licence

The Environment Protection Authority (EPA) issues environment protection licences to the owners or operators of various industrial premises under the *Protection of the Environment Operations Act 1997* (POEO Act). Licence conditions relate to pollution prevention and monitoring, and cleaner production through recycling and reuse and the implementation of best practice. All licence holders must:

- Comply with the conditions of their licence.
- Prepare pollution incident response management plans.
- Publish and/or make pollution monitoring data available.

The DLSP operates under Environment Protection Licence EPL 11147.

2.4.2 Fisheries Permit Application

If mangroves occur, a permit must be applied for prior to their removal in the eastern portion of Rocklow Creek constructed channel, an application for a Fisheries Permit Application (to harm marine vegetation) must be submitted to NSW Department of Primary Industries (Fisheries). Upon

receipt of the permit, the removal of mangroves in the eastern portion of Rocklow Creek constructed channel must be undertaken prior to the expiration of the Fisheries Permit Application.

No Saltmarsh vegetation community is within the disturbance area. If any impacts are observed on areas of Saltmarsh, a Fisheries Permit Application will be completed.

2.5 ALIGNMENT WITH OTHER PLANS RELEVANT TO THE PROJECT

This Plan has also been informed by:

- Previous and updated management plans for the Project.
- Flora and Fauna Assessment for the Dunmore Lakes Sand Extraction Proposal Stage 2, 3 and 4 (Kevin Mills & Associates 2004).
- Dunmore Lakes Sand Extraction Proposal Stage 2, 3 and 4 Environmental Impact Assessment (R.W. Corkery & Co. 2004).
- Dunmore Lakes Sand Extraction Project Modification 2 Environmental Assessment updated April 2019 and associated Response to Submissions updated June 2019.

A number of other management plans and strategies apply to the Project including a Flora and Fauna Management Plan (FFMP), Water Management Plan (WMP), and Long Term Management Strategy. The management actions in these plans complement one another and should be considered holistically.

3 EXISTING ENVIRONMENT

3.1 SITE DESCRIPTION

Dredging commenced for stages 2 to 4 in June 2007. Since then, due to the high demand for sand in the Sydney market, sand in Stage 2 has been extracted with dredging recently moving into Stage 3. Given recent high demand, the sand resource in Stage 3 is expected to be exhausted during 2021. Stage 4 encompasses an area containing the road access and private rail line to the approved project, supporting infrastructure for stages 2 to 4 and Boral's adjacent Dunmore Hard Rock Quarry. Given this, Stage 4 cannot be extracted until these activities are relocated. Stages 5A and Stage 5B are the next sand extraction areas to be developed providing product sand for the next 4 to 5 years.

Four stages (Stages 2 -5) of sand extraction within the site are shown in Figure 1.

Stage 2

Stage 2, covering 37 hectares, adjoins the northern boundary of Tabbita Road and encompasses a large area of cleared and disturbed grassland and the footprint of sand extraction activities, which is now being rehabilitated.

Stage 2 also contains the sand processing infrastructure, which will continue to be utilised during sand extraction activities in Stage 3, 4 and 5. Several tributaries drain into the sand extraction boundary; the Western tributary flows east into the western sand extraction boundary, and the Northern Tributary flows south into the northern sand extraction boundary. Stage 2 is largely drained by the Western Tributary in the south- east corner, which eventually flows into to Rocklow Creek downstream of the site.

Stage 3

Stage 3, covering 21 hectares, adjoins the southern boundary of Tabbita Road. Rocklow Creek transects Stage 3, which flows into a wetland located to the east of Kiama Bypass, conveyed by a culvert beneath Kiama Bypass.

Stage 4

Stage 4, covering five hectares, encompasses the Tabbita Road corridor, which includes the current road and rail access to Dunmore Hard Rock Quarry, located to the west of the site. Stage 4 is unlikely to be subject to sand extraction in the near future.

Stage 5

Stage 5, covering 38 hectares, is located approximately 1.1 km south- south east of the existing site and is on an alluvial coastal flood plain, adjacent to the tidal reaches of the Minnamurra River. The northern portion of the extraction area has been partially cleared and has historically been used for grazing. Stage 5 is bound by Riverside Drive to the north and Princes Highway to the west.

3.1.1 Land Use

The site is characterised by existing sand extraction activities (i.e., in Stage 3), land under rehabilitation and agricultural land that has been predominantly cleared of native vegetation for the grazing of cattle. Land use in the surrounding locality includes:

- Agricultural land, primarily cattle grazing.
- Commercial and industrial development, including Dunmore Hard Rock Quarry and Dunmore Concrete Batching Plant immediately to the west and Dunmore Resource and Recycling Facility in the east.
- Residential development, including Dunmore Lakes Estate to the south west of Stage 5 and Minnamurra to the east of stage 5.
- Infrastructure development, including the Princes Highway and the South Coast Rail Line divides the site.
- Minnamurra River and associated wetland (protected under State Environmental Planning Policy (Coastal Management) 2018) (Coastal SEPP) is located adjacent to Stage 5.

3.1.2 Hydrology

The existing site is located within the catchment of Rocklow Creek, a tributary of the Minnamurra River. The confluence of Rocklow Creek and the Minnamurra River is located one kilometre downstream of the site.

Rocklow Creek has been highly modified from its natural state and is predominantly conveyed through man-made channels. In some areas the Creek has been re-directed for agricultural activities. Rocklow Creek flows from west to east through the southern portion of Stage 3 to a culvert in the south-eastern of the site, which channels the creek under the Princes Highway and Railway line to a Coastal SEPP wetland (Cumberland Ecology 2010). The tidal influence of these wetlands extends a short distance upstream of the Princes Highway into the Stage 3 area. Tidal inundation to Stage 3 only occurs during above average high tides (R.W. Corkery & Co. 2004).

Several tributaries drain into the sand extraction boundary; the Western tributary flows east into the western sand extraction boundary, and the Northern Tributary flows south into the northern sand extraction boundary. Stage 2 is largely drained by the Western Tributary in the south-east corner, which eventually flows into to Rocklow Creek downstream of the site.

The Northern Tributary drains into the Western Tributary, and the Eastern Tributary runs in a southerly direction along the north eastern boundary of the site. The Eastern Tributary is mostly contained within the adjacent Roads and Traffic Authority easement, however flows across the north-eastern corner of the site (Cumberland Ecology 2010).

The Stage 5A and Stage 5B extraction areas are located between the Minnamurra River to the south, an unnamed tributary almost directly west, and Rocklow Creek to the north (South East engineering and environmental 2019).

3.1.3 Topography

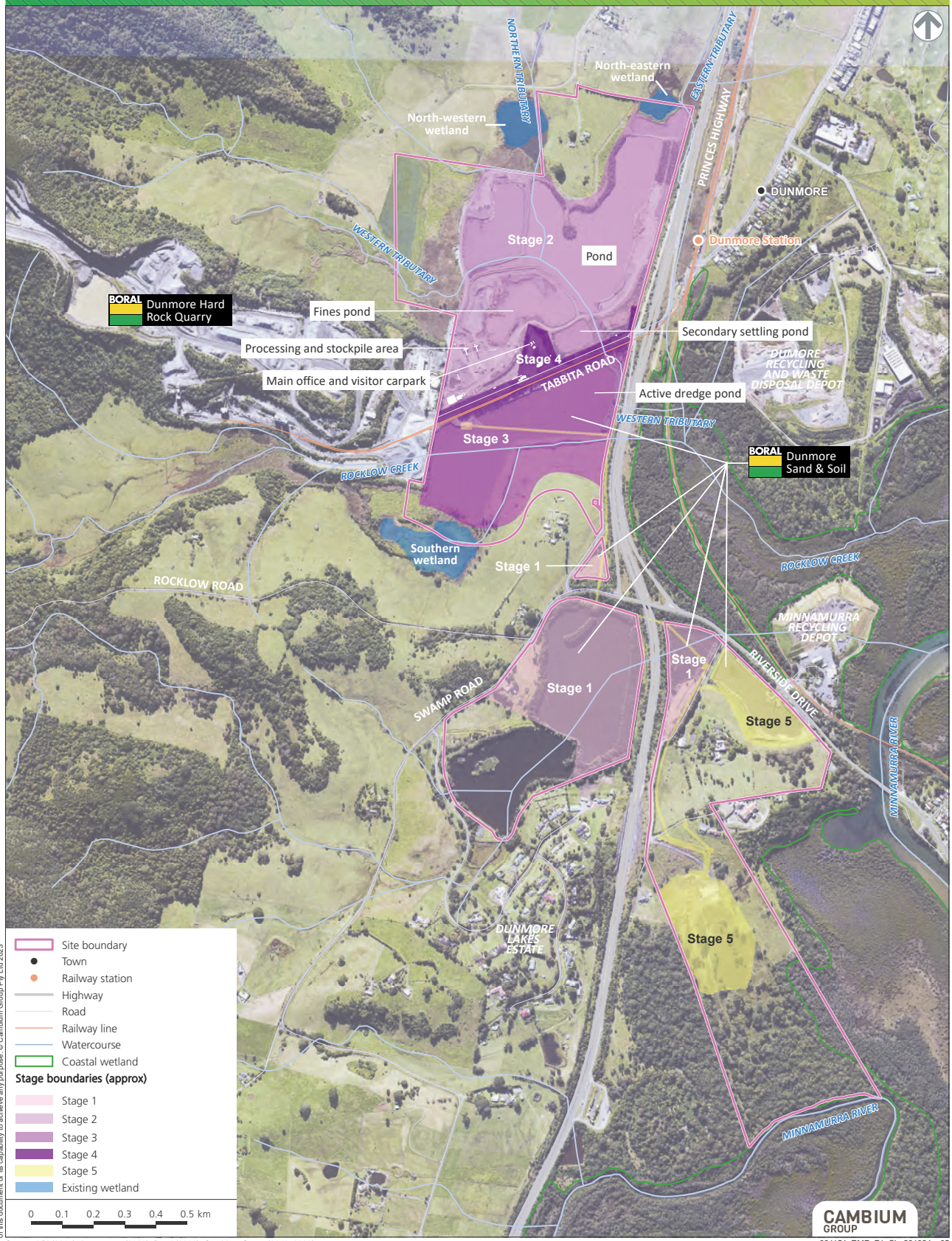
The existing site is located upon the Illawarra Coastal Plains and is characterised by low lying alluvial land (Cumberland Ecology 2010). The site lies within an area of flat to gently inclined alluvial plains on the Illawarra Coastal Plain. Surrounding relief is generally less than 20m and slopes are generally less than 30%. The entire site is low lying at approximately 1.5m to 2m AHD (R.W. Corkery & Co 2004).

The site is subject to periodic inundation caused by flooding of Rocklow Creek and Minnamurra River (Cumberland Ecology 2010).

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Figure 1
Site layout
Rehabilitation Management Plan / Dunmore Lakes Sand Project



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Source: LPI (2017), Aerometrex (2023), Boral (2016), Cambium Group (2019, 2023).

3.2 CURRENT BACKFILL ESTIMATES

Backfilling of extractive areas will continue to be progressive in Stages 2 ,3 and 5, dependent upon the dredge pond being maintained at a sufficient size for dredging to continue effectively. The current backfill estimates are summarised in Table 4.

Table 4 Current backfill estimates

Stage	Backfill Estimate (tonnes)
2	Approximately 2.5 million tonnes*
3	Approximately 2.5 million tonnes*
4	To be determined
5	Approximately 325,000 tonnes*

* Includes site overburden and imported VENM

3.3 RECENT REHABILITATION MANAGEMENT

The rehabilitation management at the site takes a progressive rehabilitation approach. Rehabilitation is able to occur concurrent to extraction activities, in areas that will not be disturbed by future dredging activities and not required for processing or stockpiling purposes.

Rehabilitation activities undertaken to date have been in accordance the RMP prepared by Arcadis (2017). Dredging is completed in the Stage 2 area.

Rehabilitation works are ongoing along the northern area of stage 2 with 6,300 native plants from the Swamp Oak Floodplain Forest and Freshwater Wetlands in Coastal Floodplains community types planted along the north western edge of Stage 2 in 2017. A bird island was also constructed and planted out with the communities and species described above.

The banks of the realigned Western Tributary channel in Stage 3 commenced rehabilitation in 2017, with the laying of jute matting and approximately 2,600 tube stock of freshwater wetland species planted out.

In December 2019 a further 8500m^2 of Swamp Oak Floodplain Forest was planted on the NE section of Stage 2. These saplings are progressing well. The tree screens planted in 2007 are progressing well with individuals now 13 years old. Landform construction using VENM is ongoing along the southern and eastern section of Stage 2. This landform will form the foundations for a further section of Swamp Oak Floodplain Forest to be planted.

Backfilling and landform construction in Stage 3 has commenced starting with the Eastern edge and the south eastern tidal zone.

The location of rehabilitation areas can be seen below in Figure 2.

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Figure 2
Recent rehabilitation management
Rehabilitation Management Plan / Dunmore Lakes Sand Project



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Source: LPI (2017), Aerometrex (2023), Boral (2016), Cambium Group (2019, 2021, 2023).

4 SITE REHABILITATION AND LANDSCAPE PLAN

4.1 REHABILITATION CONTEXT

4.1.1 Extraction Area

The development conditions specify limitations on the extraction area:

For stages 2 to 4;

- Extraction cannot occur within 3m of the site boundary;
- Extraction cannot occur within 3m of the bank of the Eastern Tributary.
- Extraction of and within 3m of the bank of the Northern and Western Tributaries will be in accordance with an approved Riparian Management Plan;
- Extraction cannot occur within 10m of the bank of the southern or north-eastern wetlands;
- Extraction within 40m of the southern, north-eastern and north-western wetlands must only occur towards the end of dredging when the dredge pond water volume is maximised, and in accordance with an approved Riparian Management Plan; and
- Extraction must not occur within 3m of the bank of the realigned Rocklow Creek.

For stage 5;

- Extraction cannot occur within 3m of the site boundary for 5A adjacent to Riverside Drive or for 5B adjacent to private property at 79 Fig Hill Lane.

4.1.2 Extraction Sequencing and Timing

The current progress of the extraction sequencing and timing is as follows:

- DLSP completed Stage 1 and Stage 2 dredging;
- The Processing Area in Stage 2 has been established and no extraction will be undertaken here during the course of site operations and possibly beyond;
- The majority of Stage 2, south of the Western Tributary, has undergone progressive filling and been converted to form part of the processing area until project completion;
- The Realignment of Western Tributary was completed in 2016 under CAA 10 ERM2010/1116 granted on 14/12/15. Details of these works are contained in Appendix D;
- Extraction in Stage 3 commenced following the realignment of the Western Tributary;
- Prior to commencing any works (including extraction) within 40m of Rocklow Creek, a Controlled Activity Approval under Water Management Act 2000 was obtained. Controlled Activity Approval 10CX122266 was approved on 18 December 2017 and has been extended to an expiry date of 17/12/23 (Appendix E). This allows for extraction up to 10m from Rocklow Creek in Stage 3;
- Rocklow Creek has yet to be realigned as landowners consent for commencement of substage 3C1 has not been granted. A controlled activity to complete the Rocklow Creek will be obtained prior to works commencing in substage 3C1 as per S3.C10; and
- Once dredging in Stage 3 is completed the dredge will move to stage 5A and then stage 5B

4.2 PROGRESSIVE REHABILITATION APPROACH

A high standard of progressive rehabilitation and landscaping of sand mining areas will be undertaken throughout the lifespan of the sand mine, initially focusing on rehabilitation of Stage 2 following the completion of resource extraction. Rehabilitation activities will commence in areas that will not be

disturbed by future dredging activities and not required for processing or stockpiling purposes. This approach will allow for rehabilitation to progress adjacent to extraction activities and consequently the establishment of vegetation in various areas of the site as they become available following the completion of extraction, backfilling and re-profiling.

4.3 REHABILITATION OBJECTIVES

This RMP has been prepared in accordance with Conditions 42 through 46 of DA 195-8-2004. The overall objectives of the RMP, as derived from these conditions, are to describe:

1. The progressive rehabilitation of all disturbed areas to a final land use in general accordance with final landform outlined in the Dunmore Lakes Sand Extraction Proposal 2, 3 and 4, EIS; EA Mod 1, EA Mod 2, SEE Mod 3.
2. The rehabilitation measures for the site that would be implemented to:
   - Manage remnant vegetation and habitat on the site; and
   - Ensure compliance with the rehabilitation objectives and progressive rehabilitation obligations in the CoA;
3. The measures that would be implemented over the next five years, including the procedures to be implemented for:
   - Ensuring compliance with the rehabilitation objectives and progressive rehabilitation obligations in this approval;
   - Providing connectivity between vegetation communities re-established on the site and between the site surrounding areas;
   - Realignment of the Western Tributary and rehabilitation the Western Tributary and Rocklow Creek; and
   - Controlling erosion.
4. A program to monitor the effectiveness of these measures and progress against the performance and completion criteria; and
5. Identify and allocate responsibility for monitoring, reporting, reviewing and implementing the plan.

4.4 LANDSCAPING PLAN

The following sections discuss the landscape plan for the areas to be rehabilitated.

4.4.1 Landscape Concept Plan

Condition 42 of the CoA requires that the site be rehabilitated in a manner generally consistent with the EIS Final Landform for stages 2 - 4 and EA Mod 2 final landform for Stage 5 (Appendix B) and, approved in principle by DoP.

4.4.2 Landscape Design

The proposed final landform for Stages 2-4 is illustrated in Figure 3 and includes developing the dredged area into lakes located within Stages 2 and 3 with habitat islands and extensive areas of wetlands and Swamp Oak Floodplain Forest being established via progressive rehabilitation. Stage 5A will be backfilled and restored to pre-existing conditions with Stage 5B remaining as an open water pond with a fringing wetland of Littoral zone species (Figure 4). No access roads will be retained in the final landform in Stage 5 as per landowners consent.

Where possible, the final landform has been designed to blend in with the surrounding landscape to reduce the visual impact of the site. The final landform is indicative at this point as it will depend on availability of appropriate materials for the task.

The perimeter of sections of the extracted areas in Stage 2 will be backfilled to create an area of predominantly flood-free land with sufficient width around the lake to accommodate the proposed final land uses.

The final landform is shown in Figure 3 and Figure 4 and features the following:

Stage 2:

- A lake that includes a bird island connected to the lakes edge by a thin strip of land. The floor of the lake will reflect the final depth of the dredging area and is approximately down to 12 m deep. The eastern edge of the lake has a been rehabilitated to create a fringing wetland vegetation community;
- A wetland environment has been created above the fines in the north-western section covering an area. This wetland would provide habitat for native flora and fauna and supplement the habitat of nearby protected wetlands
- Two areas of elevated land north of Tabbita Road have been created by a combination of fines and/or backfill with VENM. The lands have been completed to an elevation of approximately 3.7m AHD;
- Reinstatement of the channel for the Western Tributary has been completed in a similar alignment to the existing alignment with localised curvi-linear sections. The lower reaches of the Western Tributary have been re-aligned to direct runoff beneath the upgraded Princes Highway through Culvert 4; and
- The existing Tabbita Road corridor will be reinstated to either the existing level or raised to the level of the existing flood-free land.

Stage 3:

- A lake including bird islands ;
- Most areas surrounding the lake will be rehabilitated to Swamp Oak forest and Freshwater wetland communities while the area to the south-east will continue to be used for grazing;
- Areas in Stage 3 will be backfilled to approximately 2m AHD, a level comparable to pre-extraction levels; and
- The channel for Rocklow Creek would be re-instated to its former natural alignment.

Stage 5A:

- Stage 5A will be backfilled to create grazing land to its pre-extraction activity land form;
- The final land form levels are expected to be between 1-3 m AHD, depending on the existing natural slopes.

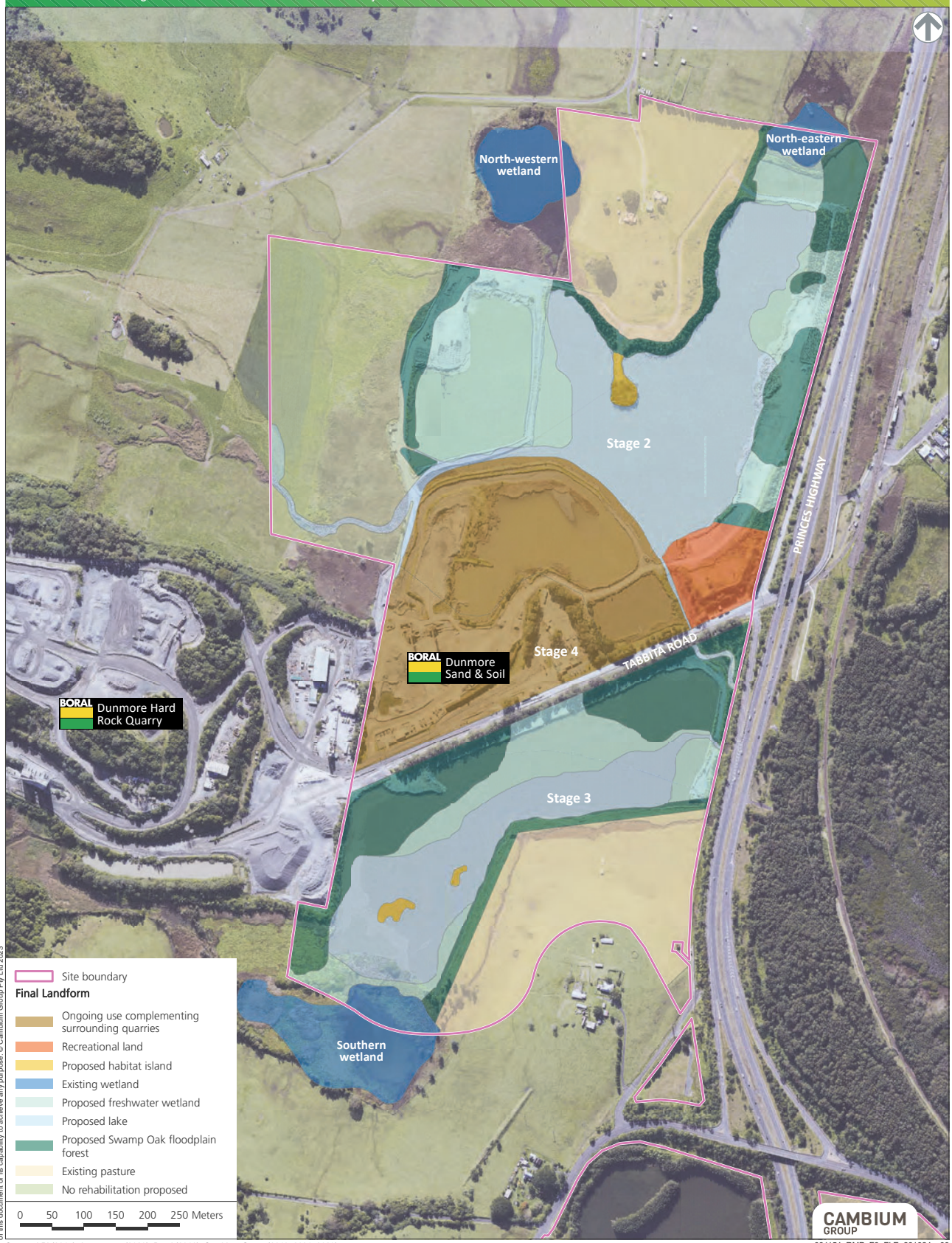
Stage 5B:

- Stage 5B will remain a lake that will be approximately 5 ha
- The bunds around the lake will remain until water quality has returned to appropriate levels that do not represent a risk to the downstream environment and can be integrated back into the floodplain storage.
- The lake edge will be rehabilitated to create a ribbon of riparian vegetation around the edges of the pond forming fringing wetland community of littoral zone species.

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Figure 3
Final landform - stages 2, 3 and 4

Rehabilitation Management Plan / Dunmore Lakes Sand Project



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Figure 4
Final landform - stage 5
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4.5 REHABILITATION SCHEDULE

The following section discusses the short-term (1-5 years) rehabilitation measures to be completed within the next five years, and the medium term (6-15 years) measures to be completed in the following six to fifteen years. Long-term rehabilitation measures are no longer applicable on the basis of the remaining resource life at DLSP.

4.5.1 Short and Medium Term Measures

The aim of the rehabilitation plan is to progressively encourage a sustainable vegetative cover in accordance with the rehabilitation and final land use objectives of the site. Progressive rehabilitation will occur in areas that will not be disturbed by future dredging operations and will consist firstly of backfilling and re-profiling the land. Backfilling of extracted areas will be progressive within each of the stages, contingent on the dredge pond being maintained at a sufficient size for dredging to continue effectively. During rehabilitation works, sediment and erosion control management actions will be undertaken in accordance with the Sediment and Erosion Control Plan included in the DLSP Water Management Plan. Once the re-profiling is complete, planting of appropriate native species will occur in accordance with the Flora and Fauna Management Plan.

The following recommendations outline the various approaches to the staged, progressive rehabilitation of the DLSP site. Rehabilitation activities are broadly separated into short and medium term measures to coincide with progressive stages of extraction and eventual decommissioning and formation of the final landform. To correspond with the extraction plans for the remaining stages, the timeframes for rehabilitation activities have been defined and discussed in the following sections:

The rehabilitation measures are covered in this document as short (1-5 years) and medium-term (6-15), are broadly outlined below (Table 5) and illustrated in Figure 5 and Figure 6.

Table 5 Short- and medium-term measures

Timing	Measures
Short-term (< 5 years)	Landform construction using VENM is ongoing along the southern and eastern section of Stage 2 and eastern section of stage 3
	Maintenance of native vegetation previously planted within Stage 2.
	Evaluation of vegetation plantings thus far and revision of species list, if successful establishment of desired plant communities has not occurred.
	Backfilled areas no longer required for access and dredge anchoring will be progressively vegetated as per the FFMP.
	Creek and riparian areas are managed in accordance with the relevant Riparian Area Management Plan (refer to Appendix B).
Medium-term (6-15 years)	Ongoing maintenance of all revegetated areas undertaken as required i.e. weed and pest control.
	Progressive rehabilitation of Stage 3 and 5 as permitted by the extraction process.
	Progressive rehabilitation of Stage 4 if commenced and rehabilitation of the processing area.
	Landscape to final landform.

4.6 REHABILITATION PROCEDURES

The following section details the rehabilitation procedures specific to different areas around the site. Any rehabilitation pertaining to riparian areas are discussed in the RAMP (Appendix B).

4.6.1 Sand Mine Site Boundary

i. Fencing

The boundary of the existing site was fenced prior to extraction to prevent cattle, horses and other livestock from entering the site and will be remain as part of the final landuse. Fencing for Stage 5 will be reviewed and replaced if necessary.

ii. Tree Screening

Along the eastern boundary, as well as the north eastern and south eastern corners of the site, a tree screen was established prior to commencement of any works to screen the processing area, as required by the Conditions of Approval. The vegetation is intended to act as a visual screen to enhance the lakes' visual appeal and to restrict and soften views of the site activities. No screen is proposed for Stage 5.

iii. Weed control

The control of invasion of competing grasses from surrounding land will be undertaken in accordance with the Pest and Weed Management Plan found in Appendix D of the Flora and Fauna Management Plan.

iv. Erosion and sediment control

Erosion and sediment control will be undertaken in accordance with the Sediment and Erosion Control Plan (SECP) found in the (WMP).

4.6.2 Active Sand Mine Areas

As previously discussed, the rehabilitation of the site is undertaken in a progressive manner. This approach will allow for rehabilitation to progress within active quarry areas, adjacent to extraction activities. Consequently, vegetation can be established in various areas of the site as they become available, following the completion of extraction, backfilling and re-profiling.

It is recognised that a strategy of progressive rehabilitation and landscaping through the lifespan of Stages 2, 3 and 4 is limited in effect due to ongoing disturbance of the areas.

i. Stockpiling of Topsoil

Topsoil from extraction areas will be stored in processing and stockpiling area until it is required for blending and/or rehabilitation works. Stockpiles will be free of weed seeds and stabilised with a sterile cover crop if they are to be in place for greater than 10 days if required.

ii. Backfilling and re-profiling

Backfilling and re-profiling will be undertaken progressively in areas where dredging is complete with VENM in accordance with EPL 11147 and the final landform presented in Figure 3.

iii. Revegetation

The areas prepared for revegetation adjacent to extraction activities will be revegetated in accordance with the final landform. Details for revegetation are discussed in Section 5.

iv. Weed control

All weed control will be undertaken in accordance with the Pest and Weed Management Plan found in Appendix D of the Flora and Fauna Management Plan.

v. Erosion and sediment Control

Erosion and sediment control will be undertaken in accordance with the Sediment and Erosion Control Plan (SECP) found in the (WMP).

4.6.3 Lakes

The final lakes within Stage 2, 3 and 5 have been designed to maximise the extent and diversity of habitats. Plant species planted along the lakes edges will be selected to maximise the bank stability. Each lake in Stages 2 and 3 will be edged with freshwater wetlands. A "bird island" tied to the edge of the lake by a thin strip of land has been constructed in Stage 2.Islands are also planned in Stage 3 to provide additional habitat for native fauna. In Stage 5 the lake will be edged in a fringing wetland community of littoral zone species. Further details are provided in Section 5.

Stage 2 Lake

i. Edging treatment

It is proposed that the eastern edge of the lake be treated to create a fringing wetland community, and this would be complemented by adjoining tree stands. Topsoil and/or processing fines will be dispersed over all areas of foreshore wetlands to provide a suitable substrate for the growth of wetland species. The edge treatment will provide for vegetation to be planted to stabilise the banks of the lakes and enhance habitat diversity intermittently around the lake edges. The boundary of the lake will be reinforced with measures described in the SECP. Detailed vegetation measures for the wetlands are discussed in Section 5.

ii. Bird habitat island

A bird habitat island has been constructed using VENM as per EPL conditions and the approved Waste Management Plan.

Stage 3 Lake

A similar treatment is envisaged for Stage 3 Lake, with the exception that the wider area surrounding Stage 3 Lake would continue to be used for grazing. The EIS (R.W. Corkery & Co. 2010) notes that in the event the lake overflows, this water would be directed via two depressions aligned with Culverts 2 and 3 to enable the flows to pass beneath the Princes Highway. Bird Islands are also planned.

Stage 5 Lake

i. Edging treatment

It is proposed that the edge of the lake be treated to create a fringing wetland community which is complemented by adjoining tree stands to the west and south. Topsoil and/or processing fines will be dispersed over all areas of lake edge to provide a suitable substrate for the growth of wetland species. The edge treatment will provide for vegetation to be planted to stabilise the banks of the lakes and enhance habitat diversity around the lake edges. The boundary of the lake will be reinforced with measures described in the SECP. Detailed vegetation measures for the lake are discussed in Section 5.

4.6.4 Fines Pond

After completion of Stage 3 extraction, the flood bund around the fines pond area will be removed to increase habitat connectivity between the wetland and Stage 2 Lake. It is planned that this area will be left last to rehabilitate due to the ongoing use of the wash plant facility.

4.6.5 Processing Area

It is likely that the Processing Area will remain functioning until the completion of Stage 4. Rehabilitation of this area would not commence until all extraction works have been completed in Stage 4 and possibly later if the area is used for processing for other quarries.

4.6.6 Northern Property

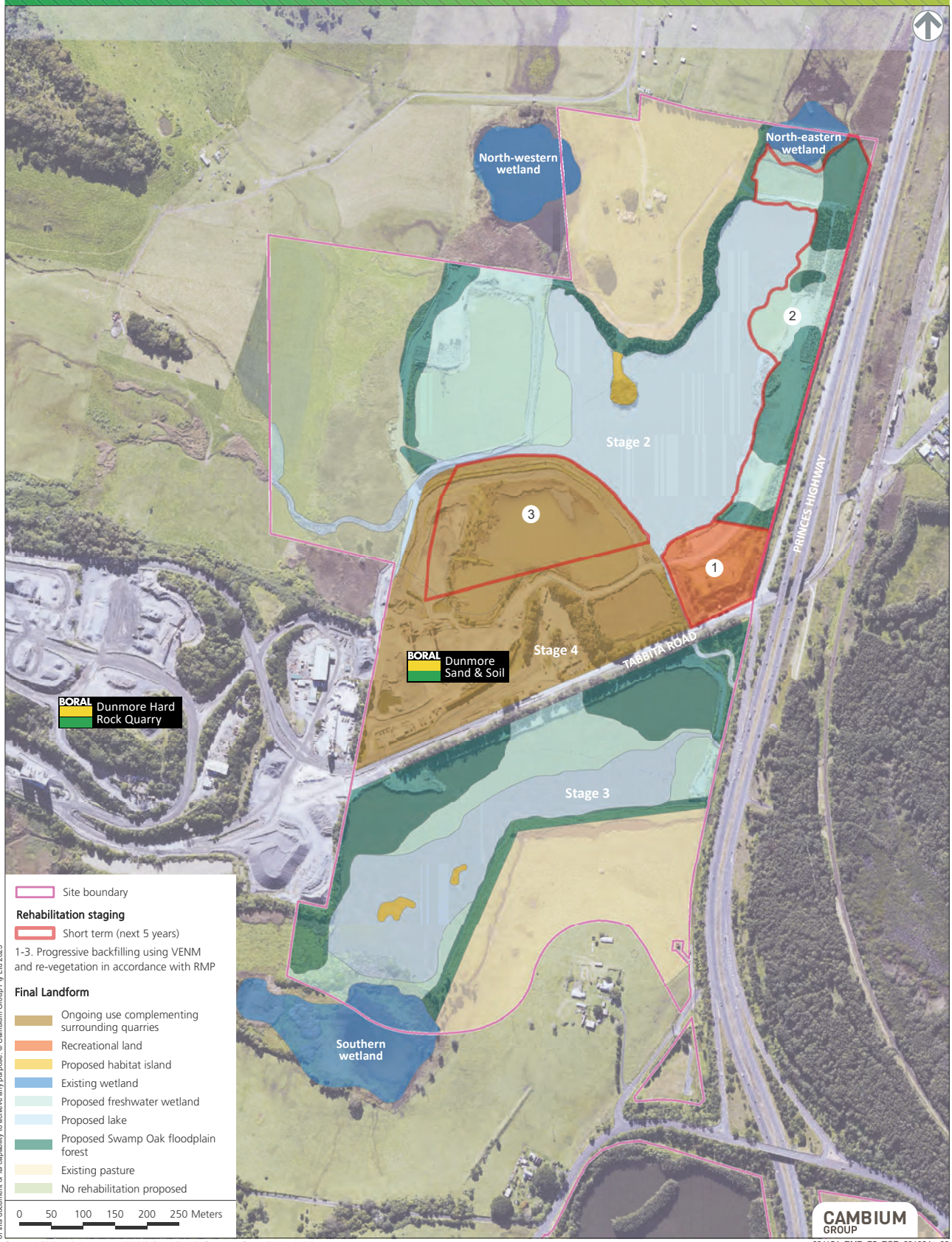
The hill separating the northern eastern and north western wetlands is owned by DLSP. The land contains a homestead, a cluster of farm infrastructure and pastureland. The hill area will not be affected by extraction and therefore no rehabilitation will be necessary.

i. Fencing

A fence will be constructed at the base of the hill to prevent livestock from entering the adjacent wetlands or Stage 2 Lake. A screen of Swamp Oak Floodplain Forest will be established along the lake edge as a further buffer between the northern property and the Stage 2 lake system.

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Figure 5
Rehabilitation - short term (next 5 years)
Rehabilitation Management Plan / Dunmore Lakes Sand Project



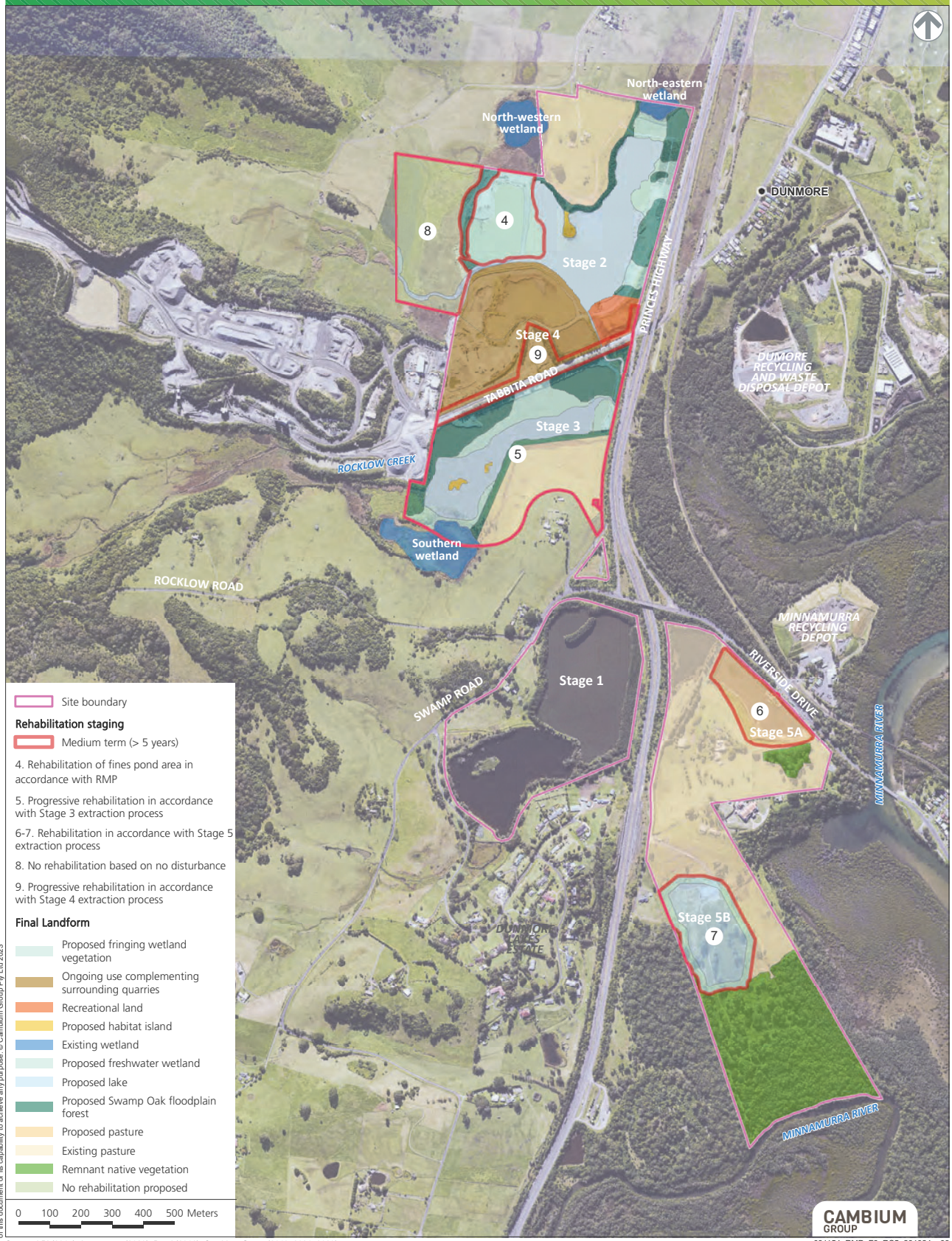
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Figure 6
Rehabilitation - medium term (> 5 years)
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5 REVEGETATION

Revegetation works undertaken as part of rehabilitation activities will be guided conducted by a qualified bush regenerator or ecologist with at least five years of experience.

5.1 STAGED REVEGETATION

The site will be rehabilitated in a manner that is generally consistent with the EIS Final Landform (Figure 3 and Figure 4). Rehabilitation and subsequent revegetation will be undertaken in Stage 2 first, followed by Stages 3, 5 and then Stage 4

Within each stage, revegetation will be undertaken progressively, as the final landform is gradually backfilled and re-profiled. This aims to stabilise re-profiled areas as soon as possible, minimise potential erosion and degradation of areas of exposed topsoil, and reduce supply pressure on local providers of seed and tubestock that will be required to provide the plantings (see Section 5.2.4).

5.2 NATIVE SPECIES SELECTION

5.2.1 Swamp Oak Floodplain Forest

Revegetation of Swamp Oak Floodplain Forest EEC will be undertaken in areas identified on Figure 3. Much of the eastern boundary of Stage 2 and Stage 3 will be revegetated with Swamp Oak Floodplain Forest, and this forest vegetation will serve as a visual screen of the site from the adjacent Princes Highway.

Locally occurring species have been selected for revegetation, to maximise plant survival and provide habitat resources to local wildlife. Species selected include native species presently occurring on the site and characteristic species of Swamp Oak Floodplain Forest (DECC 2007, NSW Scientific Committee 2011a).

The spatial arrangement of plantings will emulate a natural vegetation formation such that plants will be placed in a random arrangement. Ground layer species will be planted in small dense groups to create a mosaic effect, while trees will be planted as more widely spaced individuals. Planting densities were determined in accordance with the lessons learned from Stage 1.

The planting of tubestock will be complemented with direct seeding of locally occurring grass species, such as *Microlaena stipoides* (Weeping Grass). This grass has been previously recorded within the site (Cumberland Ecology 2015), is commonly used for revegetation of river and stream edges to reduce erosion and has high shade tolerance (Native Seeds 2016).

Species selected for revegetation will depend upon availability at the time of ordering and may not include all species listed in Table 6.

Table 6 Planting species selection and density for Swamp Oak Floodplain Forest

Scientific name	Common name	Planting density
Trees		
Casuarina glauca	Swamp Oak	1 plant per 2-4m²
Acmena smithii	Lilly Pilly	1 plant per 5m²
Glochidion ferdinandi	Cheese Tree	
Melaleuca spp. (Melaleuca quinquenervia, ericifolia, and/or styphelioides)	Paperbarks	
Groundcovers		
Lomandra longifolia	Spiny-headed mat-rush	2 plants per 1 m²
Carex appressa	Tussock Sedge	
Centella asiatica	Indian Pennywort	
Commelina cyanea	Commelina	
Gahnia clarkei	Tall Saw Sedge	
Oplismenus imbecillis	Basket Grass	
Persicaria decipiens	Slender Knotweed	
Microlaene stipoides	Weeping Grass	20-25kg seed per hectare
Vines and climbers		
Parsonsia straminea	Common Silkpod	1 plant per 5m²
Geitonoplesium cymosum	Scrambling Lily	
Stephania japonica	Snake Vine	

5.2.2 Wetlands

Revegetation of Freshwater Wetlands on Coastal Floodplains EEC will be undertaken in areas identified on Figure 3. Locally occurring species have been selected for revegetation, to maximise plant survival and provide habitat resources to local wildlife. Plantings will comprise of grasses, sedges and rushes that are characteristic of Freshwater Wetlands (DECC 2008, NSW Scientific Committee 2011b), and will be planted in clumps of the same species. Species selected for revegetation will depend upon availability at the time of ordering and may not include all species listed in Table 7. Revegetation will occur in two zones:

Littoral zone

The littoral zone surrounds the wetland edge and is frequently dry, although it undergoes regular water level fluctuations. The primary role of plants in the littoral zone is to provide an edge buffer zone to protect banks from erosion. Dense plantings of sedges and *Gahnia* species (Table 7), to achieve 80% vegetation coverage, will be established in the littoral zone.

Shallow Marsh

Shallow marsh is flooded most of the time, but plants will be tolerant of some exposure to dry conditions. The primary role of plants in the shallow marsh zone is to provide a substratum for algal epiphytes and biofilms to enhance soluble pollutant uptake. A diversity of edges and rushes (Table 7) will be established in the shallow marsh zone.

Table 7 Planting species selection and density for Freshwater Wetlands

Scientific name	Common name	Planting density
Littoral zone		
Baumea articulata	Jointed Twig-rush	~3 plants per m²
Baumea rubiginosa	Twig-rush	
Bolboschoenus caldwellii	Marsh Club-rush	
Carex appressa	Tall Sedge	
Cyperus lucidus	Leafy Flat Sedge	
Hemarthria uncinata	Matgrass	
Juncus usitatus	Common Rush	
Panicum obseptum	White Water Panic	
Paspalum distichum	Water Couch	
Pseudoraphis spinescens	Spiny Mud Grass	
Shallow marsh (to 20cm depth)		
Baumea acuta	Pale Twig-rush	~6 plants per m²
Baumea rubiginosa	Soft Twig-rush	
Bolboschoenus fluviatilis	Marsh Clubrush	
Cyperus lucidus	Leafy Flat Sedge	
Eleocharis acuta	Common Spike rush	

5.2.3 Habitat Island

The habitat islands (one in Stage 2, two in Stage 3) will remain dry. Vegetation to be established will include tall grasses, shrubs and trees characteristic of Swamp Oak Floodplain Forest (Table 6).

5.2.4 Native Seed Provenance

All plants (seeds and tubestock) sourced for revegetation will be of local provenance (i.e. Illawarra region). Local provenance plants are often better adapted to local environmental conditions and have a greater capacity to provide habitat, food, and other resources for local wildlife.

Canopy trees such as eucalypts and certain pioneer shrubs (often species of the family *Fabaceae* such as peas and wattles) are generally the most easily obtained, collected, and propagated species that are most commonly used in revegetation projects. Groundcovers, particularly in any quantity or diversity, are less often used. Accordingly, the final species selection depends on the availability of species listed in Table 6 and Table 7, and not all species may be used.

Seeds and tubestock are to be sourced from a reputable supplier of local provenance plants, such as:

- Shellharbour City Council Nursery: 02 4221 6191
- Jamberoo Native Nursery: 02 4236 0445
- Native Seeds (for native grasses): 03 9555 1722

Plants will be ordered with sufficient time prior to the commencement of proposed revegetation works to determine the availability of various species.

5.2.5 Fringing Wetland Community

The vegetation to be established on the edges of the Stage 5B lake will include species characteristic of Freshwater Wetland community (Table 6).

5.3 EXOTIC GRASSLAND SPECIES SELECTION

Stage 5a will be rehabilitated with pasture grasses and forbs in consultation with the landowner.

5.4 SOIL PREPARATION

A successful planning program starts with appropriate soil management. Ground preparation techniques are used to soften the soil and increase water infiltration, root area and soil aeration. Any damage to the soils' biological and chemical properties are most likely to happen through inappropriate stockpiling. The physical properties of the soil can be damaged through excessive compaction, over working, or working the soil at the wrong moisture content.

The following recommendations will be implemented with respect to the management of soils (Landcom, 2004):

- Use topsoil on all lands to be revegetated;
- Before spreading topsoil, scarify the ground surface along the line of the contour to break any compacted and / or smooth materials and enable key bonding of the materials to one another;
- Apply topsoil to a depth appropriate for the gradient of the slope, generally between 50 and 100mm. Topsoil must not be placed on slopes steeper than 2h:1v without any additional means of stabilisation; and
- On completion of the respreading process, leave disturbed lands with a scarified surface to inhibit soil erosion, encourage water infiltration and help with keying topsoil later.

Prior to seeding or planting of tubestock, areas to be revegetated must be free of weeds. Weed management and control is to be undertaken in accordance with the *Pest and Weed Management Plan* (Appendix D of *Dunmore Lakes Sand Project Flora and Fauna Management Plan* (Boral 2021).

5.5 PLANTING

Revegetation will involve two methods:

- Direct seeding: Sowing seeds directly onto the site on which you wish to establish them by mechanical or hand methods; and
- Planting: Planting nursery-grown seedlings such as cell or tube-grown plants by mechanical or hand methods.

5.5.1 Timing

Ideally, planting will be undertaken during wetter and milder conditions during the year (spring/summer). Seeds and tubestock need to have been ordered with sufficient time prior to the proposed planting period. If the upper soil horizon is not moist at the time of planting, it may be appropriate to water seedlings.

5.5.2 Plant Protection

Stakes and ties will be used if necessary, to protect tubestock.

5.5.3 Watering

Watering is to be undertaken regularly to promote plant growth, in accordance with water restrictions imposed by Council or the NSW State Government at that time. It is recommended that watering of

plants be conducted twice per week during their initial establishment phase (0-3 months), before 10am or after 4pm. Between 6-12 months, watering will be undertaken on a monthly basis or as required to ensure continued plant growth.

5.5.4 Record keeping

For each discrete patch of native revegetation (ie each area of Swamp Oak Floodplain Forest or Freshwater Wetland as shown in Figure 3), the following data will be recorded:

- Date of planting;
- Species planted;
- Type of planting (seed or tubestock);
- Number of plants of each species planted;
- Provenance of each species and source nursery;
- Whether any protective treatment has been applied and
- Depth of water planted in (for shallow marsh species).

5.6 MAINTENANCE

5.6.1 Replacement of Plant Losses

If, during monitoring of revegetation works (see Section 5.7), 80% vegetation coverage is not achieved (as a result of plant failure), the area will be replanted to achieve 80% native coverage.

5.6.2 Weed Control

Weed control will be undertaken in accordance with Pest and Weed Management Plan (Appendix D of Dunmore Lakes Sand Project Flora and Fauna Management Plan (Boral 2021).

The contractor is to obtain materials for planting works from disease free and weed free areas. Additionally, to minimise the risk of any new plant diseases or destructive insects being brought into the area, planting equipment will be washed down before being brought onto the construction site.

If disease or insect infestations are identified during monitoring of revegetation work (see Section 5.7), appropriate measures will be implemented in accordance with the Pest and Weed Management Plan (Appendix D of Dunmore Lakes Sand Project Flora and Fauna Management Plan (Boral 2021).

5.6.3 Other Maintenance

Other maintenance will include:

- Adjust stakes and ties to plants as necessary;
- Prune and shape plants if necessary; and
- Address any erosion of soil subsidence issues which may occur in revegetation zones.

5.7 MONITORING OF REVEGETATION

A monitoring program will be undertaken to measure the success of native revegetation efforts against the completion criteria in Section 5.9. This will allow DLSP to:

- track progress against performance criteria and attainment of completion criteria;
- provide feedback for continuous improvement; and
- assess and manage impacts/potential impacts on biodiversity.

Native revegetation monitoring will be undertaken by a suitably qualified bush regenerator or ecologist in areas identified as proposed Swamp Oak Floodplain Forest and proposed Wetland on the Final Landform (Figure 7).

Monitoring of native revegetation will comprise 2 components:

- Vegetation establishment monitoring: to assess the successful establishment of planting in the short term (measured biannually for 3 years); and
- Ecosystem development monitoring: a seasonally based monitoring program to assess changes in the structure and composition of the vegetation and key fauna habitats in the medium – long term (measured every 2 years).

5.7.1 Vegetation Establishment Monitoring

Vegetation establishment monitoring will be undertaken in areas that have recently been revegetated (see section 5.5). The objectives of the vegetation establishment monitoring are to:

- assess the need for replacing plant losses; and
- address deficiencies with the system (such as any observed bank slumping or weed invasion).

5.7.1.1 Timing

Upon the completion of the revegetation, the performance of the seedling establishment is to be monitored by a suitably qualified bush regenerator or ecologist. Inspections will be undertaken on a six-monthly basis for the first 3 years.

5.7.1.2 Methods

Monitoring will be undertaken at 5 x 5m quadrats (size may vary where revegetation zones are narrow). Indicative monitoring locations area shown on Figure 7, and:

- At least one quadrat is to be located in each discrete patch of Swamp Oak Floodplain Forest community as shown on Figure 3. Additional quadrats will be required in the larger patches of Swamp Oak Floodplain Forest; and
- At least one quadrat is to be located on the margin of each discrete patch of Freshwater Wetland, where it adjoins the lake, as shown on Figure 3.

Each quadrat will be demarcated by a starpicket that is tagged with a unique identifying number on a steel tag, and its location recorded with a GPS. A proforma has been developed that will be completed for each quadrat, for each monitoring period (Appendix C).

5.7.1.3 Photopoint monitoring

At each vegetation establishment monitoring quadrat, a photopoint will be established at the starpicket. A series of photos (north, east, south, west and ground) will be taken at each monitoring event or on a minimum annual basis. This will provide a visual record of:

- Rehabilitation works;
- Changes to vegetation structure and fauna habitats; and
- Emerging threats such as erosion or weed infestations.

5.7.1.4 Reporting

Reporting will comprise a collation of the monitoring proformas completed for each monitoring period, in addition to a summary memo to record compliance with this requirement.

5.7.2 Ecosystem Development Monitoring

Ecosystem development monitoring will be undertaken in areas where native plants have been established. The objectives of the ecosystem development monitoring are to assess:

- the success of the revegetation efforts in establishing the target PCT; and
- the protection of retained biodiversity values at the site.

5.7.2.1 Timing

This seasonally based monitoring program will be undertaken in Spring, commencing the first Spring after an area has been revegetated for 1 year (i.e. once Vegetation Establishment monitoring has been undertaken on a monthly basis for 12 months). Monitoring will be undertaken every 2 years.

5.7.2.2 Methods

The Biodiversity Assessment Method (BAM) (DPIE 2020) is a methodology defined under the *Biodiversity Conservation Act* 2016 (BC Act), which has been developed for the consistent and streamlined assessment of biodiversity values within NSW. The BAM is described in OEH (2017) and includes survey of a range of attributes within a 20 x 50 metre plot. The attributes collected are then entered into the BAM calculator to generate scores for composition, structure, function and vegetation integrity. The scores are based on comparison with standard benchmarks for the relevant plant community type (PCT).

Attributes measured by the BAM include:

- plant species richness in each growth form group;
- native vegetation cover in each growth form group;
- fallen logs;
- hollow-bearing trees;
- leaf litter cover;
- high threat exotic cover; and
- stem size classes (regeneration).

A subset of the Vegetation Establishment plots will be used for Ecosystem Development monitoring to capture both target vegetation communities and Stages 2-5. Indicative plots for Ecosystem Development are indicated in Figure 7.

5.7.2.3 Reporting and deliverables

Reports are to be prepared and submitted to DLSP for every monitoring period.

Each monitoring report will include:

- Introduction;
- Methods;
- Results;
- Maps and figures presenting data graphically, wherever possible;
- Discussion (including an assessment of progress against completion criteria); and
- Recommendations.

Additionally, the monitoring data (xls format) and photopoint images will be submitted to DLSP.

5.8 MONITORING OF EXOTIC GRASSLANDS

Monitoring will be undertaken to measure the success of pasture revegetation efforts in Stage 5A against the completion criteria in Section 5.9

5.8.1 Timing

Upon the completion of revegetation for Stage 5A, the performance of the revegetation is to be monitored on a six-monthly basis for the first 12 months, to allow for any failings in pasture establishment or regrowth of weeds to be addressed quickly. Monitoring will be undertaken on a yearly basis for the following two years.

5.8.2 Methodology

The monitoring will involve an inspection of the site looking at pasture establishment. Monitoring will be undertaken at ten random 1 x 1m quadrats. Each quadrat will measure the % cover of

- desired pasture species; and
- unwanted species.

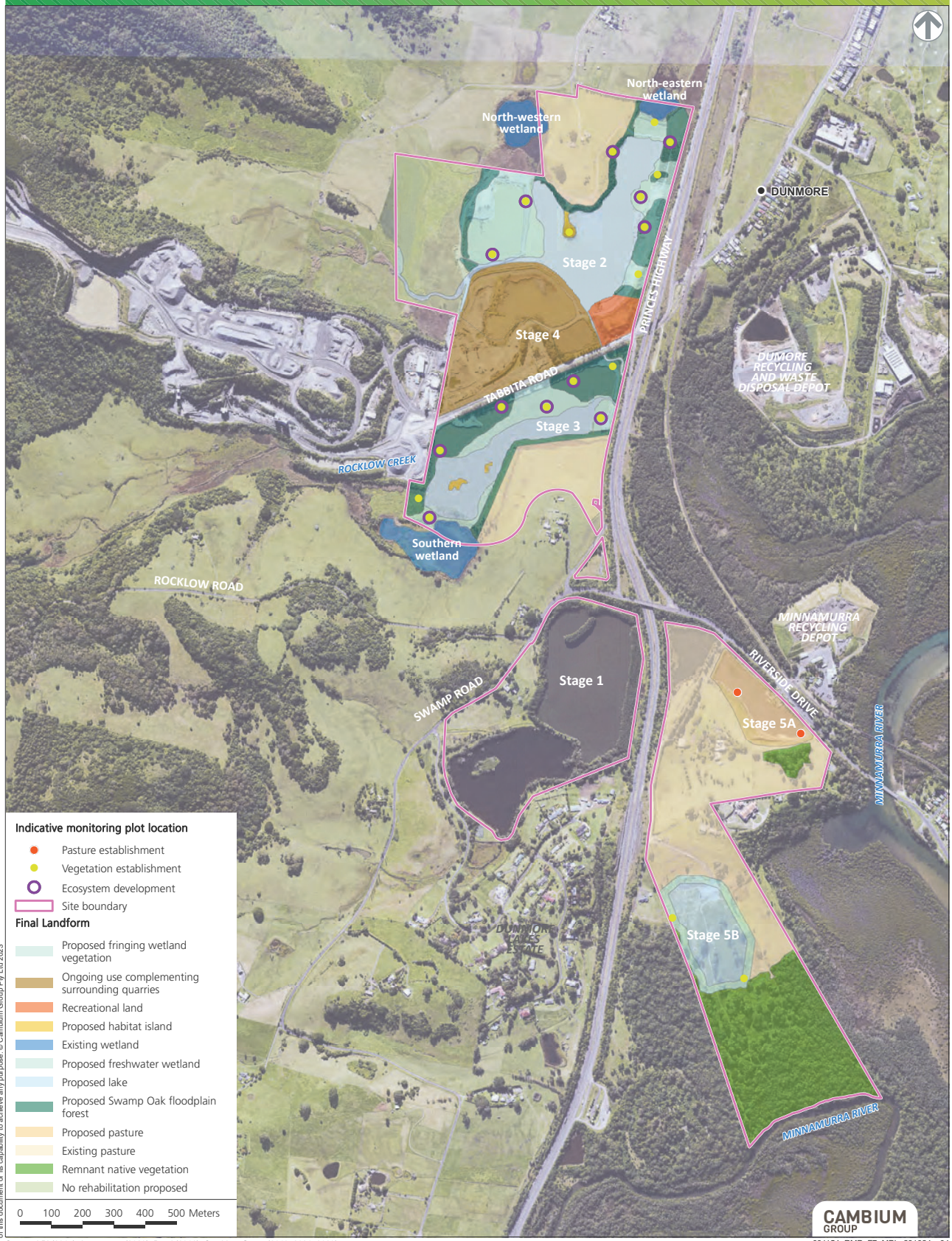
5.8.3 Reporting and deliverables

Reports are to be prepared and submitted to DLSP for every monitoring period.

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Figure 7
Indicative monitoring plot locations
Rehabilitation Management Plan / Dunmore Lakes Sand Project



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Source: LPI (2017), Aerometrex (2023), Boral (2016), Cambium Group (2019, 2021, 2023).

5.9 COMPLETION CRITERIA

Completion criteria and monitoring measures have been developed for application in accordance with the Conditions of Consent (Table 8).

Table 8 Completion criteria

Rehabilitation Aspect	Rehabilitation Performance Indicator	Target
Safety	No. of site hazards	Significant hazards removed or controlled
Landform stability	Minimal rilling, erosion, sediment deposition in drains and water retention basins Stability of voids Diversion of water flows	No significant erosion or soil loss from site No collapsing of voids
Water quality	No dirty water leaving the site	Any water leaving the site should meet consent and EPL limits
Land function	Land capability aligned to proposed future use Maintenance of environmental assets currently on or within proximity to the site	Land function commensurate with the surrounding land fabric that doesn't compromise the value of the surroundings. Works undertaken to maintain environmental assets on the site
Landscaping	Visual continuity of landscape Consistent vegetation cover	Comparable to the future use of the surrounding landscape Land rehabilitated in accordance with the Final Landform
Revegetation of disturbed areas – Vegetation Establishment	Establishment of Swamp Oak Floodplain Forest, Freshwater wetlands and habitat island in accordance with the Final Landform A success rate (survival) of 80% for all plants in Swamp Oak Floodplain Forest, Freshwater wetlands and habitat island Monitoring of revegetated areas in accordance with timing and methodology prescribed in the Rehabilitation Management Plan Within 24 months of the rehabilitation of each stage, achieve a percent cover of 5% (or less) of woody noxious weeds across this same stage	Vegetation establishment monitoring of revegetated areas in accordance with timing and methodology prescribed in the Rehabilitation Management Plan Progressive revegetation of Swamp Oak Floodplain Forest, Freshwater wetlands and habitat island in accordance with the Final Landform A success rate (survival) of 80% for all plants in Swamp Oak Floodplain Forest, Freshwater wetlands and habitat island Within 24 months of the rehabilitation of each stage, achieve a percent cover of 5% (or less) of woody weeds across this same stage
Revegetation of disturbed areas – Ecosystem Development	Resilient and self-sustaining vegetation community, aligning with the target PCT and providing fauna habitat	Ecosystem development monitoring of revegetated areas in accordance with timing and methodology prescribed in the Rehabilitation Management Plan The Composition score (derived from the BAM calculator) is at least 50% of the scores from PCT benchmark.

		The Structure score (derived from the BAM calculator) is at least 50% of the scores from PCT benchmark. The Function score (derived from the BAM calculator) is at least 50% of the scores from PCT benchmark. The Vegetation Integrity score (derived from the BAM calculator) is at least 50% of the scores from PCT benchmark. In the Swamp Oak Floodplain Forest, the density of native trees is at least 50% of that of the analogue site (no./ 1000m2 plot). Exotic plant cover is <20%. The total cover of high threat exotic species (HTEs) is <10%.
Pasture establishment	An established pasture community with a low abundance of weeds	The % cover of desired pasture species is >70% The total cover of high threat exotic species (HTEs) is <10%.

6 REPORTING AND REVIEW

6.1 ENVIRONMENTAL PERFORMANCE REVIEW

Rehabilitation management actions will be measured through regular environmental performance reviews. A status update of the rehabilitation of the site is reported in the Annual Review as per Schedule 5 Condition 9.

These will be based on the measurable outcomes identified in each environmental management plan. The reviews will be used to assess progress in meeting project environmental objectives and targets and will be undertaken by the Environmental Manager or delegate:

- In response to new or revised Boral Project approvals; and
- In response to major changes in site conditions or work methods.

Environmental performance is measured through compliance with the various environmental management plans.

Should an environmental non-conformance be identified as a result of a monitoring result, a non-conformance report will be completed and archived by the Environmental Manager or delegate and remedial action implemented in accordance with the Trigger Action Response Plan (Table 9).

6.2 REPORTING

Reporting on the implementation of this Plan would include the following:

- The results of all environmental monitoring and inspections, including adequacy of site-specific environmental safeguards and management measures;
- Any community/stakeholder complaints or non-conformances with licences/criteria, including any responses provided or actions undertaken in response to the complaint or non-conformance; and
- Any remediation actions or changes to management and mitigation measures.

6.2.1 Annual Environmental Management Report

The results of the rehabilitation management monitoring program will be presented in the Annual Review. This will include detailed assessment of monitoring results collected over the course of the annual monitoring program, an evaluation of any trends occurring across the site, and recommendations for management action. Through the Annual Review management actions may include:

- Refinement of rehabilitation management objectives and initiation of remedial action; and
- Alteration to monitoring frequency, parameters, or locations.

6.3 REVIEW

6.3.1 Review of Monitoring Actions

Any non-compliance identified during monitoring actions, of management and mitigation measures, will be highlighted and an environmental incident report will be completed. The non-conformance will be considered unresolved until:

- The non-compliance issue has been resolved;
- A new or revised procedure has been established and implemented;
- Training has been provided to relevant personnel/ sub-contractors; or
- Additional specific environmental management inspections are detailed in this rehabilitation management plan.

6.3.2 Review of Management Plan

This Plan will be reviewed as per Schedule 5 Condition 3 on the following basis:

- The submission of an incident report
- The submission of an Annual Review
- The submission of an audit report
- The approval of any modifications (unless the conditions require otherwise).

A review of the adequacy of site-specific environmental safeguards and management measures will be carried out by the Environmental Manager or delegate as required. This review will encompass site inspection and auditing reports as well as root cause assessments undertaken for any incidents reported.

6.4 TRIGGERS FOR REMEDIAL ACTIONS

A Trigger Action Response Plan (TARP) has been developed that describes triggers for when remedial rehabilitation actions would be implemented to achieve the rehabilitation measures and completion criteria described in this Plan (Table 9).

Table 9 Trigger, action, response plan

Aspect/ Category	Item	Risk Element	Trigger	Response
Landform Stability	1	Water management structures	Water management structures (pond banks, diversion channels) erosion &/or scouring	Undertake remedial actions such as amelioration, revegetation or alternative scour protection as required. For significant failures or repeat minor failures conduct review of design criteria and construction standards.
Growth Medium Suitability	2	Chemical and nutritional properties	Soil properties atypical for the surrounding landscape or alternative growth media atypical of intended specification	Undertake appropriate soil/spoil amelioration and revegetate as required.
	3	Growth medium depth	Growth medium depth (topsoil or other growth medium is less than 100mm in areas in the Growth Medium Development phase.	Top dress with additional suitable topsoil resource and /or medium if required. For repeat growth medium thickness issues conduct review of placement procedures and operational practices.
Vegetation Establishment	4	Uncontrolled entry of livestock or vehicles	Damage to vegetation caused by uncontrolled access by livestock or vehicles.	Conduct an inspection of the site. Undertake remedial actions such as fence installation or repairs, maintaining access tracks and sign posting.
	5	Planting success	Low survival rates (<80%)	Replant to achieve 80% native coverage
	6	Understorey species diversity	Understorey species diversity atypical compared to target vegetation community.	Undertake site assessment. Undertake remedial actions such as controlled burning, soil amelioration, reseeding and fertilising as required. For widespread low understorey diversity review seed/planting mix understorey species composition and seeding/planting rates. Review monitoring results to determine rates of successful establishment for various understorey species in seed/planting mixes.
	7	Tree and shrub species diversity	Tree and shrub species diversity atypical compared to target vegetation community.	Undertake site assessment. Undertake remedial actions such as controlled burning, soil amelioration, reseeding and fertilising as required. For widespread low tree and shrub diversity review seed/planting mix for tree and shrub species composition and seeding/planting rates. Review monitoring results to determine rates of successful establishment for various tree and shrub species in seed/planting mixes.

Aspect/ Category	Item	Risk Element	Trigger	Response
	8	Ground Cover	Total ground cover < 70% during Vegetation Establishment phase.	Undertake site assessment. Undertake remedial actions such as soil amelioration, soil aeration, reseeding and fertilising as required. For widespread low results for total ground cover review seasonal mixes and seeding rates.
	9	Weed levels	>50% cover of problematic weed species present.	Review if >50% cover will limit rehabilitation objectives. If needed, control problematic weed using methods such as removal, biological control, herbicide application and slashing. Treatment of infestations as appropriate to the species. Conduct follow up inspections to assess the effectiveness of weed management measures.
Ecosystem Development	10	Tree Density	Tree density is outside typical range for target vegetation community.	An inspection of the site will be undertaken by a suitably trained person. Undertake remedial actions such as cultivation or spraying to reduce grass competition, reseeding (for low density) and thinning (for high density) as required. For widespread tree density outside target ranges review seed mix tree species composition and seeding/planting rates. Review monitoring results to determine rates of successful establishment for various tree species in seed/planting mixes. Review seed bed preparation, weed/grass control and sowing/planting procedures.
	11	Ecosystem health	Composition, structure, function and vegetation integrity scores less than 50% of PCT benchmark	Undertake site assessment to determine deficiencies in ecosystem health based on BAM scores and field data. Undertake remedial actions such as controlled burning, soil amelioration, reseeding, fertilizing, spraying to reduce grass competition and pest control as required.
	12	Bushfire Resilience	Rehabilitation areas not able to recover in a reasonable time from effects of bushfire.	Conduct a rehabilitation assessment. Undertake remedial actions such as re-seeding affected area as required. Review bushfire management procedures particularly with a view to protecting young rehabilitation areas.
Fauna recolonisation	13	Vertebrate pest levels	Vertebrate pest species density causing significant damage to rehabilitation.	Consult with relevant government agencies to develop and implement appropriate vertebrate pest control program. Consider actions from relevant Threat abatement plans.

7 TRAINING

7.1 ENVIRONMENTAL INDUCTION

Environmental induction training will be delivered to all staff and subcontractors involved in the Project. This will be delivered by the relevant Boral personnel (e.g. Environmental Manager or delegate). This will include a component on environmental/what this Plan is for management and the associated controls and mitigation measures that will be implemented for the Project. All personnel will be required to sign an induction sheet, a copy of which will be maintained on site and appropriate records maintained.

Appropriate training and induction should include, but not be limited to:

- Raising awareness of on-site environmental management issues;
- Instruction and detail on how to report matters relating to ecology and rehabilitation to the site environmental representative or site manager.
- Providing information on the location and importance of EECs, threatened fauna species (and habitat) known to occur within the site (refer to Figure 3 in the FFMP);
- Providing information on the boundaries for any proposed vegetation clearing; and
- Training on procedures on encountering fauna (e.g. snakes)

7.2 SITE-SPECIFIC ENVIRONMENTAL TRAINING

Where identified by the Environmental Manager or delegate, additional site-specific training may be developed and implemented by the Project manager, delivered to relevant personnel/contractors as required regarding sensitive environmental issues. Specific training may include:

- Training in the use and location of spill kits; and
- Management and environmental incident response training.

8 CONTINGENCY PLANNING

8.1 EMERGENCY INCIDENT PLAN

Emergency incident planning will be as per the site Pollution Incident Response Management Plan (PIRMP) which has been developed to respond to uncontrolled discharges of fuels, oils and chemicals/unforeseen events as per EPL 11147 licence conditions.

Response procedures for protection of the water environment will aim to:

- Contain and control emergency incidents;
- Safeguard people on-site and offsite;
- Protect drainage paths and waterways;
- Minimise damage to the environment and property;
- Identify appropriate disposal techniques for contaminated soils and water; and
- Facilitate remediation of the environment.

Suitable containment and clean up materials will be maintained within easy and quick access.
All reporting will be in accordance with Boral's incident reporting management system. Similar complaints will be addressed through the site complaints register. Compliance with statutory requirements will be assessed through implementation of Boral's site audit program that is aligned to ISO 19011:2003. Results of the above-mentioned aspects will be used to ensure appropriate corrective actions are in place and to verify appropriate close out actions, follow up and reporting has occurred.

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