



Holcim (Australia) Pty Ltd

Dunloe Sand Quarry Landscape Management Plan

June 2021

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1. Introduction

This Landscape Management Plan (LMP) forms part of the Environmental Management Strategy (EMS) for Dunloe Sand Quarry. This LMP has been prepared to meet the requirements of the Minister's Conditions of Approval (CoA) outlined in Development Consent No. 06_0030, the mitigation measures outlined in MOD2 (GHD 2017), the Environmental Impact Statement (EIS) (Planit 2007), the Environment Protection Licence 13077 (EPL) and relevant legislation.

1.1 Aim

The aim of this LMP is to describe the rehabilitation and biodiversity management strategies, procedures, controls and monitoring programs to be implemented to prevent or minimise impacts and facilitate effective rehabilitation of Dunloe Sand Quarry during operational and post-operational phases.

1.2 Objectives

To achieve this aim, Holcim will:

- Rehabilitate areas identified in the Rehabilitation and Revegetation Management Plan (RRMP).
- Protect and manage land outside the approved disturbance areas.

1.3 Targets

The following targets have been established for the management of biodiversity and rehabilitation of Dunloe Sand Quarry:

- Screen the development from surrounding properties.
- Provide additional native habitat for flora and fauna through the creation of wildlife corridors.
- Protection and management of areas outside the disturbance areas.

Additional targets / completion criteria are included in the RRMP in Appendix A.

1.4 Consultation

Extensive consultation was undertaken with the local community during preparation of the EIS and MOD2. Any concerns identified by relevant stakeholders were addressed in the EIS and MOD2 mitigation measures which have been incorporated into this LMP.

As per CoA 27(a), Schedule 3, the Department of Industry (DoI), Office of Environment and Heritage (OEH) and Department of Primary Industries - Fisheries (DPI Fisheries) now all part of the Department of Planning, Industry and Environment (DPI&E) and Tweed Shire Council were consulted in relation to this LMP. The Community Consultative Committee (CCC) will be updated about the revised management plans at the next meeting.

A summary of the agencies' comments and the response is provided in Table 1-1 and evidence of the consultation is provided in Appendix B. DPI had no objection to the LMP and no response was received from DoI.

Table 1-1 Response to agencies comments

Agency comment	Response
Biodiversity and Conservation Division (previously OEH)	

Agency comment	Response
Revises the Landscape Management Plan to:	
Include the relevant qualifications and experience of the contributors to demonstrate compliance with Project Approval 27(a)	A letter dated 19/06/2009 from DPE approved the specialist who prepared the original Landscape Management Plan. As the current version is primarily a revision of the format, specialist input was not considered necessary.
Indicate in Table 2.1 that Project Approval Conditions 28 clauses (h) and (i) are addressed in Appendix C	The comment refers to the Koala Management Plan which is Appendix E. Conditions 28 clauses (h) and (i) in Table 2.1 updated to refer to Appendix E
Revises the Rehabilitation and Revegetation Management Plan to include Project Condition 28 in the list of conditions addressed	The Rehabilitation and Revegetation Management Plan was prepared by a previous consultant and is not able to be updated.
Revises the Koala Management Plan to:	
Replace references to sections and tables of other management plans with the relevant content being referred to in order to minimise potential errors resulting from subsequent management plan revisions or amendments	References to relevant sections of other plans is considered appropriate because it avoids duplication and possible inconsistencies when one section is updated but not the other. Reference to Section 5.4.1 updated to Section 5.4 Form A in Appendix F includes koala observations, it is also included in the Environmental Inspection Checklist
Include mapping of koala habitat, koala records and potential koala movement corridors (i.e. habitat links) within and adjacent to the subject land and along the haul road between the quarry site and the Pottsville Road intersection	Table 3-1 and Figure 3-3 provide a description and map of koala sightings (noting the Flying Fox symbols in the north west of Figure 3-3 should be koalas)
Acknowledge the possibility of infrequent koala movement during hours of quarry operation	The Koala Management Plan has been updated to indicate the possibility of koala movements during quarry operations
Identify the most likely areas of interaction between koalas and quarry vehicles (e.g. koala habitat links)	Section 1.2.1 of the Koala Management Plan identifies the most likely areas of interaction – along the haul road adjacent to koala habitat
Include a proposed amendment to the quarry induction process to include an explanation of the legal consequences of unauthorised clearing of native vegetation on the quarry site	A dot point added to control B1 in Table 4-1 of the Landscape Management Plan
Include provision of compensatory koala food tree plantings as a contingency measure in the event of unauthorised clearing taking place	Compensatory koala food tree planting included in Table 1 of the Koala Management Plan
Ensure the proposed monitoring methodology focuses on identifying areas of koala activity susceptible to road strike rather than attempting to identify temporal changes in koala densities	Koala monitoring revised to focus on identifying areas of koala activity rather than temporal changes in koala densities
Reduce the proposed koala road-strike threshold for management action from three koalas for the year to any koala at any time	Updated
Tweed Shire Council	
General comment:	

Agency comment	Response
The bulk of the overall management plan comprises material from between 2006 and 2016 and it is difficult to interpret which previous study or work the published content refer to	Initial ecological investigations were undertaken and reported in the approved 2006 RRMP. This document was then updated in the 2016 RRMP, and attached to this LMP, to reflect the change to revegetation around the ponds. The RRMP is included to provide the historical context of the ecology and rehabilitation work undertaken for the site. Further amendments to the LMP are not considered necessary.
Hours of operation are proposed as the key threat mitigating factor in relation to koalas and vehicle strike. This does not satisfactorily account for winter, when the acknowledged high risk times of dawn and dusk occur during these hours of operation	Section 3.2.2 of the LMP and Section 1.2.1 of the Koala Management Plan have been updated.
The plan should note that koalas can be on the ground at any time of day or night	Section 1.2.1 of the Koala Management Plan has been updated.
The plan should also identify the times of the year when risk is higher due to seasonal movements of young males, presence of females with back young and the concurrence of haulage times with dawn and dusk during winter as per above	Section 1.2.1 of the Koala Management Plan has been updated.
All actions in relation to koala sightings and quarry related vehicle strike are assigned responsibility to the 'Planning and Environment Manager – NSW'. The document needs specify what organisation this relates to	Unless otherwise stated, roles / positions detailed throughout the EMS and sub-plans, including the LMP and Koala Management Plan, are internal Holcim roles.
No specific actions are proposed in response to quarry related vehicle koala strikes	The LMP/ Koala Management Plan proposes an adaptive management approach to ensure any management measures implemented are targeted and will be effective in managing site-specific issues. There have been no records of koala vehicle strike during the site's operation. The adaptive management approach outlined in the LMP/Koala Management Plan will be informed by ongoing monitoring and reporting in relation to koala impacts. A new Section 1.6 has been included in the Koala Management Plan outlining potential management measures which could be implemented where vehicle strike impacts are experienced. Any measures to be implemented will be selected in response to the findings of the investigation into the incident (e.g. location, contributing factors such as non-compliance with site rules, etc.) and in consultation with local koala experts and Tweed Shire Council.
There is no obligation or accountability for quarry staff to record koala sightings	This requirement is included in Section 1.3 of the Koala Management Plan. This has also been included in an update to Table 1 in Section 1.5 of the Koala Management Plan ensuring these requirements are included in the site's induction material.

Agency comment	Response
3 koala strikes per year is too many for the endangered population to sustain	Table 1 in Section 1.5 of the Koala Management Plan has been updated to include: Quarry-related vehicle koala strikes reach or exceed three for the year recorded for any two (2) years in a rolling five (5) year period.
'Increased presence of koalas on haulage routes' is intimated as the likely cause for vehicle strikes. This is considered to be a premature and unfounded assumption	The wording referred to in Table 1 in Section 1.5 of the Koala Management Plan has been amended to reiterate that adaptive management will be required in response to both: - Increased occurrence of koala sightings on or nearby haul routes; and - Increased incidence of koala vehicle strikes as a result of quarry operations.

2. Environmental requirements

2.1 Legislation and guidelines

Legislation relevant to biodiversity and rehabilitation management includes:

- *Environmental Planning and Assessment Act 1979 (EP&A Act)*
- *National Parks and Wildlife Act 1974 (NPW Act)*
- *Biodiversity Conservation Act 2016 (BC Act)*
- *Fisheries Management Act 1994 (FM Act)*
- *Biosecurity Act 2015*
- *Pesticides Act 1999*
- *Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth) (EPBC Act)*

Further discussion of the above legislation is provided in the EMS, as well as the EIS and MOD2.

Guidelines referred to in the preparation of the LMP include:

- *The constructed Wetlands Manual, Volumes 1 and 2 (DLWC 1998)*
- *Policy and Guidelines: Aquatic Habitat Management (DPI 1999)*

2.2 Conditions of approval

The Development Consent conditions relevant to this LMP are listed in Table 2-1. A cross reference is also included to indicate where the condition is addressed in this LMP or other environmental management documents.

Table 2-1 Consent conditions relevant to the LMP

Condition No.	Requirement	Reference	
Schedule 3, Condition 1	Within 1 month of the date of approval of the Landscape Management Plan (see condition 27 below), the Proponent must:	Table 4-1	
	(a) Engage a registered surveyor to mark out the boundaries of the approved limits of extraction;		
	(b) Submit a survey plan of these boundaries to the Secretary; and		
	(c) ensure that these boundaries are clearly marked at all times in a permanent manner that allows operating staff and inspecting officers to clearly identify those limits.		
Schedule 3, Condition 25	The Proponent must rehabilitate the site to the satisfaction of the Secretary. This rehabilitation must be generally consistent with the proposed rehabilitation activities described in the documents listed in condition 2 of Schedule 2 and comply with the objectives in Table 5.		Appendix A
	Table 5: Rehabilitation Objectives		
	Feature	Objective	
	All areas of the site affected by the project	• Safe • Hydraulically and geotechnically stable • Non-polluting • Fit for the intended post-quarrying land use/s • Final landform integrated with	

Condition No.	Requirement		Reference
		surrounding natural landforms as far as is reasonable and feasible, and minimising visual impacts when viewed from surrounding land	
	Surface infrastructure	Decommissioned and removed, unless otherwise agreed by the Planning Secretary	
	Void lake	- Water retained on the site maintains long-term water quality objectives fit for the intended post-mining purpose - Water discharged from the site is suitable for receiving waters, aquatic ecology and riparian vegetation	
Schedule 3, Condition 26	The Proponent must: (a) rehabilitate and revegetate the 15 ha hectares of land identified in the EA (see the revegetation plan in Appendix 2); and		Appendix A
	(b) within 12 months of the commencement of quarrying operations, make suitable arrangements to provide appropriate long term security for the revegetation area to ensure it is managed for conservation purposes, to the satisfaction of the Secretary.		Table 4-1
Schedule 3, Condition 27	The Proponent must prepare a Landscape Management Plan for the project to the satisfaction of the Secretary. This plan must: (a) be prepared: - by suitably qualified consultants, including a specialist hydrologist, coastal engineer, wetlands ecologist and landscape architect; - in consultation with Council, DoI, OEH, DPI Fisheries and the CCC; and - in accordance with extant guidelines including the DoI's Constructed Wetlands Manual, Volumes 1 and 2 and the DPI's Policy and Guidelines: Aquatic Habitat Management, 1999;		This plan was updated by Ben Luffman (B.App.Sc. Hons). Refer to Table 1-1 for details regarding specialists.
	(b) be submitted to the Secretary prior to starting quarrying operations on the site; and		Completed circa 2009
	(c) include a: - Rehabilitation and Revegetation Management Plan; and - Long Term Management Strategy. The Proponent must implement the plan as approved by the Secretary. <i>Note: The Department accepts that the initial Landscape Management Plan may not include the detailed Long Term Management Strategy. However, a conceptual strategy must be included in the initial plan, along with a timetable for augmentation of the strategy with each subsequent review of the plan.</i>		Appendix A Appendix C
Schedule 3, Condition 28	The Rehabilitation and Revegetation Management Plan must include: (a) the rehabilitation objectives for the site and revegetation areas; (b) a description of the short, medium, and long term measures that would be implemented to: - rehabilitate and stabilise the site; - implement the revegetation strategy; and - manage the remnant vegetation and habitat on the site and in the revegetation areas; (c) detailed performance and completion criteria for the rehabilitation and stabilisation of the site and implementation of the revegetation strategy; (d) a detailed description of how the performance of the rehabilitation of the quarry and the revegetation areas would be monitored over time to achieve the stated objectives; (e) a detailed description of what measures would be implemented over		Appendix A and Appendix E

Condition No.	Requirement	Reference
	the next 5 years to rehabilitate and manage the landscape of the site and revegetation areas including the procedures to be implemented for: • progressively rehabilitating and stabilising areas disturbed by quarrying; • implementing revegetation and regeneration within the disturbance areas and revegetation areas; • protecting areas outside the disturbance areas, including SEPP 14 wetlands and SEPP 26 littoral rainforests; • vegetation clearing protocols; • managing impacts on fauna; • controlling terrestrial and aquatic weeds and pests; • controlling access; • bushfire management; and • reducing the visual impacts of the project; (f) a description of the potential risks to successful rehabilitation and/or revegetation, and a description of the contingency measures that would be implemented to mitigate these risks; (g) details of who is responsible for monitoring, reviewing, and implementing the plan; and (h) a monitoring and reporting program of the project's impacts on Koalas, including road strike, to the satisfaction of the Secretary; and (i) adaptive management options for managing impacts on Koalas, including specific impact triggers, developed in consultation with Council.	Appendix D
Schedule 3, Condition 29	The Long Term Management Strategy must: (a) define the objectives and criteria for quarry closure and post-extraction management; (b) investigate options for the future use of the site; (c) describe the measures that would be implemented to minimise or manage the ongoing environmental effects of the project; and (d) describe how the performance of these measures would be monitored over time.	Appendix C
Schedule 3, Condition 30	Prior to starting quarrying operations on the site, the Proponent must lodge a rehabilitation bond for the project with the Secretary. The sum of the bond must be calculated at: (a) \$2.50/m² for the total area to be disturbed and/or revegetated in each 5 year review period (see condition 31 below); and (b) \$1.50/m² for the total area of land previously disturbed and/or rehabilitated by the project, to the satisfaction of the Secretary. <i>Notes:</i> <i>If the rehabilitation and revegetation works are completed to the satisfaction of the Secretary, the Secretary will release the rehabilitation bond.</i> <i>If the rehabilitation and revegetation works are not completed to the satisfaction of the Secretary, the Secretary will call in all or part of the rehabilitation bond, and arrange for the satisfactory completion of the relevant works.</i>	Table 4-1
Schedule 3, Condition 31	Within 6 months of each Independent Environmental Audit (see condition 6 of schedule 5) excluding the inaugural audit, unless the Secretary directs otherwise, the Proponent must review, and if necessary revise, the sum of the rehabilitation bond to the satisfaction of the Secretary. This review must consider: (c) the effects of inflation; (d) any changes to the total area of disturbance; and (e) the performance of the rehabilitation and revegetation to date.	Table 4-1
Schedule 3, Condition 38	The Proponent must establish and subsequently maintain the vegetated buffer around the extraction area within 12 months of the date of this approval.	Appendix A

Condition No.	Requirement	Reference
	<i>Note: The vegetation buffer must be detailed in the Landscape Management Plan.</i>	
Schedule 5, Condition 1A	The Proponent must ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
	(a) a summary relevant background or baseline data;	Section 3
	(b) a description of: - the relevant statutory requirements (including any relevant approval, licence or lease conditions); - any relevant limits or performance measures/criteria; and the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 1.3 and Section 2.1
	(c) a description of the measures that to be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 4
	(d) a program to monitor and report on the: impacts and environmental performance of the project; and effectiveness of any management measures (see (c) above);	Section 5.2
	(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 5.3
	(f) a program to investigate and implement ways to improve the environmental performance of the project over time	Section 6
	(g) a protocol for managing and reporting any: - incidents; - complaints; - non-compliances with statutory requirements; and exceedances of the impact assessment criteria and/or performance criteria; and	Refer to the EMS Incidents will be reported in accordance with conditions 3 and 4 of Schedule 5
	(h) a protocol for periodic review of the plan.	Section 6
Schedule 5, Condition 1B	Within 3 months of the submission of: (a) an incident report under condition 4 below; (b) an Annual Review under condition 5 below; (c) an audit report under condition 6 below; and (d) any modifications to this approval, the Proponent must review the strategies, plans and programs required under this approval, to the satisfaction of the Secretary. The Proponent must notify the Department in writing of any such review being undertaken. Where this review leads to revisions in any such document, then within 6 weeks of the review the revised document must be submitted for the approval of the Secretary. <i>Note: The purpose of this condition is to ensure that strategies, plans and programs are regularly updated to incorporate any measures recommended to improve environmental performance of the project.</i>	Refer to the EMS

3. Existing environment and impacts

3.1 Existing environment

A Flora and Fauna Assessment completed in 2006 identified, eleven (11) vegetation communities on the property, as listed below and shown on Figure 3-1:

- Community 1: Tall Closed Forest (Littoral Rainforest)
- Community 2: Very Tall Open Forest/Woodland (Blackbutt)
- Community 3: Tall/Very Tall Closed Forest (Brushbox)
- Community 4: Tall Closed Forest (Coastal Swamp Box with Littoral Rainforest understorey)
- Community 5: Mid-High Woodland (Banksia)
- Community 6: Tall/Very Tall Closed Forest (Paperbark)
- Community 7: Mid-high/Tall Closed/Open Forest (Paperbark/Swamp Oak)
- Community 8: Mid-high/Tall Closed/Open Forest (Swamp Oak)
- Community 9: Low/Tall Open Forest (Mangrove)]
- Community 10: Low/Mid-high Closed Grassland (Pasture)/Open Paddock with scattered trees
- Community 11: Very Tall Closed Grassland (Sugarcane)

The fauna survey of the site (and immediately adjacent areas) resulted in the recording of 71 species of bird, 8 reptiles, 7 amphibians and 17 mammals (or evidence of their presence).

3.2 Impacts

3.2.1 Flora

The flora survey of the site identified 152 species on site. The development of the quarry will result in the removal of vegetation contained within Community 10 (Grassland/pasture with scattered trees) within the approved sand extraction areas. It is considered that the development of these areas will not have a significant environmental impact to these flora species.

3.2.2 Fauna

The proposed development will result in a very minor loss (isolated trees / shrubs within paddocks) of fauna habitat.

The proposed vegetation removal / modification works are not considered to significantly impact upon the endemic fauna assemblage of the site or local / sub-regional populations.

A relatively low diversity of fauna was recorded or predicted to occur within the areas to be disturbed.

The quarry access road runs parallel with the northern Brushbox Forest (Community 3), which provides koala habitat. Potential impacts to koalas include unauthorised clearing of koala habitat and vehicle strike as a result of trucks and light vehicles accessing the Quarry.

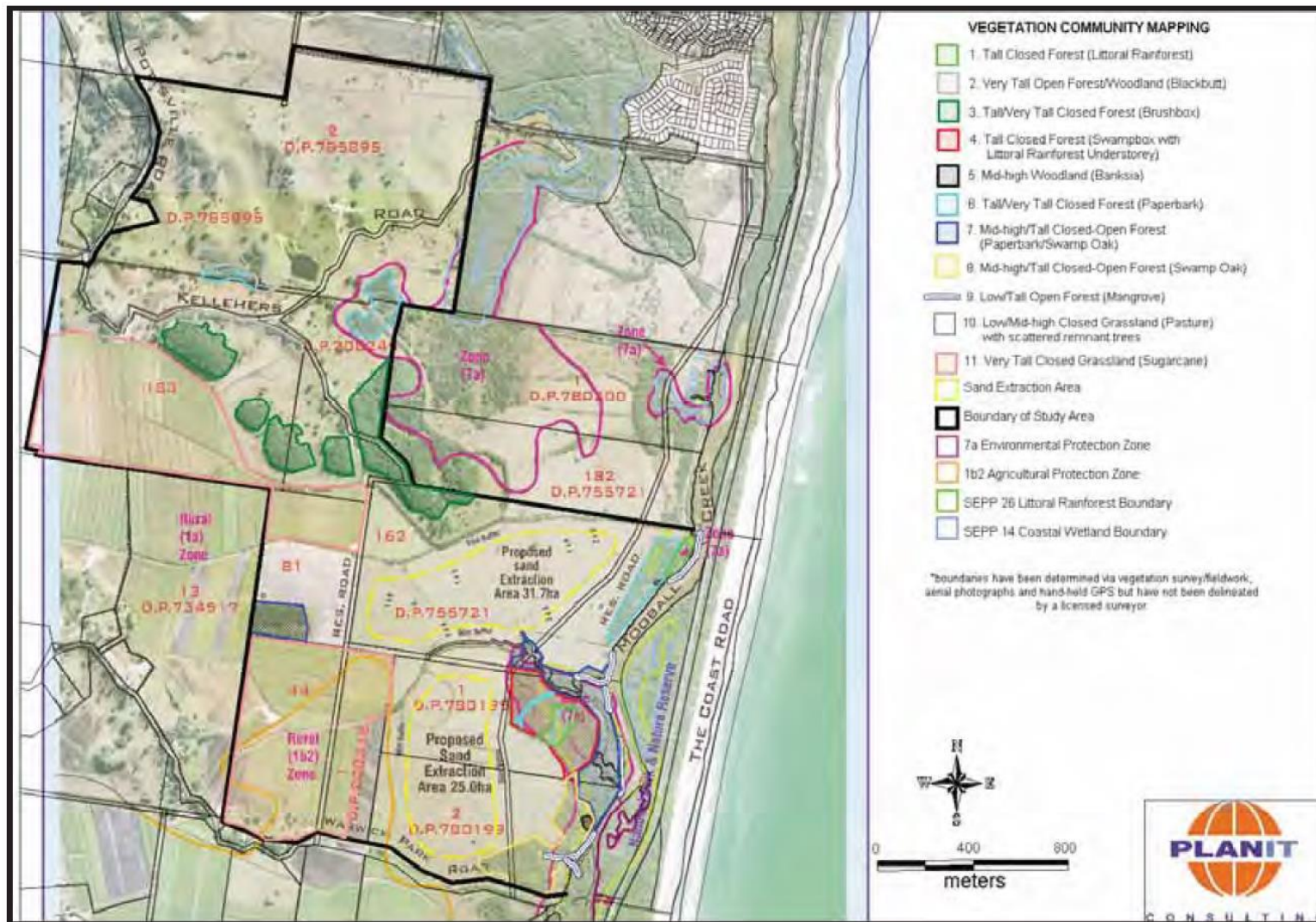


Figure 3-1 Vegetation communities

3.2.3 Threatened Species

Of the species identified on the property, six (6) species in total are identified as endangered under the *Threatened Species Conservation Act 1995*, as listed in Table 3-1 and shown on Figure 3-2 and Figure 3-3. It is considered that the proposal will not result in a significant adverse impact to these species.

Table 3-1 Threatened species

Species	Location	Status
Fauna		
Koala	NW corner of the site in association with Community 3 Brushbox Forest on Bedrock. Two individuals recorded via spotlighting.	Vulnerable
Grey Headed Flying-fox	All areas where melaleuca, Eucalypts and Banksias. Predominately eastern forests adjacent Mooball Creek.	Vulnerable
Little Bentwing Bat	Eastern forests on sand (predominately Littoral Rainforest, Swampbox Forest on sand, Paperbark Forest [Communities 1, 4, 6] and also NW Brushbox Forest on bedrock [Community 3]	Vulnerable
Flora		
<i>Cryptocarya foetida</i>	Littoral rainforest, usually on sandy soils, but mature trees are also known on basalt soils.	Vulnerable
<i>Syzygium moorei</i>	Two planted specimens (~3 m in height) recorded adjacent entry track to Lot 1 on DP208249. Both plants to be retained.	Vulnerable
<i>Lepiderema pulchella</i>	11-13 individuals (<3 m in height) and 2 mature flowering individuals (<10 m) recorded within Communities 1 and 4. As these communities will be retained and buffered in association with the development no impact is expected.	Vulnerable

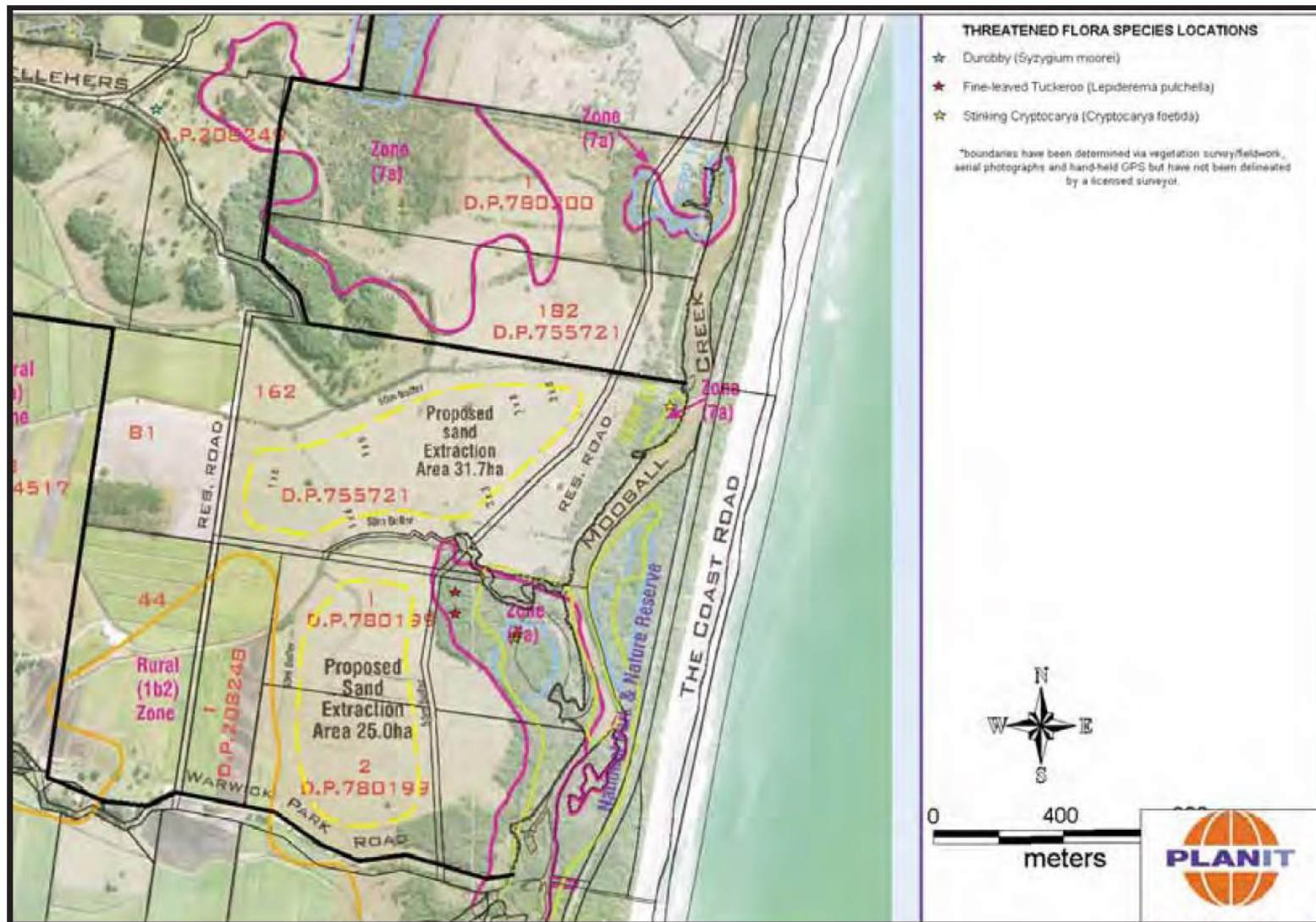


Figure 3-2 Threatened flora locations

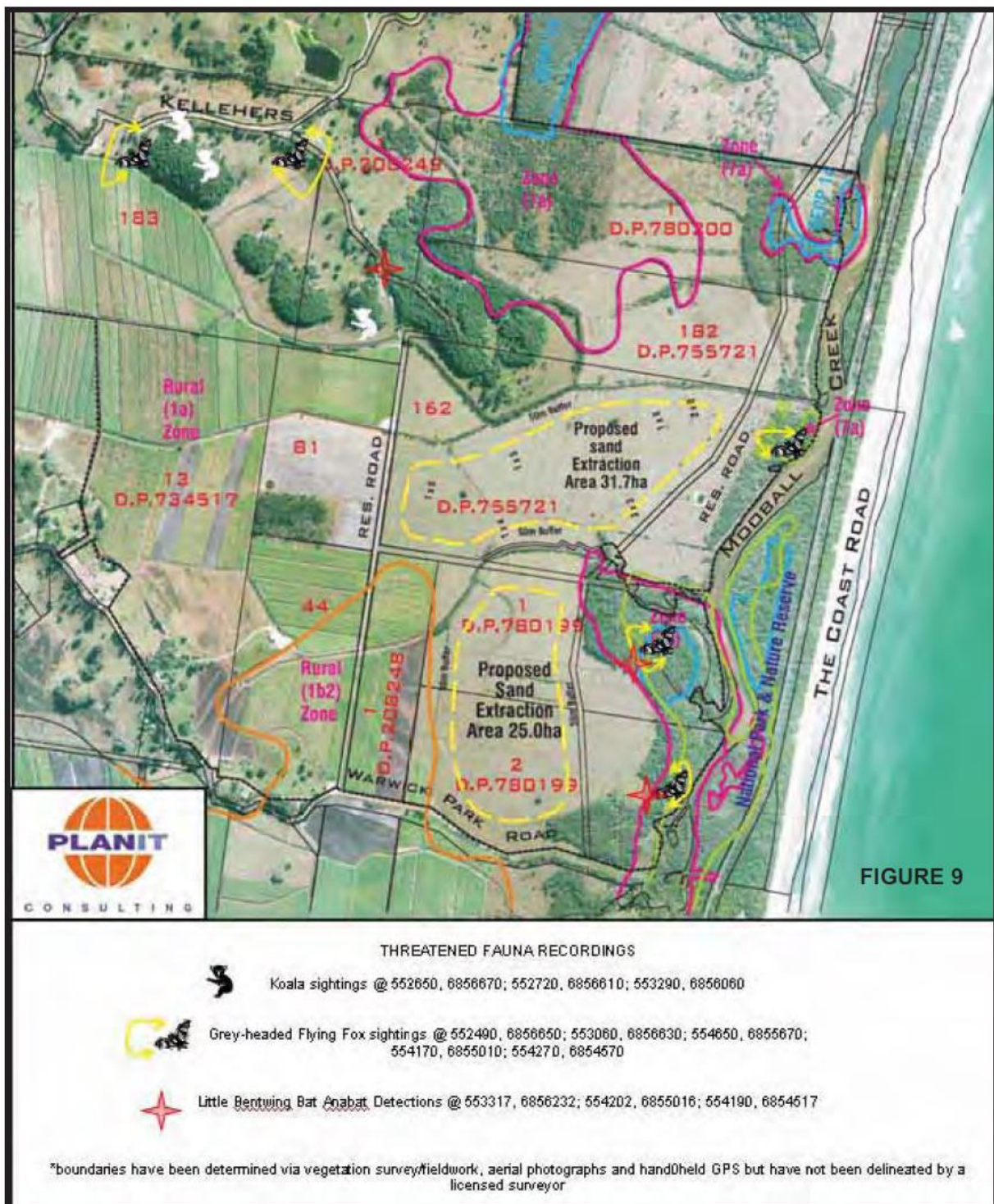


Figure 3-3 Threatened fauna recordings

4. Environmental control measures

Environmental requirements and control measures are identified in the CoA and the EIS. Specific measures and requirements to address biodiversity and rehabilitation are outlined in Table 4-1.

Table 4-1 Environmental controls and mitigation measures

Ref.	Environmental Management Measure	Timing	Responsibility
B1	All employees and subcontractors will undergo site induction training relating to flora and fauna management issues, including: • Pre-clearing requirements • Fauna rescue requirements • Weed control measures • No-go areas • Unexpected finds procedure • Legal consequences of unauthorised clearing	Pre-operation and operation	Quarry Manager
B2	Engage a registered surveyor to mark out the boundaries of the approved limits of extraction and submit a copy of the survey plan to the Secretary. ensure that these boundaries are clearly marked at all times in a permanent manner that allows operating staff and inspecting officers to clearly identify those limits.	Pre-operation and operation	Quarry Manager
B3	Prior to starting quarrying operations on the site, Holcim will lodge a rehabilitation bond for the project with the Secretary. The sum of the bond must be calculated at: (a) \$2.50/m² for the total area to be disturbed and/or revegetated in each 5 year review period; and (b) \$1.50/ m² for the total area of land previously disturbed and/or rehabilitated by the project, to the satisfaction of the Secretary. The rehabilitation bond is to be reviewed within 6 months of each Independent Environmental Audit, excluding the inaugural audit, to the satisfaction of the Secretary – refer to Schedule 3, Condition 31.	Operation	Quarry Manager
B4	Implement the RRMP (Appendix A)	Pre-operation and operation	Quarry Manager
B5	Implement the Koala Management Plan (Appendix E)	Operation	Quarry Manager
B6	Within 12 months of the commencement of quarrying operations, the proponent will make suitable arrangements to provide appropriate long term security for the revegetation area to ensure it is managed for conservation purposes	Operation	Quarry Manager
B7	Implement the Long-term Management Plan (Appendix C) so at the completion of extraction, the infrastructure is removed and the site is rehabilitated to the satisfaction of the Secretary to ensure it is: • Safe • Hydraulically and geotechnically stable • Non-polluting • Fit for the intended land use and integrated in to the surround landform	Post operation	Quarry Manager

Ref.	Environmental Management Measure	Timing	Responsibility
B8	Install and monitor (refer Section 5) fauna boxes within the Rehabilitation Areas, including: • 2 x sugar glider boxes • 2 x cockatoo boxes • 2 x possum boxes • 1 x rosella/orikey box • 1 x microbat box • 1 x owl box • 1 x kingfisher box	Operation	Quarry Manager

5. Monitoring and reporting

5.1 Environmental inspections

Routine weekly inspections by the Quarry Manager (or delegate) will occur throughout the operational lifetime of the quarry to identify any ad-hoc issues such as weeds and pest animals using the *Environmental Inspection Checklist* in the Environmental Monitoring and Management Plan.

5.2 Monitoring

In relation to the LMP, routine weekly monitoring will be recorded on the *Environmental Inspection Checklist* in the Environmental Monitoring and Management Plan.

Specific monitoring of Rehabilitation Areas will utilise systematic visual monitoring to determine the success of the measures implemented and establishment of the rehabilitation areas. This data will be used to provide comparisons between monitoring efforts.

Monitoring requirements are adapted from the RRMP (Appendix A) and detailed in Table 5-1. The plot based monitoring forms (i.e., Forms C and D, Appendix F) are to be undertaken at all 13 permanent monitoring locations, as shown on Figure 5-1. The plot-less monitoring forms (i.e., Forms A and B, Appendix F) are to be undertaken within the whole area of each of the three Rehabilitation Areas or the 13 permanent monitoring locations.

Table 5-1 Rehabilitation area monitoring

Monitoring Requirement	Frequency	Details
Routine Rehabilitation Monitoring	Quarterly	See Form A (Appendix F)
Site Condition	Six Monthly	See Form B (Appendix F)
Revegetation / Forest Structure	Annually (end-calendar-year)	See Form C (Appendix F)
Floristic Composition	Annually (end-calendar-year)	See Form D (Appendix F)
Photographs at established photo points	Quarterly	See Figure 5-1
Fauna Box Monitoring	Six Monthly	See Fauna Box Monitoring Form (Appendix F)
Koala monitoring	On going	See Section 1.3 Appendix E

Thirteen permanent photo points have been established (Figure 5-1) where photographs will be taken at regular intervals to provide a visual indication of plant growth (height and extent) and weed presence. Photographs shall be taken at the SW, SE, NW, NE corners of each monitoring site.



Figure 5-1 Permanent photo points and monitoring locations

5.3 Contingency plan

Contingency plans are provided in the RRMP (Appendix A).

5.4 Reporting

The general reporting requirements are described in the EMS.

Annual reports summarising the findings of monitoring detailed in Section 5.2 will be prepared in Quarter 1 each calendar year for the previous calendar year. This summary report will be presented in the Annual Report (refer to the EMS).

All records will be:

- Maintained in a legible form.
- Kept for at least 4 years.
- Produced to any authorised officer of the EPA upon request.

6. Review and improvement

Continuous improvement of this LMP will be achieved in accordance with the EMS, through the ongoing evaluation of environmental management performance against environmental policies, objectives and targets.

The continuous improvement process is designed to:

- Identify areas of opportunity for improvement of environmental management and performance.
- Determine the cause or causes of non-conformances and deficiencies.
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies.
- Verify the effectiveness of the corrective and preventative actions.
- Document any changes in procedures resulting from process improvement; and make comparisons with objectives and targets.

Appendices

Appendix A – Rehabilitation and Revegetation Management Plan

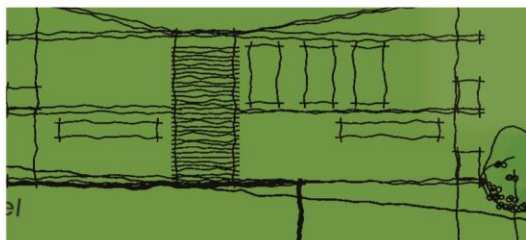


CONSULTING

REHABILITATION & REVEGETATION MANAGEMENT PLAN

DUNLOE PARK SAND QUARRY
KELLEHERS ROAD, POTTSVILLE

Prepared for RAMTECH Pty Ltd



Planit Consulting Pty Ltd
June 2016

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1.0 INTRODUCTION

This Amended Rehabilitation and Revegetation Management Plan has been prepared in response to the NSW Department of Planning conditions of Development Consent relating to an approved Sand Quarry Project located at Pottsville (refer Attachment 1). Specifically, this report addresses the requirements of Conditions 26, 27a and 29 of the Section 75J approval issued for the quarry. Also relevant to the preparation of the report are the previous findings and commitments of the previously prepared and submitted Flora and Fauna Assessment (Planit Consulting, 2006) and Rehabilitation Concept Plan (Planit Consulting, 2007) and the previously approved Rehabilitation & Revegetation Management Plan (Planit Consulting, 2009).

The progressive rehabilitation of the wider site throughout the lifespan of the sand quarry operations is a commitment made by Ramtech with the aim of providing for a well established and long term environmentally sound landscape at the completion of operational works of the quarry and visual buffering to adjoining properties throughout the lifespan of the project.

This Rehabilitation and Revegetation Management Plan outlines a program of staged rehabilitation of various areas of the site. These areas to be rehabilitated were previously approved within the development consent 06_0030. This plan shows a detailed commitment to revegetating previously disturbed areas to create and enhance wildlife corridors, protect riparian areas and ensure the stability of ground and surface water quality within the catchment of Mooball Creek. It is envisaged that the revegetation of the site can, where possible, through future evolving legislation, be implemented within the scope of a carbon offset program. It is noted that revegetation has already commenced in numerous zones in accordance with the approved Rehabilitation & Revegetation Plan (Planit Consulting, 2009). The purpose of this Amended Rehabilitation & Revegetation Plan is to incorporate minor changes regarding areas proposed to be rehabilitated and monitoring procedures, as well as future uses of the site after the project has ceased operation.

This document will outline the procedures for management and monitoring to achieve the objectives beyond the lifespan of the quarry operations.

Objectives of this Plan

- To ensure that rehabilitation works undertaken during the lifespan of the quarry continue to thrive following the completion of operational works of the quarry.
- To implement management and monitoring procedures throughout the completion of quarry operations to provide for a permanent, healthy, local ecosystem that successfully functions within the natural parameters of the existing, localised, vegetative communities.
- Upon closure of the quarry operations the rehabilitated and revegetated areas are considered well established and capable of thriving without the need for continuing works and management.

Potential future uses of the site following a lengthy lifespan project such as this are difficult to accurately predict. Many variables could occur that may dictate end uses such as State, Regional and Local Government, strategies, policies and legislation

changes and directions over time. The certainty is that the mitigation and remedial measures implemented during the operations and at the cessation of operations, as presented throughout the Environmental Management Plan (EMP) and this Plan, will ensure that the site will be remediated to the satisfaction of the company, the relevant Government agencies and the community, ensuring environmental quality in the locality.

Much of the existing areas of the site that are presently under environmental protection through zoning within the Tweed Shire Council LEP may remain under various legislated forms of environmental protection. Those areas of rehabilitated land (particularly those linking and expanding wildlife corridors) not within these protected zones, may overtime be included.

Similarly, agriculturally zoned lands within the site that will not be impacted by the sand quarry operations may remain under such zonings into the future.

The proposed use for the land surrounding the lakes is for agricultural purposes, in particularly the plantation of fruiting trees (i.e. avocado trees). More details regarding the proposed agricultural use of these areas are provided later on in this report.

2.0 SITE DESCRIPTION

2.1 LOCATION AND CURRENT USE

The following table identifies the allotments which comprise the total site area of the property. As described within table 1 below, the subject lots are considered to constitute 'the site' within this report.

Real Property Description	Lot Number	Plan Number
	Lot 1	Deposited Plan 208249
	Lot 182	Deposited Plan 755721
	Lot 183	Deposited Plan 755721
	Lot 44	Deposited Plan 755721
	Lot 81	Deposited Plan 755721
	Lot 162	Deposited Plan 755721
	Lot 2	Deposited Plan 780199
	Lot 1	Deposited Plan 780199
	Lot 1	Deposited Plan 780200
	Lot 2	Deposited Plan 785895
	Lot 13	Deposited Plan 73451
	Lot 1	Deposited Plan 785895
	Lot 1	Deposited Plan 208248
Address	Pottsville/Mooball Road, Pottsville	
Total Site Area	629.74 hectares	
Total Extraction Area	56.7 hectares	

The property is informally known and referred to as, 'Dunloe Park'.

The site is currently used for agricultural purposes (grazing of livestock) and Stage 1 of the Sand Quarry. All existing site improvements are associated with these agricultural uses, with the exception of existing dwelling houses as depicted in the aerial photograph and facilities/infrastructure associated with Stage 1 of the sand quarry.

In addition, the site currently contains the following:

- Maintained and intact boundary and paddock fencing
- Agricultural drainage lines running predominantly east west
- Small live stock water dams
- Internal access tracks for farm machinery movement.

Large agricultural sheds are also present which are utilised for the purpose of storage and ancillary maintenance of machinery and plant equipment associated with the quarry.

Access to the site is primarily provided from Pottsville Mooball Road and Kelleher's Road. Various unconstructed road reserves and dirt/gravel tracks provide access within the property. A dedicated ingress and egress facility occurs on Pottsville Mooball Road through to the quarry site via the haul road.

The site is large in extent (~630ha) and exhibits evidence of having been previously cleared in association with the historical farming uses (i.e. even aged/height canopies of existing vegetation communities). Evidence of logging on the upper slopes and ridges is also apparent with cut-stumps recorded and existing trees with bifurcated trunks regrown from older, larger stumps also noted. It is considered likely that a

previous selective logging cycle removing Blackbutt, Mahogany, Tallowwood and Turpentine has occurred with Brushbox left as a result of its lower timber production value.

The majority of the site is utilized for agricultural purposes (with the exception of the sand quarry). This historical and ongoing use has resulted in the construction of numerous paddocks (partitioned by barbed wire fencing, cattle grates, constructed drains etc) and rotational agriculture plots which are dominated by pasture grasses and associated herbaceous weed species (i.e. Fireweed, Blue Billygoat, Blady Grass etc). Remnant trees do occur within the paddock zones (Figs, Eucalypts) with regrowth Casuarina also common adjacent the constructed channels which drain the grazing/agriculture areas. One large dam is also present proximate to the farmhouse on the northern lot 2 with several small dams other dams scattered throughout the property.

Whilst the rural uses dominate the site, native vegetation communities occur in the form of regrowth Wet Sclerophyll Forest on the western upper slopes and a combination of Swamp Sclerophyll (Melaleuca, Casuarina) and Coastal Forests on sand (Swampbox, Littoral Rainforest, Banksia Forest) in the eastern areas adjacent Mooball Creek. An examination of the structural diversity of the lower strata of the recorded forests and review of the grazing use indicates that cattle have been largely excluded from the eastern coastal forests for the duration of their growth. The western sclerophyll forest patches, however, exhibit impacts of ongoing cattle grazing within the lower strata which have reduced typical structural and floristic diversity.

Portions of the eastern areas are nominated as being contained within the SEPP 26 (Littoral Rainforest) and SEPP 14 (Coastal Wetlands) designations. Such areas reflect the mosaics of Swampbox/Littoral Rainforest communities on sand and Melaleuca/Casuarina Forests/Swamps respectively.

2.2 APPROVED PROJECT DESCRIPTION

A section 75J approval has been issued under the Environmental Planning and Assessment Act 1979 to allow the sand quarry development. The relevant conditions of approval are contained within Attachment 2. A brief discussion of the major issues considered within the Environmental Assessment contributing to the approval of the development in 2008 are provided below:

EXTRACTION PROPOSAL

The development involves the staged extraction of sand from two proposed pond areas comprising at total of 56.7 hectares. The northern extraction pond (31.7ha) will form Stage 1 of the proposal; and Stage 2 will involve the extraction of sand from the southern pond (25ha). It is noted that Stage 1 works has commenced operations.

Mineral Resources within the two approved extraction pits total 6.88Mm³, including approximately 0.22 Mm³ of overburden. Computer modelling of a proposed pit design indicated that up to 6 Mm³ of sand products could be extracted from the proposed pits; processing of the sand would result in <100 000 m³ of fines requiring re-internment in the pits.

The approved development will ultimately yield approximately 230,000 cubic metres or 300,000 tonnes of sand per annum, with an anticipated lifespan of 26 years.

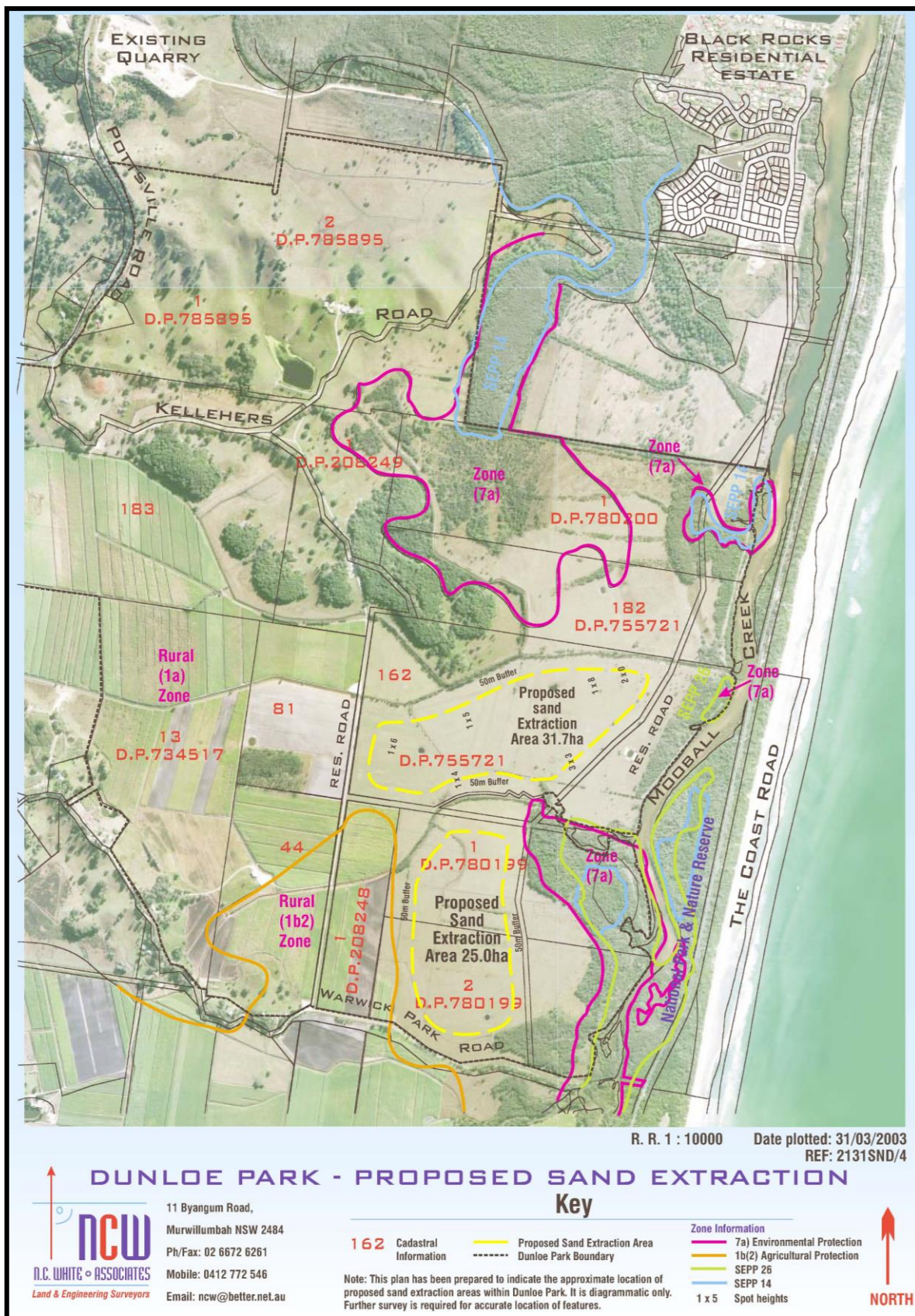


FIGURE 1: AERIAL PHOTOGRAPH

A relatively small works area has been established adjacent to the south western corner of extraction pond stage one (1), which contains the work plant and machinery, stockpiled material and a small building housing workers amenities and an administration area.

Results of soil testing have indicated that the sand resource is of a quality that is in line with Australian Standard 2758.1-1998 (Aggregates and Rock for Engineering Purposes) and is suitable for use in the manufacture of concrete. Calculations indicate that the *in situ* sand resource volume present within the proposed extraction areas, assuming 35% batters is approximately 6,000,000m³. The volume of overburden has been calculated at approximately 220,000m³. Of the estimated 6,000,000m³ of extractable material, 90,000 tonnes has been identified as being suitable for brickies loam. However, the latter was estimated from an area of only 4ha subject to investigations in this regard.

The approved development layout and extraction ponds are confined to areas containing mainly pastoral grasses, thereby avoiding disturbance to surrounding areas of wetlands and littoral rainforest. Approximately 17 hectares of the site will undergo revegetation to increase the flora and fauna links between the existing areas of vegetation on and adjacent to the site.

The approved development will see unwanted material and potential acid sulfate soils strategically re-inturned within the extraction ponds to limit chances for oxidation (below the watertable).

LAND USE AND CAPABILITY

The site is currently used for agriculture, primarily focused on livestock grazing, and the existing sand quarry (Stage 1). The site contains scattered and fringe areas of native vegetation bordering the site to the east and north and sugar cane fields to the south and west. The site contains a majority of Class 3 & 4 agricultural lands with small areas of class 5 agricultural lands. The class 3 and 4 lands have been identified as generally suitable for grazing and pasture improvement only.

HYDROGEOLOGY AND GROUND WATER QUALITY

Existing and proposed ground water levels and quality have been modelled within the evolution of the development proposal. The modelling undertaken has predicted that groundwater quality or levels will not be affected by the proposal.

On going groundwater depth and quality monitoring will continue throughout and beyond the life of the operation.

SURFACE WATER

The site is located within the Mooball Creek catchment and Sheens Creek sub-catchment areas. Detailed flood modelling confirms that the proposal will have no significant impact upon existing drainage regimes within the catchment.



FIGURE 2: PREVIOUSLY APPROVED DEVELOPMENT CONCEPT (Total Rehabilitation Area 15Ha, exact location and extent determined in OPW Rehabilitation Plans)

Extraction operations have been designed in conformity with best practice environmental management procedures, including the use of appropriate sediment and water quality devices and the retention of ground cover in areas outside of the extraction ponds.

Sub stage top soil stripping is used to ensure the potential for erosion and sediment problems are limited. On going surface water monitoring will provide a safety net which will be present throughout and beyond the life of the operation.

NOISE

To mitigate noise levels, the dredge contains acoustical treatment when operating within the southern extraction pond. In addition, strategically placed earth mounds are constructed, all trucks on and off the site are to be fitted with residential mufflers and on site speed limits are restricted to 25km/h.

AIR QUALITY

Airborne particulate matter concentrations and dust deposition from the sand quarry have been predicted to exceed the relevant requirements prescribed by the Department of Environment and Conservation at three of the eight monitoring locations. In particular, exceedances are expected as a result of dust generated from the use of unsealed access roads by haul vehicles.

In order to meet the prescribed requirements, dust controls included sealing of the entire internal roadway length and planting of vegetated buffers. These have already been implemented.

FLORA AND FAUNA

A number of threatened species have been identified within the surrounding vegetated areas of the site with none being found, or expected to occur, within the previously disturbed areas of the site (including current/proposed extraction areas).

Rehabilitation measures implemented/proposed will provide increased flora and fauna habitat, additional food resources for identified threatened species, improved opportunities for breeding and dispersal and other benefits associated with returning ~17 hectares of cleared pasture to native vegetation.

No clearing of remnant vegetation is required in respect of the proposal, inclusive of haulage routes and operational areas. Removal of small areas of swamp oak and expansive areas of pasture will be necessary to facilitate the quarry use.

ARCHAEOLOGY

A heritage assessment focusing on both Aboriginal and non-Aboriginal heritage has been previously carried out, with no areas of concern identified. Recommendations stemming from the investigations undertaken include that in the unlikely event that any cultural material is exposed during quarrying operations, works that disturb soil or subsoils will cease immediately and government representatives from the Department of Environment and Conservation (now OEH) are to be invited to the site.

TRAFFIC AND ACCESS

Entry and exit from the site occurs via a single asphalted route. Entrance to the extraction areas are gained via the dedicated 'haulage track', before turning to the south along an unnamed road. The proposed exit route follows the same path. The haulage track connects with Pottsville Mooball Road for travel to and from the Pacific Highway. Connection to Pottsville Mooball Road is towards the northern extent of the site.

Traffic travelling to and from the site utilises the Pacific Highway, via the Cudgera Creek interchange.

The quarry relies on the use of Council road reserves adjacent to the extraction areas. All roads utilised within the quarry site is sealed.

VISUAL

A Visual Impact Assessment has been carried out in relation to the existing visual catchment. The site is located on low lying lands at the coastal end of the Mooball Creek catchment and Sheens Creek sub-catchment areas. Accordingly, on face value that appears to be potential for the site to be visually intrusive.

In particular, properties fronting the northern side of Warwick Park Road and the eastern side of Pottsville Mooball Road have been identified as being within a visual catchment that may be impacted upon by the quarry.

The closest dwelling house to the extraction areas is located at a distance of approximately 900m. Due to the undulating topography and the presence of existing vegetation surrounding Warwick Park Road, very few direct or unimpeded view lines are available to the proposed extraction area. Where direct views are available, it is considered that the ameliorating benefits of significant spatial separation and the inclusion of extensive screen and buffer plantings are sufficient to ensure that no unacceptable visual impacts are created.

WASTE

Solid waste generated on site is disposed of by licensed contractor and disposed of or recycled accordingly. Effluent generated by staff employed upon the site is pumped off site for treatment at a Council facility.

Fuel for machinery is currently stored off site. If in the future fuel is to be stored on site, bunding around the fuel storage will occur in accordance with conditions of consent.

SOCIO-ECONOMIC ASPECTS

A Socio Economic Impact Assessment has been prepared for the Sand Quarry. The sand quarry will produce quality sand over a 26 year period which is suitable for use in the manufacture of concrete, filling and brickies loam. The size and location of the sand quarry will enable the quarry to service the growth areas of not only the Tweed Shire, but also the Gold Coast Local Government Area to the north and Byron, Ballina and Lismore City Local Government areas to the south. It is anticipated that the population of the region will continue to grow over the life of the quarry.

It has been found that the Sand Quarry would have a positive economic impact upon the local economy extending over a twenty-six-year period. Total revenues have been estimated at \$117 million based on an assumed sales price of \$15 per tonne for processed sand. The proposal will have a measurable contribution to the local economy of \$47 million with an economy multiplier effect (2.7 X) of \$126 million on direct costs over the life of the quarry. The Sand quarry will also provide healthy competition and enable concrete batchers, landscapers and builders to source material from a second quarry within Tweed Shire.

As the quarry is located to the south of the Pottsville township, and as suitable mitigation measures are proposed to manage potential environmental impacts, no adverse impacts are anticipated upon surrounding residential areas.

Haulage of material is to be directed westwards to the Pacific Highway for destinations to the north and south of the quarry, and no traffic will be directed through the Pottsville Village.

In summary, the potential socio economic impacts arising from the proposal are of a positive nature and provide strong justification for the proposed development to proceed.

ESD AND CUMULATIVE ASPECTS

The principles of Ecologically Sustainable Development have been considered and underpin the evolution of the sand quarry. Ramtech Pty Ltd strongly support the requirements to limit cumulative impacts, support the precautionary principle, support social and intergenerational equity and the conservation of biological diversity and ecological integrity.

The sand quarry demonstrates adherence to these principles via the retention and regeneration of extensive, previously disturbed areas, the assurance of no impacts upon adjacent sensitive areas, the maintenance of existing groundwater quality and the adoption of management measures relating to air quality, acoustic management and traffic efficiency.

MITIGATION MEASURES AND ENVIRONMENTAL MANAGEMENT

An environmental management plan has been prepared and implemented for the development in accordance with the conditions of Development Consent and reflective of the numerous technical reports undertaken by various specialist consultants.

2.3 GEOLOGY, LANDFORM & TOPOGRAPHY

LANDFORM & TOPOGRAPHY

The majority of the development site is generally low lying with elevations ranging from <1.3m AHD towards the south western boundary to only a few metres above sea level in the south eastern corner of the proposed Extraction Area No.1. The north western corner of the site has levels in the vicinity of 3.3m AHD

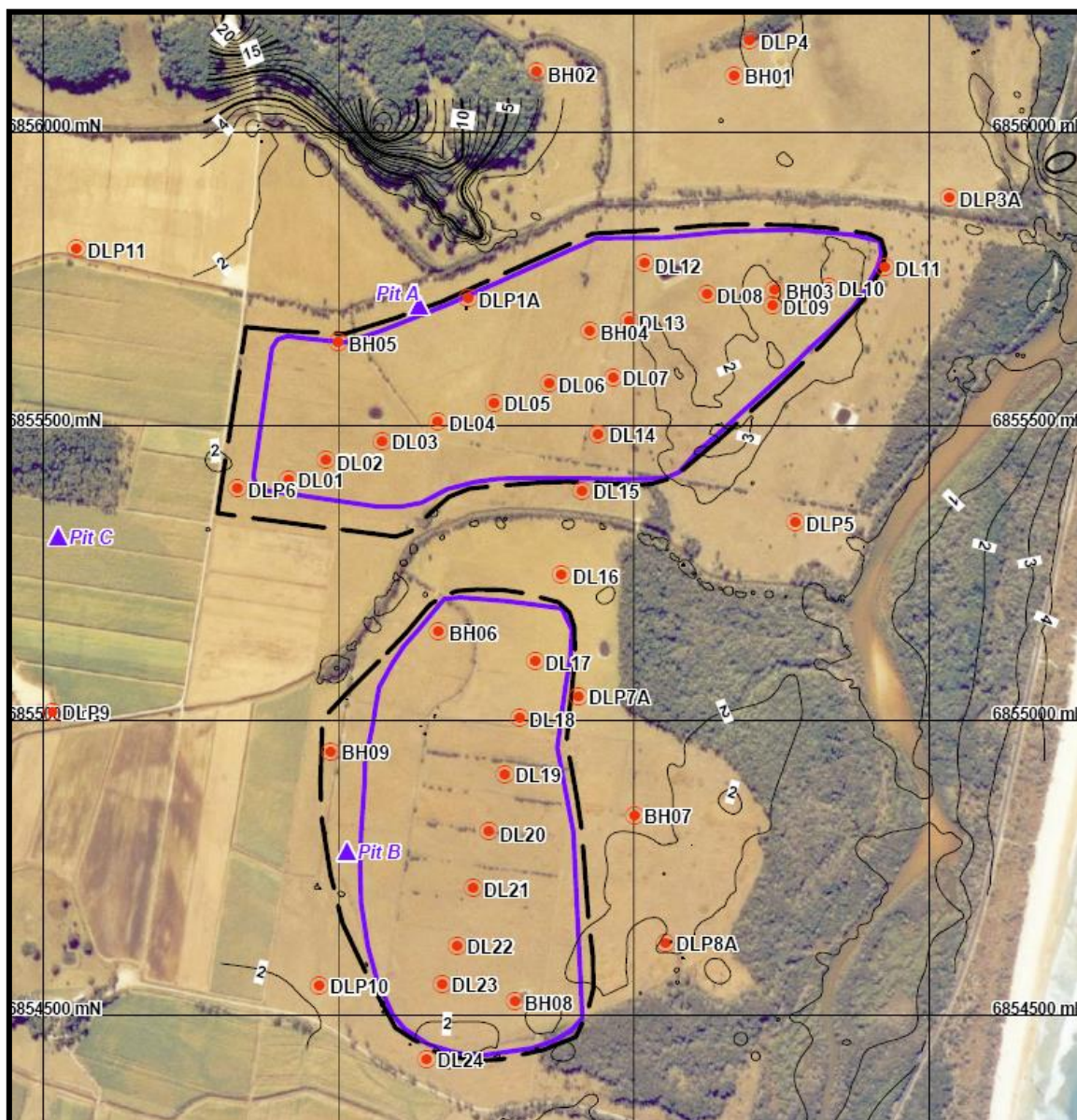


FIGURE 3: TOPOGRAPHY (SOURCE: GILBERT & SUTHERLAND, 2007)

The extraction areas proper are generally limited in elevation to between 1.3m AHD and 2.0m AHD. The subject site abuts elevated areas to the north (Kelleher's Road) and also to the south (Warwick Park Road). The Sheens Creek Catchment continues at a similar grade to the excavation area back to the Pacific Highway.

SITE GEOLOGY

As indicated by the previous soil assessments undertaken, the dominate soil order within the site is Podzols. The site is generally underlain by a uniform soil profile consisting of a small amount of topsoil (a silty sand of less than 0.3m depth), overlaying the resource of fine to medium grained sand of average depth 12m. Marine clay of variable thickness (0.5m to 5m) generally underlies the sand resource located at an average depth of 13m.

Generally, the topsoil materials are greyish brown to brownish black silty sands which grade gradually to very dark grey to yellowish grey, fine to medium sands. Top soil materials occasionally contained trace dark fine silt. Areas of brown/black indurated sands were encountered at depths between approximately 6m to 15m below natural ground level in sporadic location.

REGIONAL GEOLOGY

The Tweed 1:250,000 Geological Series Sheet identifies the topographically elevated ridgeline to the west and north of the site as outcrops of greywacke, slate, phyllite and quartzite (part of the regionally extensive Neranleigh Fernvale Group). The low-lying floodplain sections of the site generally consisted of unconsolidated deposits of river gravels, alluvium, sand and clay of Holocene age.

SOIL LANDSCAPE

As classified under the Great Soil Group Classifications (GSGC), the soil landscapes in the local area are defined as Kingscliff (variant) and Pottsville soil landscapes. Descriptions of soil landscapes in the local area were conducted by Morand (1996), the following general descriptions were noted.

- Kingscliff soil landscape variant (Kib) – These soil landscapes were identified throughout most of Lot 1 in DP755721, in the western half of Lot 1 in DP780199 and throughout most of Lot 2 in DP780199. This soil landscape typically consists of extremely low, level to gentle undulating Pleistocene sand sheet overlaying peat and alluvium. Soils are described as Podzols, are non-cohesive, highly erodible, permeable, have low fertility and are prone to water logging with high water tables.
- Pottsville soil landscape (po) – These soil landscapes were identified in the eastern portions of Lot 1 in DP755721 and Lot 2 in DP780199, adjacent to Mooball Creek. This soil landscape typically consists of poorly drained depressions within Pleistocene sand sheets and dunes. Pondered surface water is common, as is shallow (0.1m below NSL) water tables. Soils are described as poorly drained Podzols, Humus Podzols, poorly drained Humic Gleys and Acid Peats. Soils are non-cohesive, highly erodible and permeable, have low fertility and are prone to water logging and high water tables.



The underlying geological and upper soil layer units (above) are utilised in association with the existing vegetation of the site to determine regional ecosystem types (vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil [Sattler & Williams, 1999]). Analysis of the regional ecosystem types occurring within bushland on similar geology proximate to the rehabilitation areas can provide insight on what pre-clearing vegetation communities previously occurred and are likely to be successful if utilised within a revegetation project.

2.4 EXISTING VEGETATION COMMUNITIES

A detailed Flora and Fauna Assessment was undertaken over the Dunloe Park lands by Planit Consulting in 2006. This assessment described and mapped (refer Figures 5-7) eleven Vegetation Communities:

Community 1:	Tall Closed Forest (Littoral Rainforest) [T7D]
Community 2:	Very Tall Open Forest/Woodland (Blackbutt) [T8M/S]
Community 3:	Tall/Very Tall Closed Forest (Brushbox) [T7D]
Community 4:	Tall Closed Forest (Coastal Swamp Box with Littoral Rainforest understorey) [T7D]
Community 5:	Mid-High Woodland (Banksia) [T6S]
Community 6:	Tall/Very Tall Closed Forest (Paperbark) [T8D]
Community 7:	Mid-high/Tall Closed/Open Forest (Paperbark/Swamp Oak) [T6D]
Community 8:	Mid-high/Tall Closed/Open Forest (Swamp Oak) [T6D]
Community 9:	Low/Tall Open Forest (Mangrove) [T5M]
Community 10:	Low/Mid-high Closed Grassland (Pasture)/Open Paddock with scattered trees [G2D]
Community 11:	Very Tall Closed Grassland (Sugarcane) [G4D]

Of these communities, numbers 1, 6, 7, 8 and 9 are reflective of Endangered Ecological Communities all of which will be retained in association with the approved quarry development.

2.5 THREATENED FLORA SPECIES

Three threatened flora species were recorded onsite during the previous survey works (refer Figure 8):

Stinking Cryptocarya

8-10 individuals (<5m in height) were recorded within Communities 1 and 6. As these communities will be retained and buffered in association with the development no impact is expected.

Durrobbby

Two planted specimens (~3m in height) were recorded adjacent entry track to Lot 1 on DP208249. Both plants to be retained in association with the sand quarry.

Fine-leaved Tuckeroo

11-13 individuals (<3m in height) and 2 mature flowering individuals (<10m) were recorded within Communities 1 and 4. As these communities will be retained and buffered in association with the development no impact is expected.

2.6 EXISTING FAUNA

The fauna survey of the site (and immediately adjacent areas) resulted in the recording of 71 species of bird, 8 reptiles, 7 amphibians and 17 mammals (or evidence of their presence).

Of these species, three (Koala, Grey Headed Flying-fox, Little Bentwing Bat) are listed as vulnerable within the *Threatened Species Conservation Act 1995*.

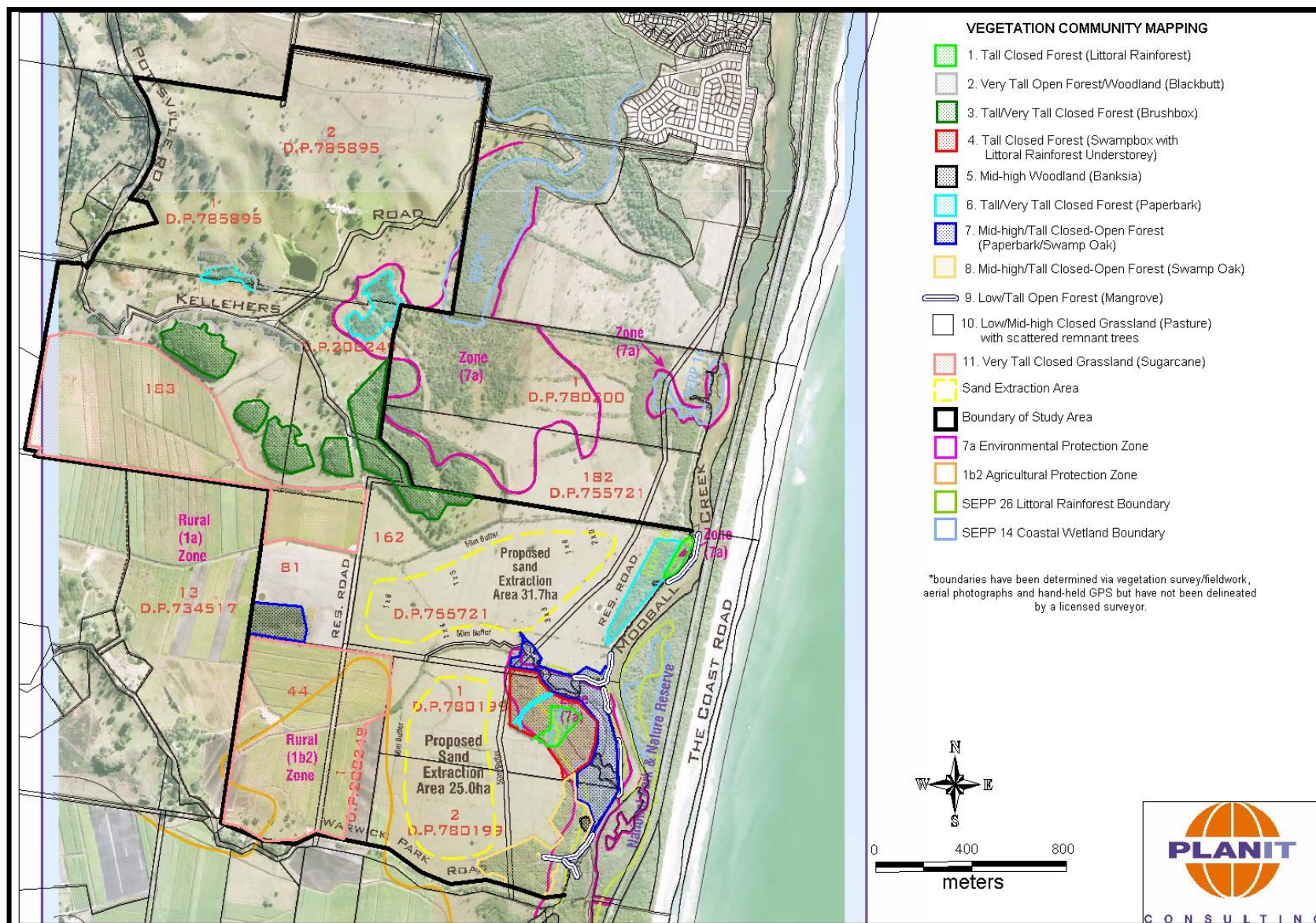
A Section 5A of the *Environmental Planning and Assessment Act 1979* (the '7-Part Test of Significance') was conducted for the three recorded species plus an additional three species which are considered possible occurrences on site and may have the potential to be impacted as a result of the proposal. Section 5A was also conducted for the recorded Endangered Ecological Communities. The assessment concluded that the impacts of the development are unlikely to threaten the viability of any local populations of the nominated species/communities. A species impact was therefore not required and the development was subsequently approved subject to conditions.

2.7 HABITATS AND COMMUNITIES OF SIGNIFICANCE

The areas of the site to be protected from development impacts contain several vegetation communities/ecosystems of significance which mostly occur in the eastern portions of the site adjacent Mooball Creek and the Wooyung Nature Reserve. These communities (interconnected eastern Communities 1 & 4-9) are considered to be of ecological significance as a result of one or more of the following:

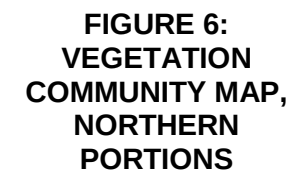
- Being a wetland environment (freshwater or marine)
- Representing riparian communities fringing Mooball Creek
- Being representative of a rare, vulnerable or endangered forest ecosystem (Upper Northeast Bioregion) or being a regionally significant vegetation community (Tweed Shire)
- Being representative of an Endangered Ecological Community
- Containing vulnerable or endangered plant species

As such, the development does not encroach into these areas nominated as being significant which are largely contained within the existing 7a zone and/or SEPP14/26 designations. Recommendations for management of weeds and revegetation to promote the continued viability of these ecosystems are incorporated within this report.

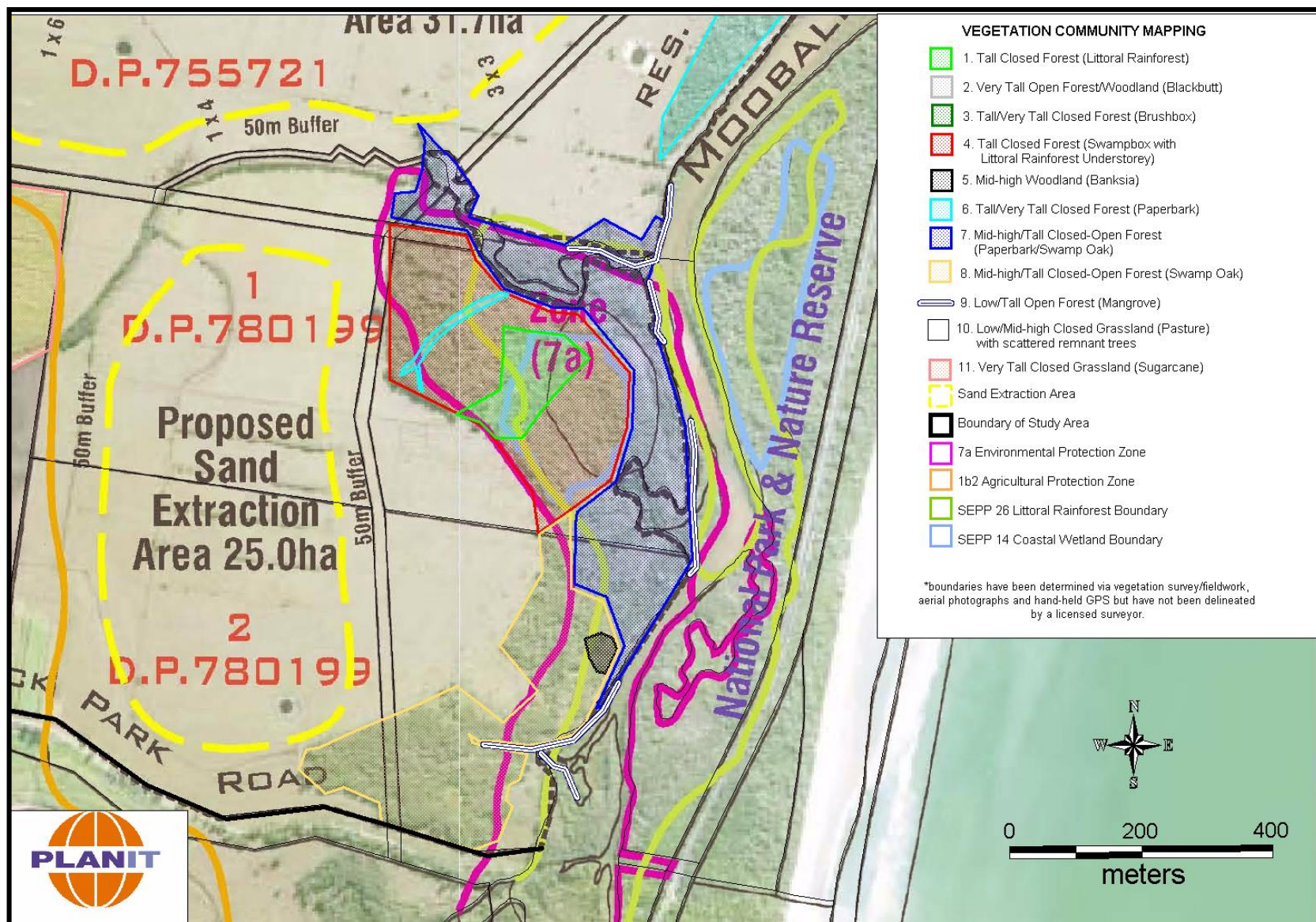


**FIGURE 5:
VEGETATION
COMMUNITY MAP**

**SOURCE: PLANIT
CONSULTING, 2006**

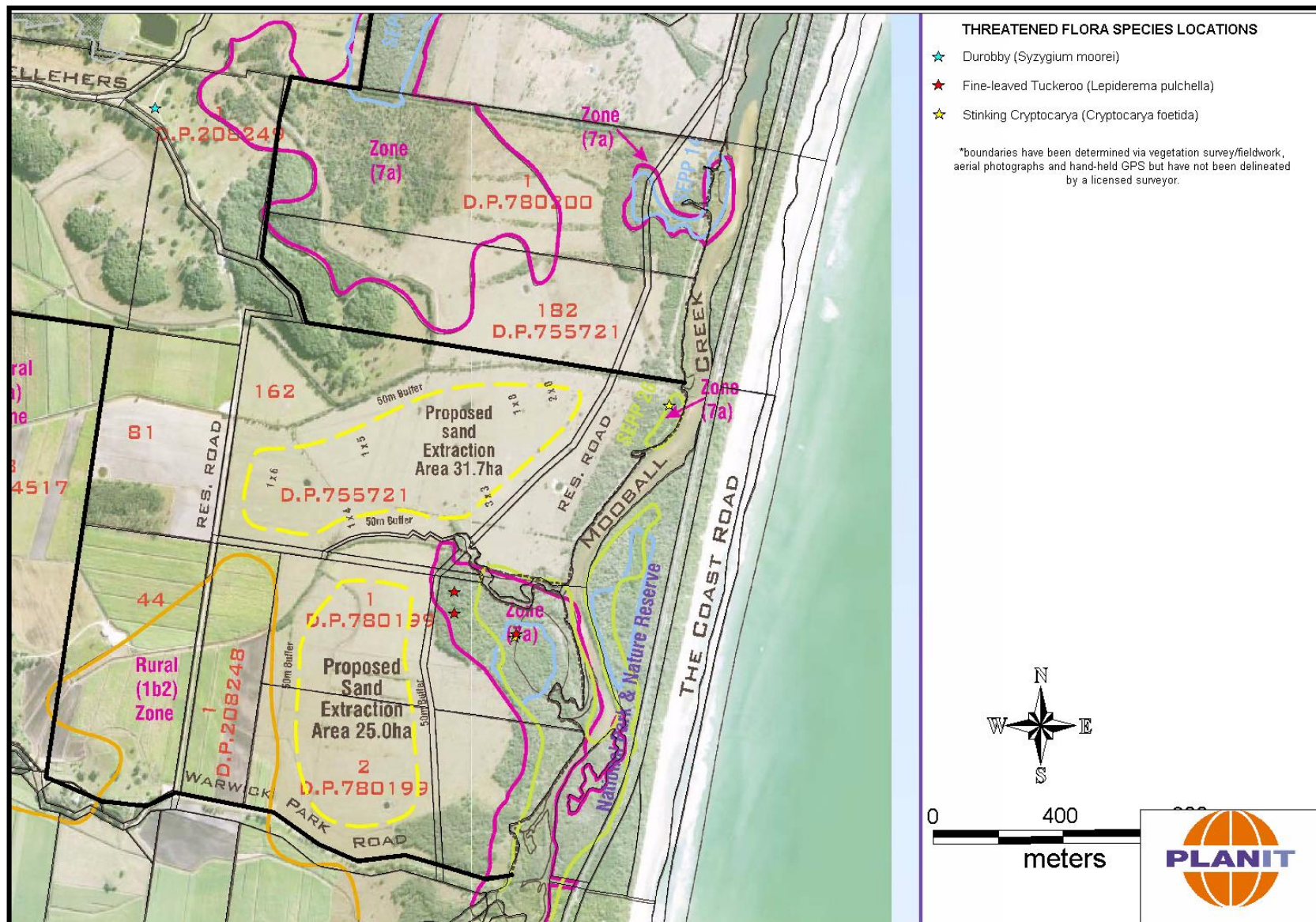


**SOURCE: PLANIT
CONSULTING, 2006**



**FIGURE 7:
VEGETATION
COMMUNITY MAP,
SOUTHERN
PORTIONS**

**SOURCE: PLANIT
CONSULTING, 2006**



**FIGURE 8:
THREATENED FLORA
RECORDS**

**SOURCE: PLANIT
CONSULTING, 2006**

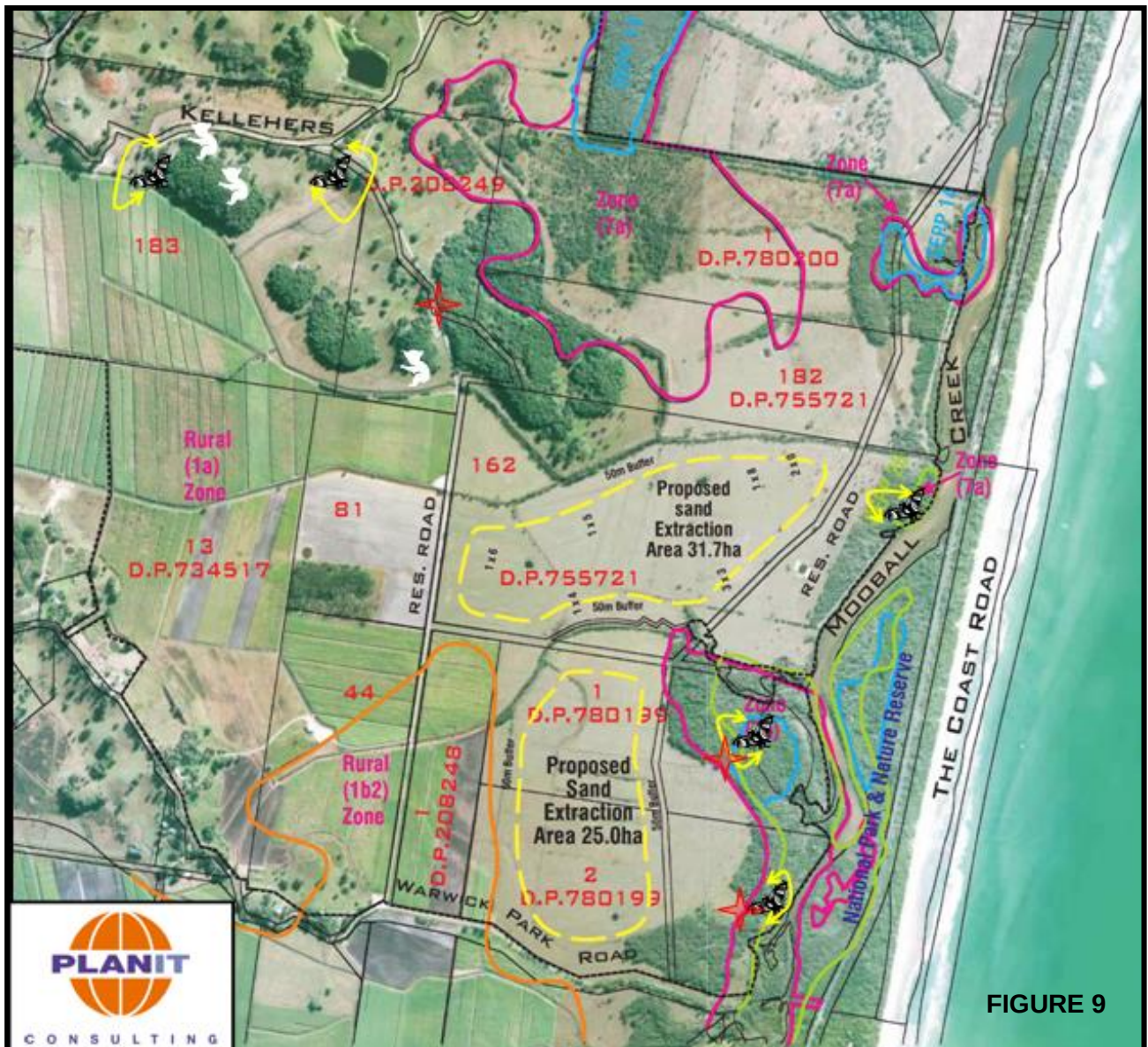


FIGURE 9

THREATENED FAUNA RECORDINGS



Koala sightings @ 552650, 6856670; 552720, 6856610; 553290, 6856060



Grey-headed Flying Fox sightings @ 552490, 6856650; 553060, 6856630; 554650, 6855670; 554170, 6855010; 554270, 6854570



Little Bentwing Bat ~~Anabat~~ Detections @ 553317, 6856232; 554202, 6855016; 554190, 6854517

*boundaries have been determined via vegetation survey/fieldwork, aerial photographs and handheld GPS but have not been delineated by a licensed surveyor

3.0 SITE REHABILITATION

Rehabilitation has been conditioned as part of the development to plant a partially vegetated buffer around the two extraction ponds and to also rehabilitate part of the site with native vegetation.

This landscaping has been carried out for the following reasons:

- To provide an effective, aesthetically appealing and practical vegetation buffer to the perimeter of the development; and
- To Rehabilitate selected areas within the overall Dunloe Park Land holding to consolidate and enhance the existing flora and fauna corridors to the north and east of the extraction areas.

A conceptual Revegetation/Rehabilitation Plan has been prepared by Planit Consulting which was approved as part of the Sand Quarry approval (refer Figure 10) and refined and implemented within the approved Rehabilitation & Revegetation Management Plan (Planit Consulting, 2009) which identified 15 hectares of land to be rehabilitated in accordance with Condition 27 of the Consent issued. In addition, a further 2ha will be provided along watercourses and a road within the site to provide wildlife linkage corridors between habitats of the site and locality.

REHABILITATION PROCESS

A long-term staged rehabilitation/revegetation process has also been derived and implemented for the 15ha required by the Development Consent (additional 2ha now provided) and associated approved concept plans. This strategy has chronologically focused upon assisting natural regeneration, plantings of pioneer species (to establish cover and suppress pasture weeds) and increasing floristic diversity. Additional actions to exclude cattle and increase foraging potential for threatened fauna has also be performed.

Planting initially begun on the western side of the development site and concentrated around the stockpiling locations and haulage routes and has now included Rehabilitation Zones 1-3 (as described within this report). Planting surrounding the extraction areas (proposed for agricultural use) will take place once extraction has ceased. This is due to the continuous need for accessibility (i.e. removing the dredge from the lake for servicing) which would be difficult with vegetated buffers surrounding the extraction lake during operation.

REHABILITATION SPECIES

A wide range of native species endemic to the area has been selected for the rehabilitation and buffer areas. In this regard Rehabilitation Zone No.1 has been revegetated (combination of 'assisted natural regeneration' and revegetation/landscaping) with endangered ecological community (EEC) Swamp Sclerophyll plus Eucalypt Open Forest species and EEC Coastal Wetland within the localised soaks.



Rehabilitation Zone No. 2 has been revegetated with a combination of EEC Swamp Sclerophyll, EEC Swamp Oak and Banksia open forest species with EEC Saltmarsh within a minor tidal extension zone of the existing paddock.



Rehabilitation Zone No. 3 has been revegetated with a combination of EEC Swamp Sclerophyll and EEC Swamp Oak open forest.

Rehabilitation Zone No.4 is proposed to be revegetated reflective of a Wet Sclerophyll Forest.

The shrub and small tree layer of all rehabilitated forest communities has also incorporated (via regeneration or revegetation) a reasonable diversity of EEC Littoral Rainforest species reflective of existing remnant communities and to expand foraging habitat for threatened flying foxes and rainforest pigeons.

The rehabilitation program over the ~17 hectares will be staged over a 10-15 year timeframe (commenced ~ 6 years ago for Zones 1-3) and will ensure that regular monitoring and maintenance will continue for the life of the extraction project.

An amended Rehabilitation and Revegetation Management Plan has been prepared within this document which expands upon the previously approved conceptual plans / Rehabilitation & Revegetation Management Plan and satisfies the relevant conditions of the approval issued relating to site rehabilitation. The main purpose of the amended

Rehabilitation and Revegetation Management Plan is to incorporate additional revegetation areas proposed (Zone No. 4) and the proposed future agricultural use surrounding the two lakes (i.e. avocado tree plantations).

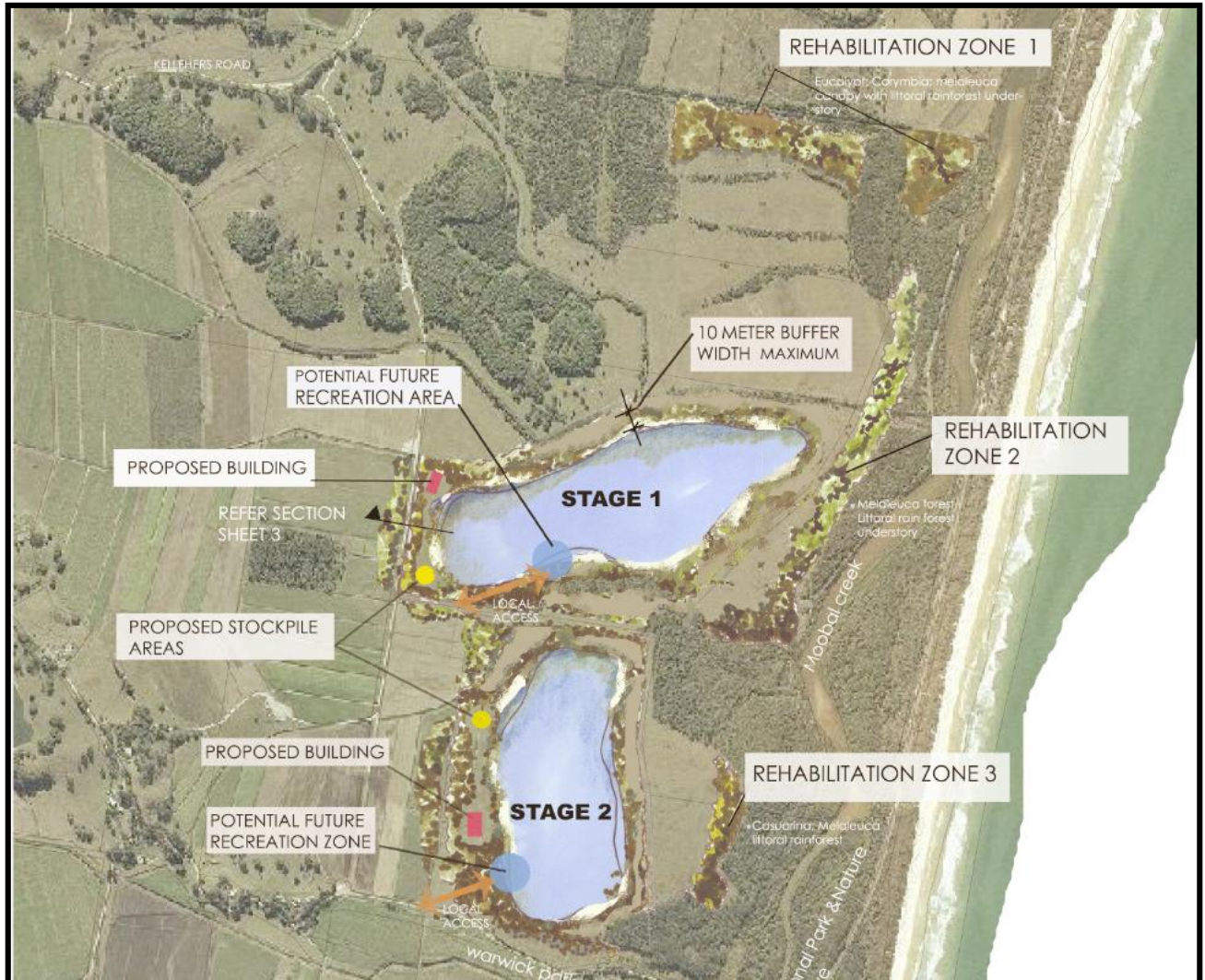


FIGURE 10: APPROVED REVEGETATION CONCEPT PLAN
(Total Rehabilitation Area 15Ha, exact location and extent determined in OPW
Rehabilitation Plans)

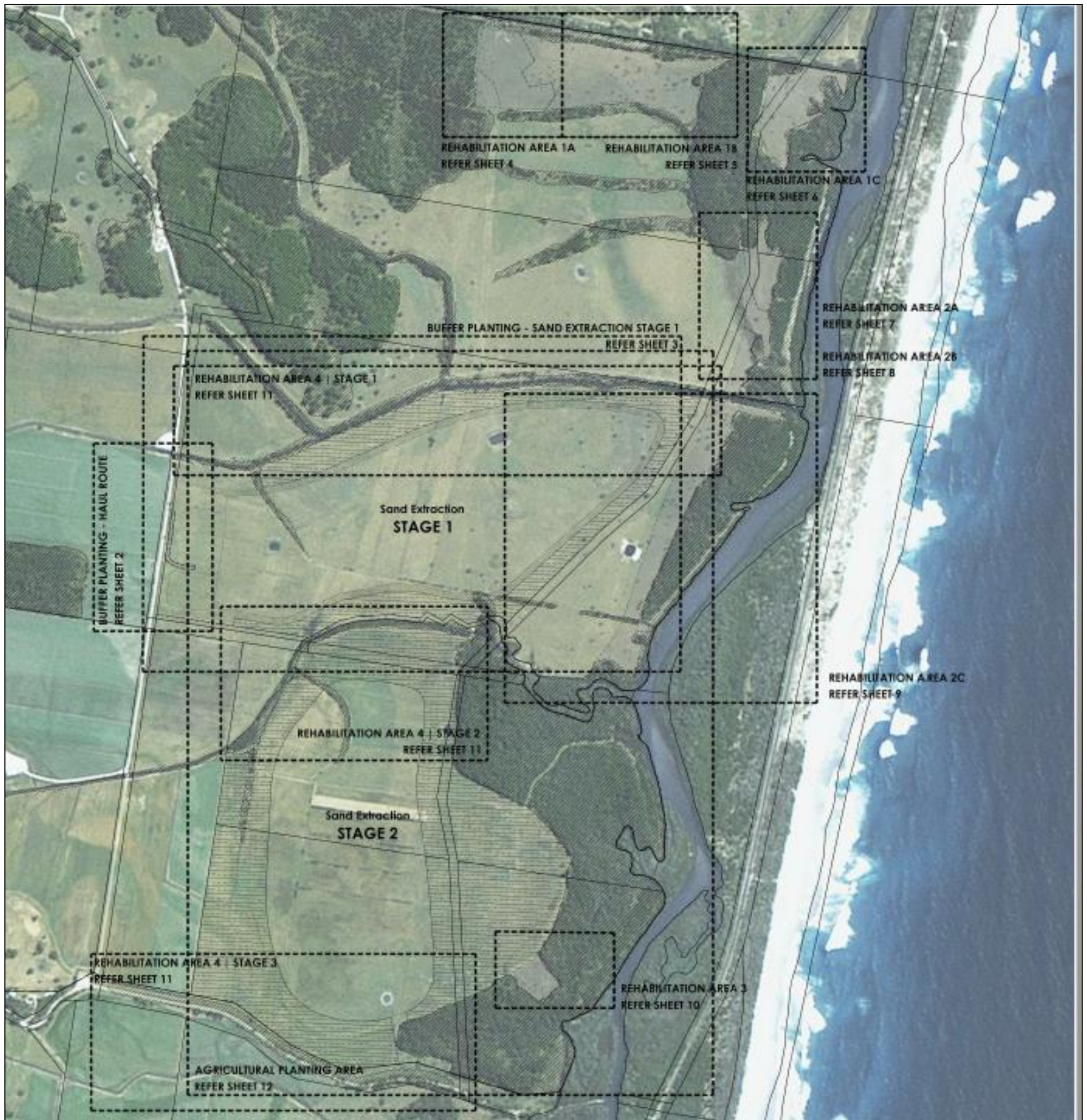


FIGURE 11: DETAILED REVEGETATION/REHABILITATION PLAN (ALSO REFER ATTACHMENT 3)

4.0 REHABILITATION STRATEGY

This Section outlines the Rehabilitation/Revegetation Strategy for the Environmental Protection Zones (EPZ) which has/will incorporate the following:

- **EXISTING VEGETATION COMMUNITIES:** Existing vegetation communities located external to the works area (refer Figure 5). The predominate management strategy for these zones will be the continued exclusion of cattle, monitoring and control of environmental weed infestations (to promote ongoing natural regeneration) and maintenance of existing fire trails
- **REHABILITATION ZONES:** The 17ha rehabilitation zone (Zones 1-4, refer Figure 11). A detailed staged rehabilitation/revegetation strategy for these zones is contained within the following sections of this report and focuses upon removing threatening impacts (i.e. grazing and weed invasion), managing natural regeneration and revegetation works to deliver the proposed vegetation communities. Targeted fauna habitat enhancement works have also been incorporated.

In accordance with best management practice, restoration and rehabilitation works sought to stabilize and reverse the negative effects of habitat fragmentation. Priority has been given to works which protect and expand larger remnants so that they are reintegrated into larger revegetated areas. This is based on the following ecological observations:

- Habitat fragmentation generally reduces the viability of both faunal and floral populations by restricting ranges of fauna below minimum levels and by preventing the natural exchange of genetic material which may ensure genetic vigour.
- Reconnecting fragmented landscapes into larger, (and, where appropriate, more consolidated) units by filling in gaps can increase habitat area and may improve linkages for passage of species. (The configuration of those linkages, however, will determine whether edge/area ratios reduce or increase.)
- Narrow corridor links may themselves be subject to feral predation, disease and species imbalances, therefore, the width of a corridor should exceed the extent of edge effects.
- Biological potential for diverse natural regeneration and expansion frequently exists in and adjacent to remnants. Investments which harness this potential usually provide higher ecological returns than reconstruction elsewhere (Greening Australia, 1999).

As such, the 17 hectares of site rehabilitation/restoration have been sited to close remnant canopy caps, re-connect existing fragmented remnants, increase the area:edge ratio of endangered ecological community remnants and provide/increase fauna habitat corridor widths.

- **BUFFER ZONES:** Visual buffer and extraction lake revegetation works (refer Figure 11). The strategy for these areas is the retention of the adjacent casuarinas buffers and landscaping of the visual buffer to the machinery compound areas. Such

revegetation was established within 12 months in accordance with condition 39 of the consent. On-going weed management and monitoring are routinely performed to ensure the long-term viability of the buffers. Revegetation of riparian plantings to the edge of the lakes would not commence until the cessation of extraction activities cease at each pond. This is necessary as ground anchors for the dredge are required to be set at the edge of the pond during extraction activities and moved around the pond perimeter from time to time as the dredging process dictates.

The below rehabilitation strategy has been prepared, implemented, and aimed to protect and enhance habitats retained within the EPZ.

It often takes a period of several years before the achievement of such aims are realised and as such it is of paramount importance that an appropriate strategy is derived and implemented in the initial phases of rehabilitation.

The primary objectives for the EPZ are quite simple and include:

- Retain significant existing communities (refer Figure 5)
- Retain and enhance existing fauna habitat
- Remove and manage processes potentially threatening the viability of existing remnants (refer Figure 5)
- Increase the extent of vegetation communities and potential fauna habitat over time (refer Figure 11)

Three management techniques will be implemented for the EPZs as follows:

EPZ	OVER-RIDING TECHNIQUE
Existing vegetation communities	Weed removal and ongoing monitoring only (no revegetation)
Rehabilitation Zones	Assisted Natural Regeneration
Buffers	Reconstruction

Weed removal and management is discussed within Section 4.1 below and will be undertaken where necessary within the existing vegetation communities in association with routine management.

The 17ha rehabilitation zone has been managed via Assisted Natural Regeneration (GCCC (2007)/Greening Australia (1999)) due to its location within a fragmented landscape and proximity to established native vegetation communities. Greening Australia (1999) notes that 'in or immediately adjacent to remnants, priority is given to facilitation of natural regeneration. In these locations, planting or direct seeding is only carried out where pre-existing species are incapable of colonization – and after a "rest" period sufficient to test natural regeneration. This is based on the following ecological and field observations.

- Natural regeneration potential can be surprisingly persistent in and adjacent to fragmented remnants.

- Natural regeneration maintains natural selection processes, can provide a wider range of site adapted species and genetic stock, demonstrates any capacity for future regeneration, and informs us about a site's regeneration dynamics and any pre-existing species requiring reintroduction.
- Planting can be more expensive, interfere with regeneration and compromise the genetic integrity and scientific value of a site. Planted stock may not regenerate if the species selection or genetic stock is inappropriate to the site.
- The mechanisms of recovery of individual species after natural disturbances (particularly whether they form persistent soil seed banks or not) can provide insight into the restoration approach needed. This determination can be improved by conducting preliminary trials to trigger germination from soil seed banks (e.g. using fire, smoke, tillage or irrigation as appropriate) - Such trials can also help to determine pre-existing plant associations more precisely.'

Cattle were excluded from portions of the 15ha rehabilitation zone (zones 1-3) in late 2008 to allow test trials of natural regeneration to be monitored with germination of pioneer canopy trees (melaleuca, callistemon, casuarina, lophostemon, banksias etc) noted.



FIGURE 12: EXAMPLE OF NATURAL REGENERATION DURING TRIALS IN 2008

A staged strategy (refer Section 4.0/4.2) which involves a combination of monitoring (and cattle exclusion & weed management) natural regeneration for a minimum period of 12 months, planting pioneer species (if needed) and supplementary planting (groundcovers and diversity plantings-if needed) has therefore been established (and implemented). This approach will ensure that establishment of endemic genetic flora is maximized over the life of the rehabilitation project.

In accordance with GCCC (2007) Assisted Natural Regeneration applies:

- To natural areas where the native plant community is largely healthy and functioning.
- When native plant seed is still stored in the soil or will be able to reach the site from nearby natural areas, by birds or other animals, wind or water.
- Where the natural regeneration processes (seedling germination, rootsuckering, etc.) are being inhibited by external factors, such as weed invasion, soil compaction, cattle grazing, mechanical slashing, etc
- When limited human intervention, such as weed removal, minor amelioration of soil conditions, erection of fencing, cessation of slashing, etc. will be enough to trigger the recovery processes through natural regeneration.
- When the major component is weed control.

As discussed above assisted natural regeneration will apply to the 17ha regeneration/restoration zones.

However, the buffer areas associated with the extraction lake and machinery/compound areas (refer Figure 11) are disjunct from native vegetation communities and are located in historical areas of intensive grazing and agriculture. Natural regeneration potential from these areas is considered minimal with growth of pasture species prevalent. As such, Reconstruction/landscaping were required in these areas. Such intensive planting of native species was also considered necessary to comply with Condition 39 of the consent which required the buffer areas to be established within 12 months. In accordance with GCCC (2007) Reconstruction applies:

- Where the site is highly degraded or altered
- When the degree of disturbance has been so great and long-standing that the pre-existing native plant community cannot recover by natural means.
- To sites such as areas of fill, sites affected by stormwater flow, and areas that have been drastically cleared, either mechanically or by stock even though there may be a few remaining native trees or shrubs.
- When a greater degree of human intervention is required, such as weed removal, cessation of grazing and/or slashing, amelioration of soil conditions such as importation of soils, drainage works or reshaping of the landscape.

- When a major component is the importation of native species through planting.

4.1 WEED MANAGEMENT STRATEGY

The following weed management strategy has been prepared for the EPZ. The intent of the strategy is to progressively remove weed species from these areas. Substantial research regarding weed management activities within areas of native bushland has been undertaken in this regard. The strategy presented has been adapted from the following sources:

- Bradley, J. (1988) *Bringing back the bush: The Bradley method of bush regeneration*. Lansdowne Publishing Pty. Ltd. The Rocks, NSW;
 - Buchanan, R. A. (1989) *Bush Regeneration: Recovering Australian Landscapes*. TAFE Student Learning Publications, NSW;
 - Robertson, M. (1994) *Stop Bushland Weeds: A guide to successful weeding in South Australia's bushland*. The Nature Conservation Society of South Australia Inc;
 - Greening Australia (1995) *Local Greening Plans: A Guide for Vegetation and Biodiversity Management*. Greening Australia, Canberra;
 - Department of Planning (1991) *Urban Bushland*. Department of Planning, Sydney.
 - Department of Environment and Heritage (1999) *Suggested Conservation Criteria for Development Assessment for use by Local Government Officers*. DEH, Brisbane.
1. Target areas of least disturbance and weed invasion and work towards the more weed infested areas.

Under these circumstances the indigenous species have the upper hand because their seed or spores are already in the ground and the natural environment favours the plants that have evolved in it (Bradley 1988). This method represents a significant reduction in follow-up time and related costs because the regeneration is more likely to comprise a higher proportion of native species. It is noted that this method is the EPAs preferred method of weed control (DEH, 1999).

2. Minimising the amount of soil disturbance will reduce the potential for a fresh weed invasion.

Weeding will cause some disturbance to the existing soil structure and layers depending on weed methods utilised (i.e. mechanical removal, hand removal). Disturbed soil should therefore always be returned as close as possible to its original layer and firmed down. This includes the mulch which is the first line of defence against a fresh invasion (Bradley 1988).

3. Let native plant regeneration dictate the rate of weed removal

The regeneration of native species is inversely proportional to increasing weed growth. Therefore, weeding should not automatically move into more degraded areas when less infested areas have been initially weeded. It is often better to simply wait for the less infested areas to regenerate before proceeding slowly into the worse areas. Clearing all infested areas at once causes extensive, additional follow up weeding works (refer Figure 13 below).

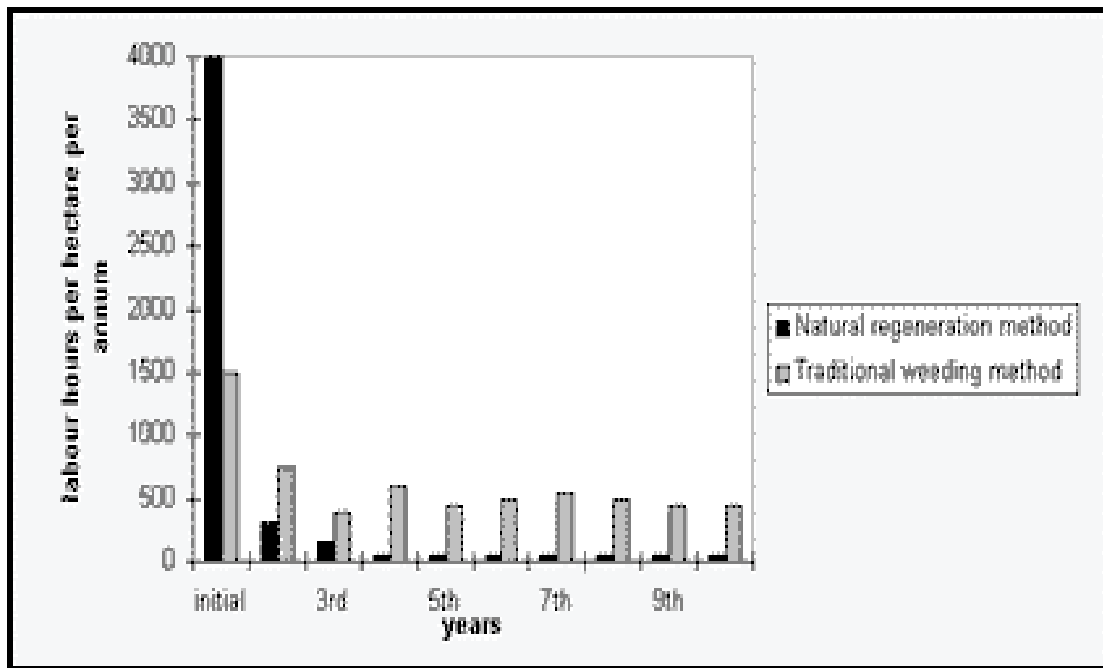


FIGURE 13 : Source - Ku-ring-gai Parks Dept. NSW, cited in Buchanan (1989)
Comparison of labour hours using traditional weeding and natural regeneration methods.

Implementing these principles into a weed management strategy begun by determining priority species and areas for management. In this regard, numerous inspections of the EPZs note the following with regard to weed presence:

EPZ	OBSERVED WEED PRESENCE
Existing Vegetation Communities	The existing native vegetation communities (refer Figure 5) contain minor elements of weed invasion, mostly on the perimeters or edges. Those recorded are described below: <u>Community 3: Tall-Very Tall Closed Forest (Brushbox) on Bedrock</u>: The highly fragmented nature of this community, ongoing grazing and proximity to pasture areas resulted in the recording of numerous weed species on the remnant fringe. Such species included pasture/exotic grasses (Couch, Kikuyu, Guinea Grass, Pigeon Grass, Paspalum), Fireweed, Mistweed, Billygoat Weed, Balloon Cotton, Mile-a-Minute, Camphor Laurel, Bitou Bush, Flatweed, Cobblers Pegs, Thistle, Sirato, Inkweed, Wild Tobacco and White Passionflower. <u>Community 4: Tall Closed Forest (Coastal Swamp Box with Littoral Rainforest understorey)</u>: Weed species were common in the western areas of the association adjacent to the open paddock/grassland grazing areas and included Lantana, Mile-a-minute, Groundsel and pasture grasses (Whisky Grass, Paspalum, Rhodes Grass etc).
Existing Vegetation Communities	<u>Community 5: Mid-high Woodland (Banksia)</u>: Weed species within this small forest patch included Lantana and pasture grasses (Whisky Grass, Paspalum, Rhodes Grass etc). <u>Community 6: Tall/Very Tall Closed Forest (Paperbark)</u>: The most common weed species noted were Camphor Laurel which was a quite common re-growth species within the sub-canopy layer and Bitou Bush and Mickey Mouse Plant in the shrub layer. <u>Community 7: Mid-high / Tall Closed-Open Forest (Paperbark / Swamp Oak)</u>: Weeds were present mostly within more recently disturbed areas adjacent to Mooball Creek or on remnant fringes and included Lantana, Groundsel, Camphor Laurel, pasture grasses, Umbrella Tree and Bitou Bush. The small western remnant also included common weeds in the ground-layer (pasture grasses [Couch, Kikuyu, Pigeon Grass, Guinea Grass] Fireweed, Crofton Weed, Mistweed, Billygoat Weed, Balloon Cotton, Mile-a-Minute, Camphor Laurel, Bitou Bush) <u>Community 8: Mid-high/Tall Closed-Open Forest (Swamp Oak)</u>: Weeds occupied a number of small patches within this community and mostly included Lantana, Groundsel, Bitou Bush and pasture grasses.
Rehabilitation Zones	All Rehabilitation Zones (with the exception of Zone 4) have been excluded of cattle for a number of years and regeneration is currently in progress. Prior to rehabilitation works, pasture grasses and herbaceous pasture weeds (i.e. siratro, cuphea, fireweed, purple top, bitou bush, flatweed) were observed.
Buffers	These areas contain pasture grasses and occasional herbaceous pasture weeds (i.e. siratro, cuphea, fireweed, purple top, bitou bush, flatweed). These areas have been 'reconstructed' concurrent with adjacent extraction works with continuous weed control occurring

Scientific Name*	Common Name	Recommended Treatment
<i>Panicum maximum</i> <i>Paspalum dilatatum</i> <i>P. conjugatum</i> <i>Setaria sphacelata</i> <i>Andropogon virginicus</i> <i>Chloris gayana</i> <i>Cynodon dactylon</i> <i>Pennisetum clandestinum</i>	Exotic/ pasture grasses	Spot spraying of clumps and hand removal of scattered individuals within rehabilitation zones. Routine spot spraying is to ensure that all foliage is wetted with Roundup Biactive [at a ratio of 1:100 [1 part glyphosate to 100 parts water]].
<i>Lantana camara</i>	Lantana	Spot spraying of Lantana with Roundup Biactive [at a ratio of 1:100] is recommended. Following treatment, Lantana is to be removed via hand and stored until complete browning out occurs. Note that removed biomass must be stored/hung off the ground to prevent re-shooting. Spot spraying is to ensure all foliage is wetted. Addition of surfactant PULSE (200 mL/100 L) to Roundup is recommended to improve Lantana control.
<i>Ageratum houstonianum</i>	Blue Billygoat Weed	Spot spraying with Roundup Biactive [at a ratio of 1:100]. Spot spraying is to ensure all foliage is wetted.
<i>Bidens pilosa</i>	Cobblers Pegs	Spot spraying with Roundup Biactive [at a ratio of 1:100]. Spot spraying is to ensure all foliage is wetted.
<i>Phytolacca octandra</i>	Inkweed	Spot spraying with Roundup Biactive [at a ratio of 1:100]. Spot spraying is to ensure all foliage is wetted. Following herbicide treatment, any individuals regenerating from taproots are to be removed by hand. Care to be taken to avoid skin contact with sap.
<i>Baccharis halimifolia</i>	Groundsel	Spot spraying with Roundup Biactive [at a ratio of 1:100] or hand removal is recommended. Spot spraying is to ensure all foliage is wetted. NOTE: If groundsel is seeding at any time, individual plants are to be removed via hand and bagged to prevent seed spread via wind.

<i>Cinnamomum camphora</i>	Camphor Laurel	Saplings of camphor laurel are to be treated via stem injection. 2mL of roundup bioactive is to be injected per cut. Juveniles sprayed with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Ageratina riparia</i>	Mistweed	Spot spraying with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Ageratina adenophora</i>	Crofton Weed	Spot spraying with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Conyza spp.</i>	Fleabane	Spot spraying Roundup Biactive [at a ratio of 1:100] (or hand removal for minor infestations). Spot spraying is to ensure all foliage is wetted.
<i>Chrysanthemoides monilifera</i>	Bitou bush	Mature stems to be treated via Cut-stump method. This will involve cutting the trunk at ground level and immediately swabbing the stump surface with Roundup Biactive. Juveniles sprayed with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Hypochoeris radicata</i>	Flatweed	Spot spraying with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Senecio madagascariensis</i>	Fireweed	Spot spraying with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.
<i>Passiflora subpeltata</i>	Passionflower	Hand removal of juvenile stems is recommended with cut-stump for larger specimens. Cut stump treatment will involve cutting the stem at ground level and immediately swabbing the stump surface with Roundup Biactive (1 part roundup: 2 parts water).
<i>Solanum mauritianum</i>	Wild Tobacco	Cut-stump treatment is to occur for mature stems. This will involve cutting the trunk at ground level and immediately swabbing the stump surface with Roundup Biactive. Spot spraying of juveniles with Roundup Biactive [at a ratio of 1:100]. Spot spraying is to ensure all foliage is wetted.
<i>Verbena bonariensis</i>	Purple Top	Given low leaf surface area of this species, if isolated plants occur (i.e. small numbers, not within an area dominated by other weeds) they are to be removed via hand.
<i>Gomphocarpus physocarpus</i>	Cotton Bush	Spot spraying with Roundup Biactive (at a ratio of 1:100) or hand removal. Spot spraying is to ensure all foliage is wetted.

* where herbicide treatment is required the use of Roundup Biactive has been predominately recommended. The active ingredient of this herbicide is Glyphosate isopropylamine which has been found to be non-toxic to frog tadpoles and generally does not require the use of additional surfactants. The use of surfactant is only recommended for *Lantana camara*.

RECOMMENDED APPLICATION TECHNIQUE FOR SPRAYING (Knapsack/Handgun Equipment)

The dilution rate is given as a ration (i.e. 1: 100 is 1 part Roundup Biactive: 100 parts water). Adjust equipment to achieve an even spray pattern. Apply to ensure complete and uniform wetting of all foliage. For handgun equipment, a D6 spray tip (Spraying Systems Australia P/L) or equivalent, and an operating pressure of 400-700 kPa is recommended.

Additional Recommendations: Surfactant

GENERAL GUIDELINES

Do not vary from the 200ml of Pulse per 100L of spray solution because as has been shown, this is the optimum rate for Pulse. Do not reduce the rates of Roundup as all trial work has shown that the recommended label rates of Roundup are needed to achieve control. AVOID EXCESSIVE AGITATION BOTH WHEN MIXING AND WHEN SPRAYING, AS FOAMING CAN OCCUR IF SOLUTION IS OVER AGITATED. Wear gloves and a face shield or goggles when handling Pulse undiluted as it is severely irritating to the eyes.

Mixing:

1. Half fill tank with water.
2. Add the correct amount of Roundup and mix.
3. Fill tank until almost full.
4. Add Pulse at the rate of 200ml per 100L of spray solution and mix.
5. Complete filling tank.
6. Mix.

RESTRAINTS ON USE

Pulse should not be added to Roundup as a general-purpose surfactant as some antagonism can occur between Roundup and Pulse on typically easy-to-kill grasses such as wild oats and Brome grass. Currently there are no other herbicides recommended for use with Pulse on the Pulse label. Users should check with the manufacturer before using any particular herbicide or other pesticide with Pulse. Pulse is not a general-purpose surfactant but rather a specific spray additive for Roundup herbicide for the improved control of brush and woody weeds.

RECOMMENDED APPLICATION TECHNIQUE FOR CUT-STUMP TREATMENT

Cut stump treatment will involve cutting the stem of the plant at ground level and immediately swabbing the stump surface with Roundup Biactive (1 part roundup: 2 parts water).

RECOMMENDED APPLICATION TECHNIQUE FOR STEM INJECTION

This shall involve use of an applicator calibrated to deliver 1 or 2 mL of Roundup Biactive per cut. 5cm cuts at 10-15cm centres around the trees circumference are to be made at an oblique angle to ensure penetration of the sapwood beneath the outer bark.

Referenced Material:

Mann, M. (2000) *Toxicological Impact of Agricultural Surfactants on Australian Frogs* (PHD Thesis). Curtin University of Technology, Perth

Nufarm Australia Limited (undated) Roundup Biactive Herbicide by Monsanto NRA Approval No. 48518/1102

Pulse Penetrant online @ <http://www.nrrbs.com.au/chemicalspulse.htm>

In association with the progressive removal of the nominated weed species from these areas, a revegetation/regeneration strategy should be selected to ensure that the newly weeded areas become established with native species. The regeneration strategies utilised on site are discussed below.

4.2 REVEGETATION STRATEGY

Revegetation of disturbed areas have been (or proposed to be) undertaken on site for the following reasons:

- To maintain the existing level of integrity of vegetation communities contained within the EPZ
- To maintain and potentially increase the floristic diversity currently exhibited within the EPZ
- To ensure that degraded and managed areas regenerate and are revegetated with native endemic flora species
- To stabilize areas subjected to weed management and cessation of grazing pursuits
- To restore cover, habitat diversity and dispersal options for the faunal assemblage
- To increase crown cover in open areas such that with the ongoing regrowth succession of the site there is potential for the existing communities to reach remnant status in the future
- To reduce the visual impact of the extraction use via the use of planted buffers.

In addition to the above, revegetation of the ~17 hectares of cleared/pasture areas is necessary to long-term protection to the retained vegetation communities (including riparian and endangered ecological communities) from existing edge effects and ongoing fragmentation including:

- Abiotic effects: those changes in light, temperature, humidity and wind that occur when a remnant edge is formed by the creation of new surrounding land uses, such as clearing land for grazing, agriculture or urban development.
- Direct biological effects: include changes in the number and abundance of species brought about by changed environmental conditions (e.g. the spread of species that adapt well to the altered climatic conditions, and the reduction in recruitment of species that do not prosper).
- Indirect biological effects: changes in the way species interact, particularly modified patterns of competition, pollination, and the dispersal of seeds (Greening Australia, 2000).

4.3 REVEGETATION TYPES

As suggested for the 17ha Rehabilitation Zone and the extraction Buffer Zones, the strategy of Assisted Natural Regeneration (with supplementary plantings where necessary) and Reconstruction (large-scale planting/revegetation) are the methods

that would prove the most feasible and effective. These types of strategies are outlined below in addition to the discussions previously offered in Section 4.0 above.

4.3.1 ASSISTED NATURAL REGENERATION (WITH SUPPLEMENTARY PLANTINGS)

Assisted Natural Regeneration (with supplementary plantings where necessary) has been implemented for the Zones 1-3 (and to be implemented within Zone 4). The entire 15ha was subdivided into three smaller zones based upon location (refer Figure 11). These three smaller zones were subdivided further based upon existing levels of natural regeneration (following the initial trials) and adjacent community types and have commenced regeneration procedures. Due to the large area of rehabilitation, each zone has also been broken into manageable units of 0.5-1 hectare. Similar approach is now proposed for Zone 4 which has been divided in three stages. These stages will provide linkages between existing habitats within and immediately external to the site, as well as providing a visual buffer.

The staging process shall/has occurred as follows and has been selected to maximize potential for natural regeneration of endemic flora:

NATURAL REGENERATION AND WEED MANAGEMENT

This management stage involved the following:

- Ensuring cattle are removed from the relevant rehabilitation zones/stages. Fencing shall only be necessary in the instance that cattle are grazing adjacent paddocks. If the adjacent paddocks are fallow then separate fencing is unnecessary.
- Monitoring and eradication of weeds as necessary
- Maintenance of fire trails

This process shall occur for a minimum of one year to five years (for later stages).

ASSESSMENT OF REGENERATION EFFORTS AND SUPPLEMENTARY PLANTING (PIONEER SPECIES)

This management stage has involved the following (and to be implemented within upcoming efforts):

- Assessing the success of the preceding natural regeneration to establish cover across the rehabilitation zone/stage.
- Where gaps in native cover occur, planting of pioneer trees and shrubs will be necessary in accordance with selected modules (refer Section 4.3.1.1). Pioneer species have been selected upon previous regeneration trials, adjacent communities intended to be replicated and ability for pioneer species to establish quickly and shade-out weed species. Establishment of quick growing species will bring forward flowering and attraction of fauna to the rehabilitation zone. Birds and bats are likely to then deposit flora seeds from surrounding areas
- Cattle, weed and fire trail monitoring and maintenance will be ongoing

This process shall occur over a period of one year.

ASSESSMENT OF REGENERATION EFFORTS AND SUPPLEMENTARY PLANTING (DIVERSITY)

This management stage has involved the following (and to be implemented within upcoming efforts):

- Assessing the success of the preceding natural regeneration and pioneer plantings to establish cover across the rehabilitation zone/stage.
- Assess the diversity of the flora assemblage to ensure a healthy mix of native species typical to the community being replicated is present (i.e. the community is not mono-specific except in intended areas).
- Where diversity is low, undertake diversity plantings from selected modules (refer Section 4.3.1.1). These species selected are based upon the existing adjacent vegetation communities, endemic littoral rainforest species and species suitable for threatened fauna foraging (in accordance with approved concept plans).
- Cattle, weed and fire trail monitoring and maintenance will be ongoing

This process shall occur over a period of two years.

ASSESSMENT OF REGENERATION EFFORTS AND SUPPLEMENTARY PLANTING (GROUNDCOVERS)

This management stage has involved the following (and to be implemented within upcoming efforts):

- Assessing the success of the preceding natural regeneration, pioneer plantings and diversity plantings to establish cover and floristic diversity across the rehabilitation zone/stage.
- Assess the occurrence of native ground covers within the across the rehabilitation zone/stage. In some instances, native groundcovers may be suppressed in association with early regrowth communities. If ground covers are not sufficiently established than groundcover planting from selected modules shall be performed.
- Cattle, weed and fire trail monitoring and maintenance will be ongoing

This process shall occur over a period of one year.

NATURAL REGENERATION AND WEED MANAGEMENT

This management stage has involved the following (and to be implemented within upcoming efforts):

- Assisted regeneration monitoring and maintenance (ongoing)
- Cattle, weed and fire trail monitoring and maintenance (ongoing)

This process shall occur for the balance of the project time-frame. Routine monitoring and maintenance (refer Section 4.4) shall be undertaken with corrective actions (refer Section 4.6) performed in incidences of non-compliance with set rehabilitation performance criteria (refer Section 4.5).

4.3.1.1 DESCRIPTION OF ASSISTED REGENERATION ZONES

As discussed zones 1-3 (initial 15ha rehabilitated) was subdivided into three smaller zones based upon site location. An additional area (zone 4) is now proposed to enhance linkages between existing habitats within, and immediately adjacent to the site. Each of these zones is described separately below with discussions provided regarding existing levels of natural regeneration (following trials), intended vegetation communities to be established and planting modules for supplementary planting (only required if regeneration is unsuccessful and to increase floristic diversity). It is noted that rehabilitation has commenced within zones 1-3 (mixture of both supplementary planting and natural regeneration) with additional revegetation areas now proposed for Zone 4 (refer 14). Furthermore, areas surrounding the two extraction lakes are proposed for future agricultural use (i.e. plantation of fruiting trees).

The following has been prepared and implemented within the rehabilitation zones:

REHABILITATION ZONE/AREA 1:

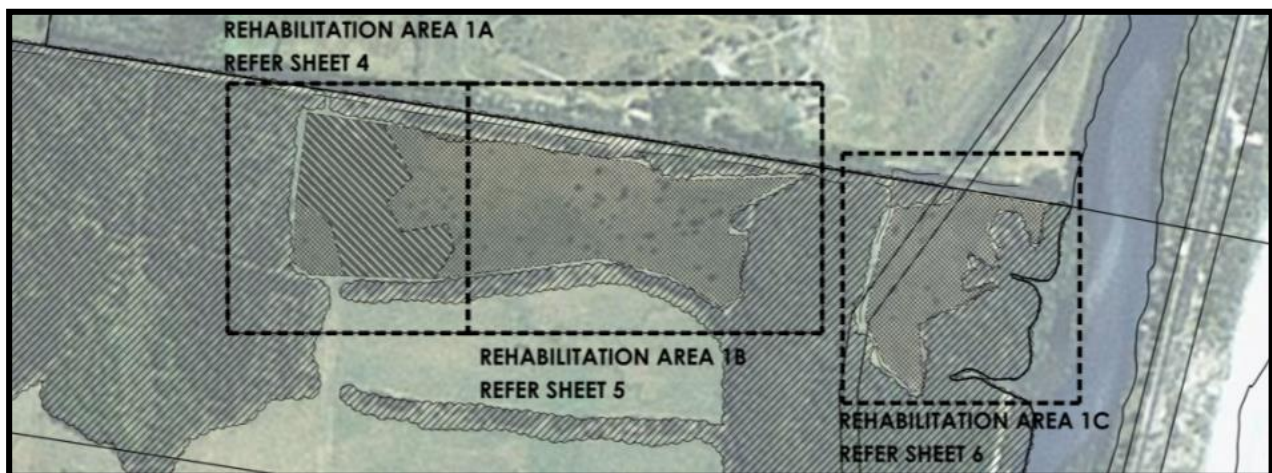


FIGURE 14: REHABILITATION AREA/ZONE 1

This rehabilitation zone covers 8.9 hectares and consolidates a fragmented corridor of swamp sclerophyll endangered ecological communities and wetlands located in the northern areas of the site. Cattle have been excluded from this zone to allow rehabilitation. Species noted include Paperbark, Swamp Oak, Swamp Mahogany, Corkwood, Swampbox, Banskia, Hovea, Hatpins, Pennywort, Blady Grass, Bunchy Sedge and Sundew. Wetland plants are also common with a low-lying soak in the west of the zone managed for Freshwater Wetland Endangered Ecological Community (EEC) regeneration.



**FIGURE 15: BEFORE AND AFTER REHABILITATION IMAGES OF
REHABILITATION AREA/ZONE 1**

Each zone/area (1A-1C) has been broken down into management stages of approximately 0.5ha to allow staged management as described in Section 4.2.1 above. Zone 1A has been managed to establish a Freshwater Wetland EEC and zones 1B & 1C managed to establish Swamp Sclerophyll EECs. Littoral Rainforest EEC species are utilized in the sub-canopy and shrub layers.

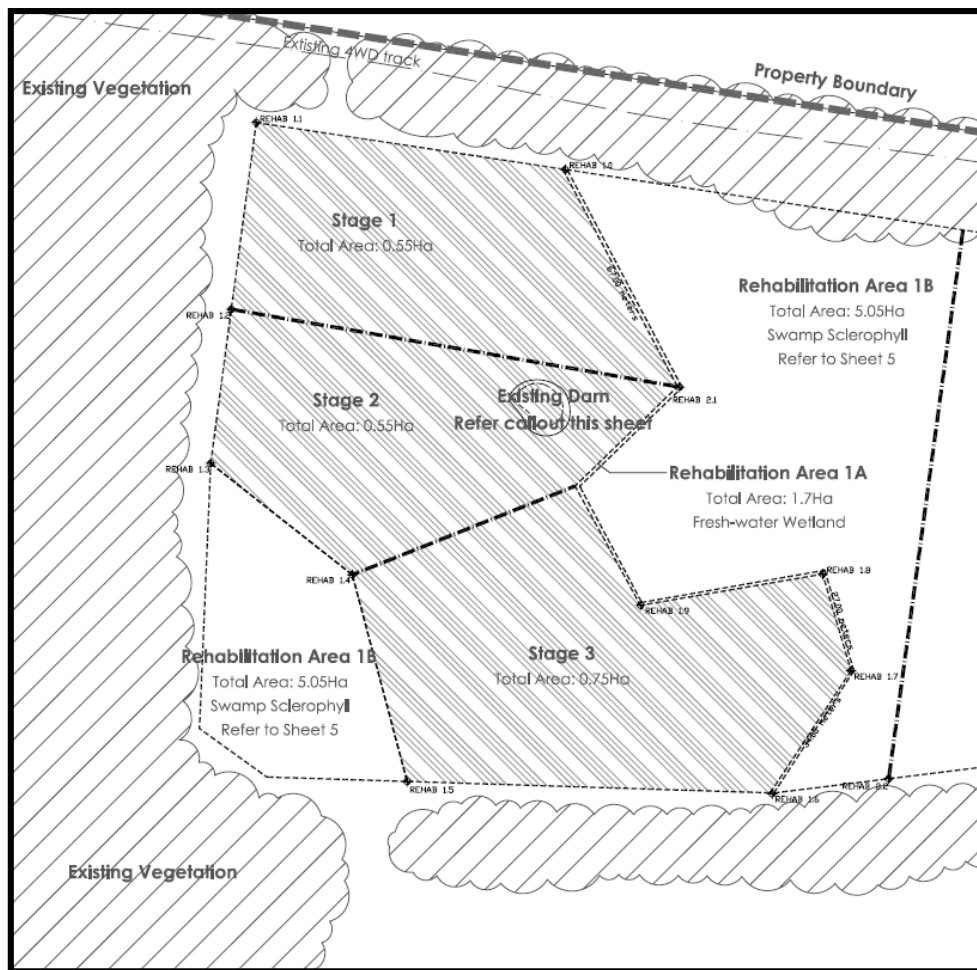


FIGURE 16: STAGING OF ZONE 1A (ALSO REFER ATTACHMENT 3)

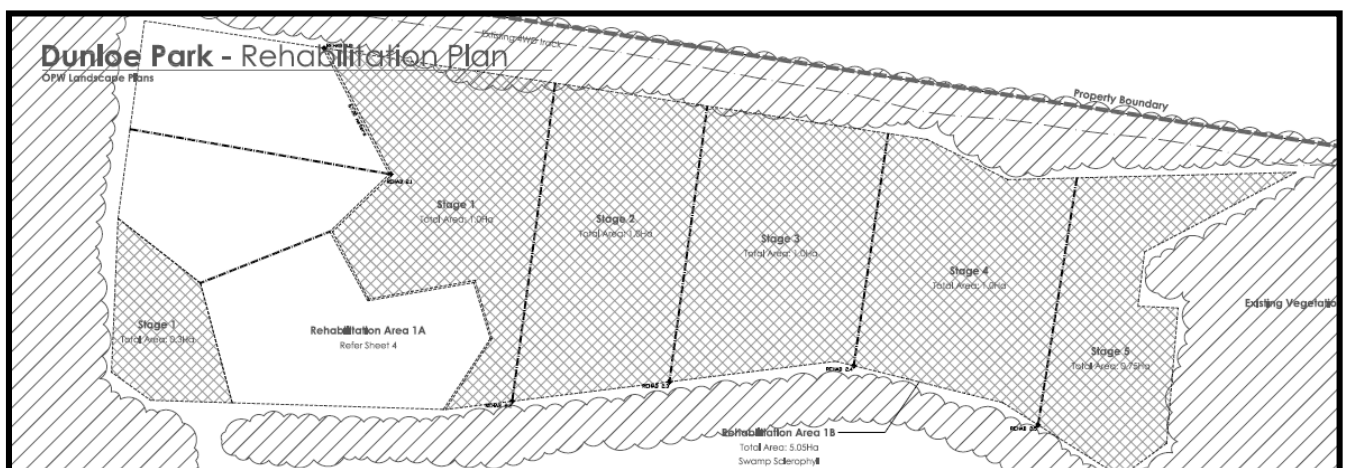


FIGURE 17: STAGING OF ZONE 1B (ALSO REFER ATTACHMENT 3)

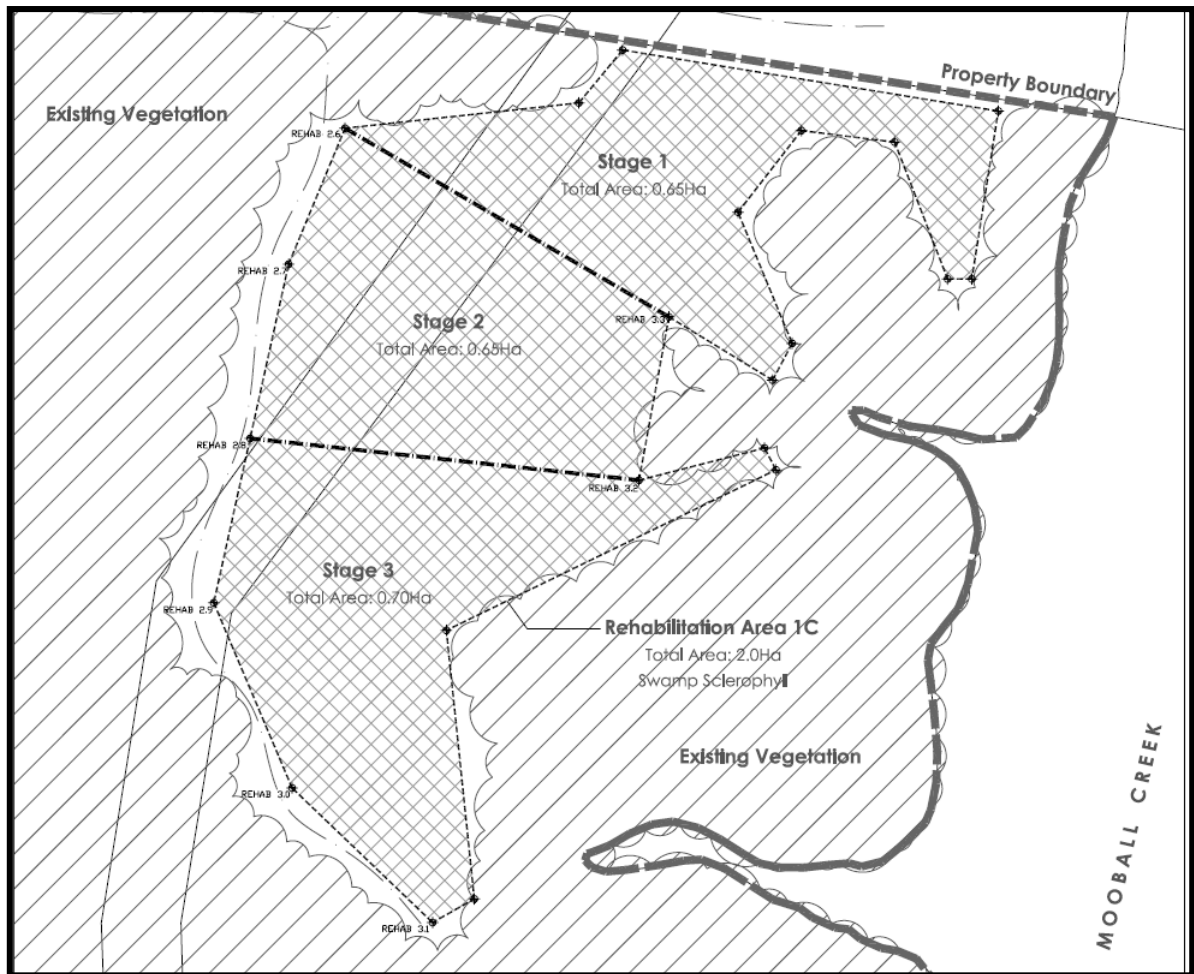


FIGURE 18: STAGING OF ZONE 1C (ALSO REFER ATTACHMENT 3)

Revegetation modules for each of the community types have been provided for use in association with 'pioneer', 'diversity' and 'groundcover' supplementary plantings if required (as described in Section 4.2.1 above). A full module and quantities (refer below and Attachment 3) are included in the instances that the rehabilitation project for any reason is not performed or is completely unsuccessful (currently not the case).

However, the modules shall be utilized to select species and densities from to perform 'pioneer', 'diversity' and/or 'groundcover' supplementary plantings in the instances that the performance requirements for the natural regeneration are not achieved or fail (refer Section 4.5).

I.E. Natural regeneration canopy coverage will not be considered achieved for any one area if it does not contain a canopy or small tree typical to the community (refer Section 4.3.1 modules) within an area equal to or greater than 4sqm (i.e. if an area 2m x 2m does not contain any juveniles of required canopy tree/small tree than natural regeneration canopy cover is considered to be unsuccessful at that particular location).

In the event that such a location is deemed to occur then supplementary (pioneer species) planting shall be undertaken within the patch in accordance with Section 4.3.1.

For example, a patch of 10sqm within Rehabilitation Zone 1B is noted to be regenerated with native ground covers and/or shrubs but no tree species typical to the listed 'Swamp Sclerophyll' community occur. In this instance 5 x trees/small trees from the Rehabilitation Zone 1B are to be pocket planted at 75mm pot sizes within the patch.

Further discussions regarding performance requirements and triggers for canopy 'pioneer', 'diversity' and/or 'groundcover' supplementary plantings are provided in Section 4.5.

Rehabilitation Area 1A

Total Area: 1.85Ha

Vegetation Type: Fresh-water Wetland

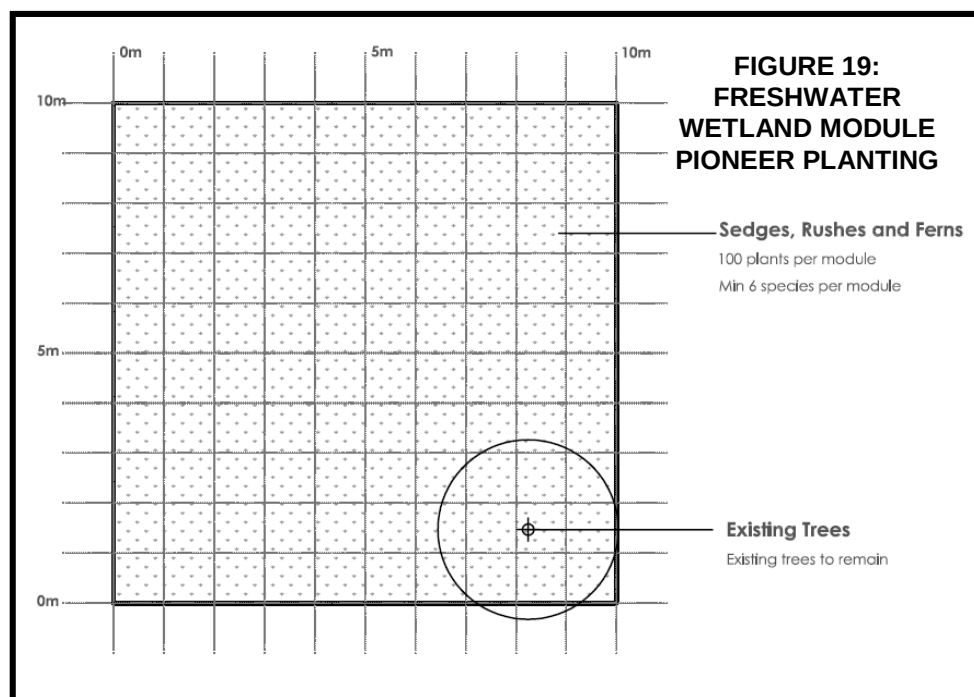
TREES - TO DAM

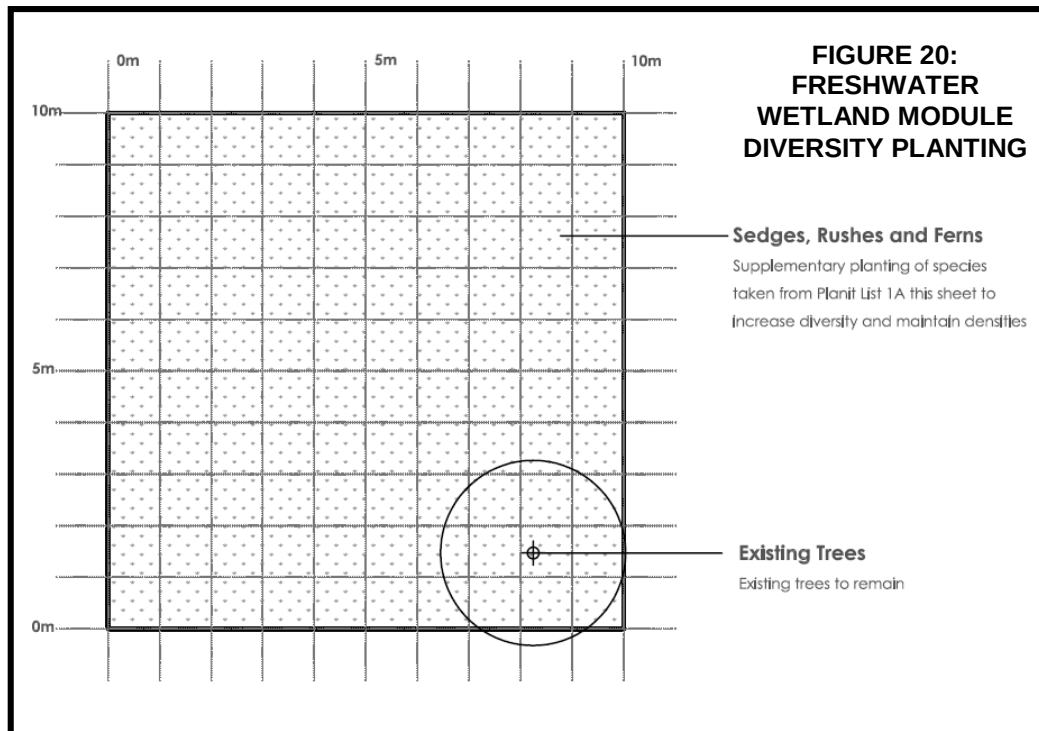
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
cas gla	Casuarina glauca	Swamp Oak	9	140MM	21
col sal	Callistemon salignus	Willow Bottlebrush			
lop sau	Lophostemon suaveolens	Swampbox			
mel qui	Melaleuca quinquenervia	Paperbark			

REHABILITATION AREA 1A (185 MODULES)

SEDGES, RUSHES + FERNS

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
bau jun	Baumea juncea	Bare Twigrush	100 min 6 species per mod	75MM TUBE	Stage 1 5500
bau ter	Baumea teretifolia	Twigrush			
ble ind	Blechnum indicum	Bungwall Fern			
cen asi	Centella asiatica	Pennywort			Stage 2 5500
cyp pol	Cyperus polystachyos	Bunchy Sedge			
flm fer	Fimbristylis ferruginea	Rusty Fringesedge			
flm pol	Fimbristylis polytrichoides	Fuzzy Rush			Stage 3 7500
gah asp	Gahnia aspera	Saw Sedge			
jun kra	Juncus kraussii	Searush			
jun usi	Juncus usitatus	Common Rush			Stage 3 7500
phl lan	Philydrum lanuginosum	Frogsmouth			
phr aus	Phragmites australis	Common Reed			
sch val	Schoenoplectus valldus	Clubrush			Stage 3 7500
sch lit	Schoenoplectus littoralis	Clubrush			
spo vir	Sporobolus virginicus	Salt Couch			
tri str	Triglochin striatum	Steaked Arrow Grass			Stage 3 7500
xyr com	Xyris complanata	Halplns			





REHABILITATION AREAS 1B & 1C
TOTAL AREA: 4.2HA
VEGETATION TYPE: SWAMP SCLEROPHYLL

TREES - module 1, 2 and 3				
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
cal sal	Calistemon salignus	White Bottlebrush	20 Minimum 3 species selected per module	75MM TUBE
cor int	Corymbia intermedia	Pink Bloodwood		
euc ter	Eucalyptus tereticornis	Blue Gum		
euc rob	Eucalyptus robusta	Swamp Mahogany		
mel qui	Melaleuca quinquenervia	Paperbark		
lop sau	Lophostemon suaveolens	Swamp Box		

SMALL TREES / SHRUBS - module 1, 2 and 3				
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
all tor	Allocasuarina torulosa	Forest Oak	30 Minimum 3 species selected per module	75MM TUBE
acr imp	Acronychia imperforata	Beach Acronychia		
ban int	Banksia integrifolia	Coastal Banksia		
cup ana	Cupaniopsis anacardioides	Tuckeroo		
dub myo	Duboisia myoporoides	Corkwood		
hov acu	Hovea acutifolia	Hovea		
not lon	Notolaea longifolia	Long-leaved Mock-olive		
plt rev	Plittosporum revolutum	Forest Plittosporum		
syz ole	Syzygium oleosum	Blue Lillipilli		
tro lau	Trocarpa laurina	Tree Heath		

GROUNDCOVERS - module 3 only

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
aus dul	<i>Austromyrtus dulcis</i>	Mildyln	50 Minimum 5 species selected per module	75MM TUBE	To be determined on-site by bush regeneration expert
ble ind	<i>Blechnum indicum</i>	Bungwall Fern			
cen asl	<i>Centella asiatica</i>	Pennywort			
cyp pol	<i>Cyperus polystachyos</i>	Flat Sedge			
dla cae	<i>Dianella caerulea</i>	Blue Flax Lilly			
gah asp	<i>Gahnia aspera</i>	Saw Sedge			
hib sca	<i>Hibbertia scandens</i>	Snake Vine			
har vio	<i>Hardenbergia violacea</i>	Native sarsaparilla			
lom lon	<i>Lomandra longifolia</i>	Matrush			
pte esc	<i>Pteridium esculentum</i>	Braken Fern			
sch val	<i>Schoenoplectus validus</i>	Clubrush			
xyr com	<i>Xyris complanata</i>	Yelloweyed Grass			

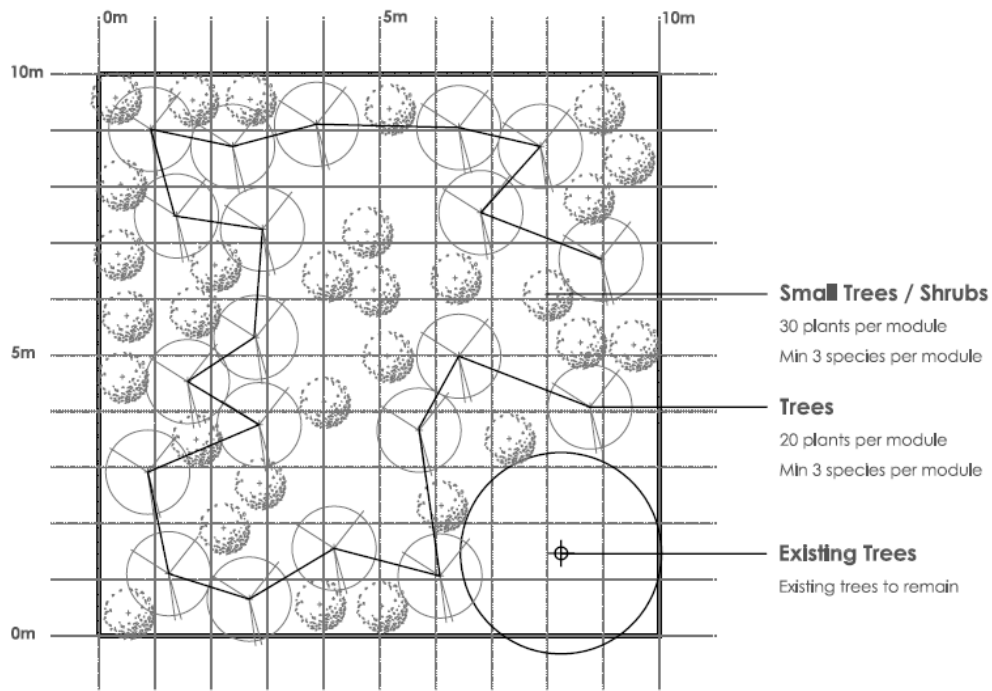
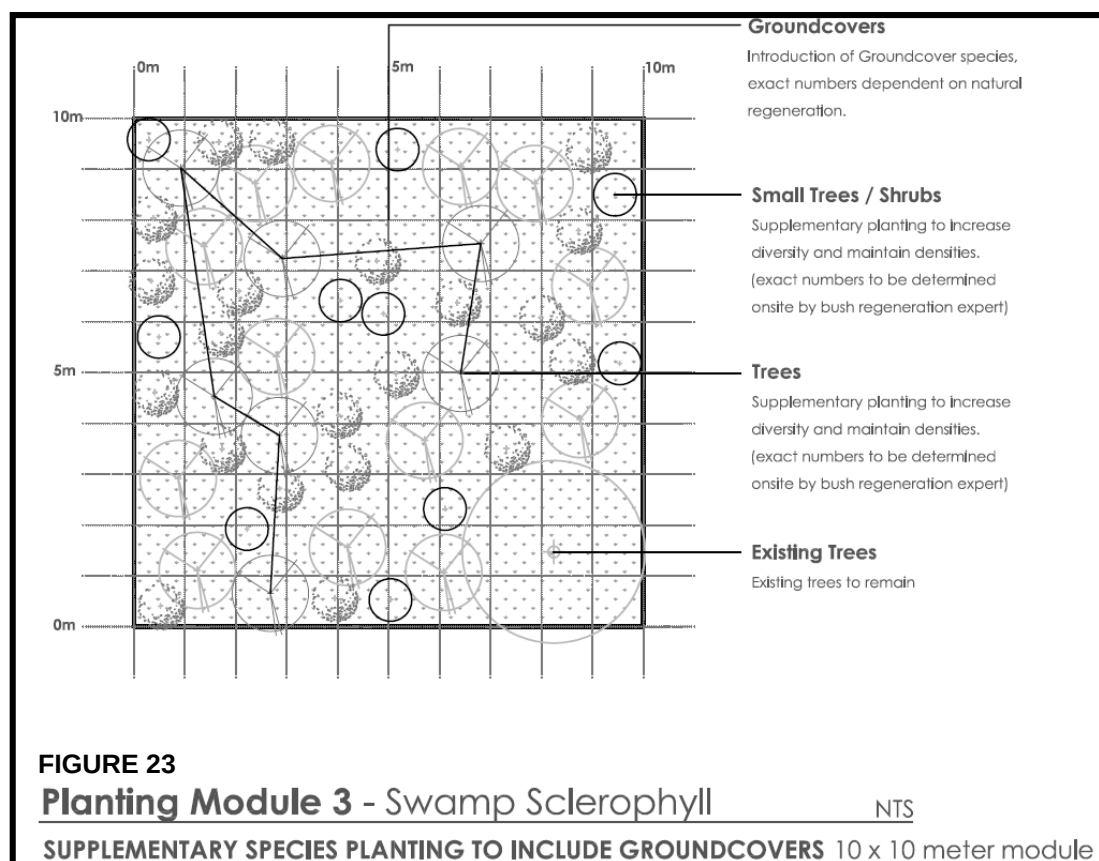
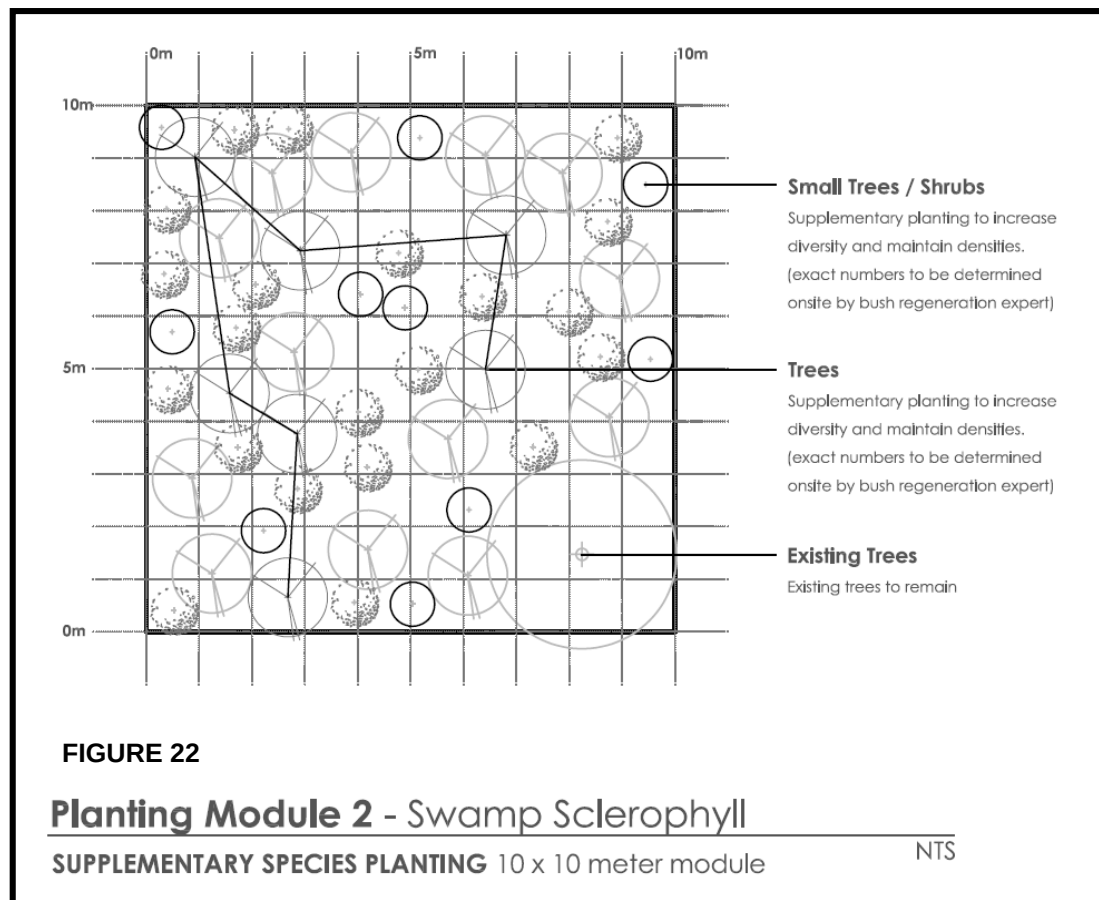


FIGURE 21

Planting Module 1 - Swamp Sclerophyll

PIONEER SPECIES PLANTING 10 x 10 meter module

NTS



REHABILITATION ZONE/AREA 2:

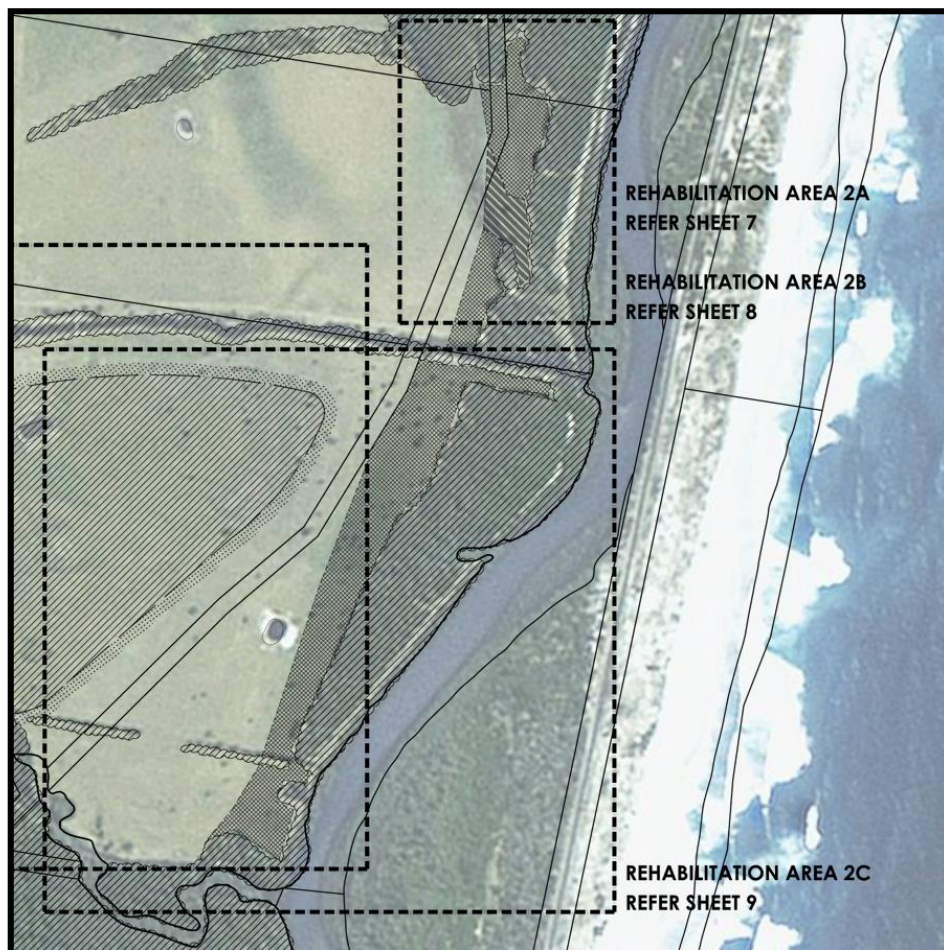


FIGURE 24: REHABILITATION AREA/ZONE 2

This rehabilitation zone covers 5.08 hectares and consolidates a fragmented corridor of swamp sclerophyll endangered ecological communities and wetlands located adjacent to Mooball Creek. Cattle have been excluded from this zone to allow rehabilitation. Species noted prior to regeneration procedures include Banksia, Swamp Oak, Paperbark, Willow Bottlebrush, Corkwood, Swampbox, Geebung, Bracken, Midyim, Blady Grass, Bunchy Sedge and Tuckeroo. Wetland plants are also common with a low-lying soak in the northeast of the zone managed for a combination Freshwater Wetland and Saltmarsh Endangered Ecological Community (EEC) regeneration.



FIGURE 25: BEFORE AND AFTER IMAGES OF REHABILITATION AREA/ZONE 2

Each zone/area (2A-2C) has been broken down into management stages of approximately 0.5-1ha to allow staged management as described in Section 4.2.1 above. Zone 2B is managed to establish a Freshwater Wetland EEC and zones 2A & 2C is managed to establish a combination of Swamp Sclerophyll/Swamp Oak EECs and Banksia Forest. Littoral Rainforest EEC species is utilized in the sub-canopy and shrub layers.





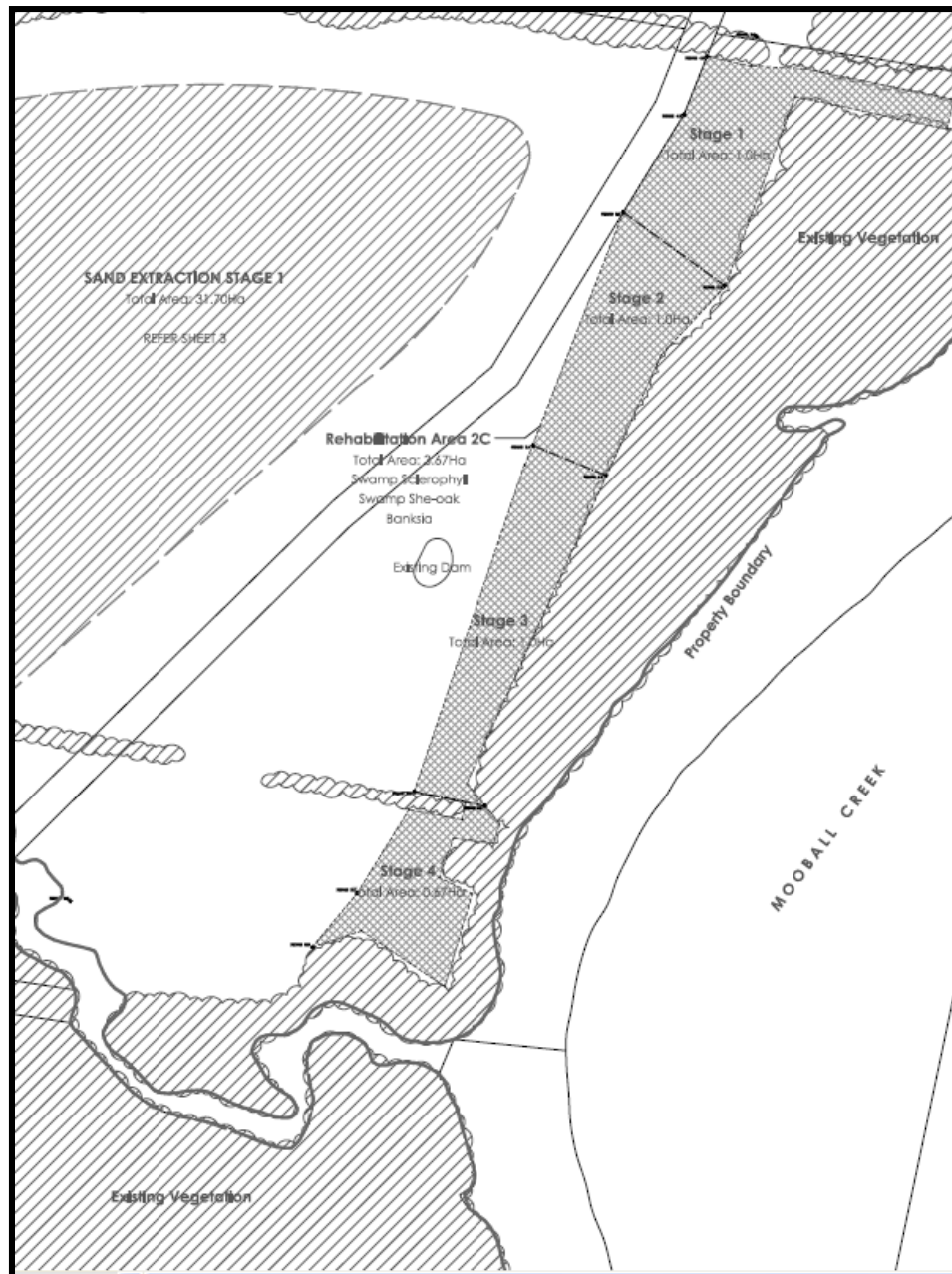


FIGURE 28: STAGING OF ZONE 2C

Revegetation modules for each of the community types have been provided for use in association with 'pioneer', 'diversity' and 'groundcover' supplementary plantings if required (as described in Section 4.2.1 above). A full module and quantities (refer below and Attachment 3) are included in the instances that the rehabilitation project for any reason is not performed or is completely unsuccessful (currently not the case).

However, the modules shall be utilized to select species and densities from to perform 'pioneer', 'diversity' and/or 'groundcover' supplementary plantings in the instances that the performance requirements for the natural regeneration are not achieved (refer Section 4.5).

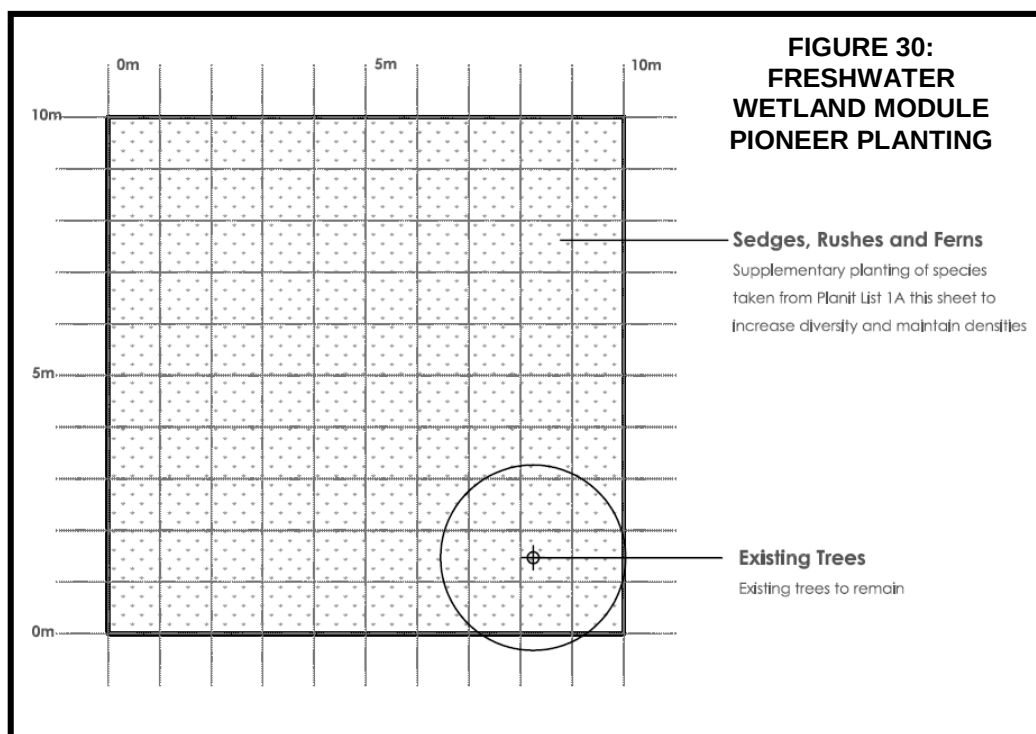
Rehabilitation Area 2B - species list

REHABILITATION AREA 2B
TOTAL AREA:0.43Ha (43 MODULES)

**FIGURE 29: WETLAND
COMMUNITY MODULE**

SEDGES, RUSHES + FERNS

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
bau jun	Baumea juncea	Bare Twigrush	100	75MM TUBE
bau ter	Baumea teretifolia	Twigrush		
ble ind	Blechnum indicum	Bungwall Fern		
cen asi	Centella asiatica	Pennywort		
cyp pol	Cyperus polystachyos	Bunchy Sedge		
flm fer	Fimbristylis ferruginea	Rusty Fringesedge		
flm pol	Fimbristylis polytrichoides	Fuzzy Rush		
gah asp	Gahnia aspera	Saw Sedge		
jun kra	Juncus kraussii	Searush		
jun usl	Juncus usitatus	Common Rush		
phl lan	Philydrium lanuginosum	Frogsmouth		
phr aus	Phragmites australis	Common Reed		
sch val	Schoenoplectus vallidus	Clubrush		
sch lit	Schoenoplectus littoralis	Clubrush		
spo vir	Sporobolus virginicus	Salt Couch		
trl str	Triglochin striatum	Steaked Arrow Grass		
xyr com	Xyris complanata	Hatpins		



REHABILITATION AREAS 2A & 2C

TOTAL AREA: 7.1HA

VEGETATION TYPE: SWAMP SCLEROPHYLL/SWAMP OAK & BANKSIA

Rehabilitation Area 2A - species list

REHABILITATION AREA 2A

TOTAL AREA: 1.40ha (140 MODULES)

TREES - module 1, 2 and 3

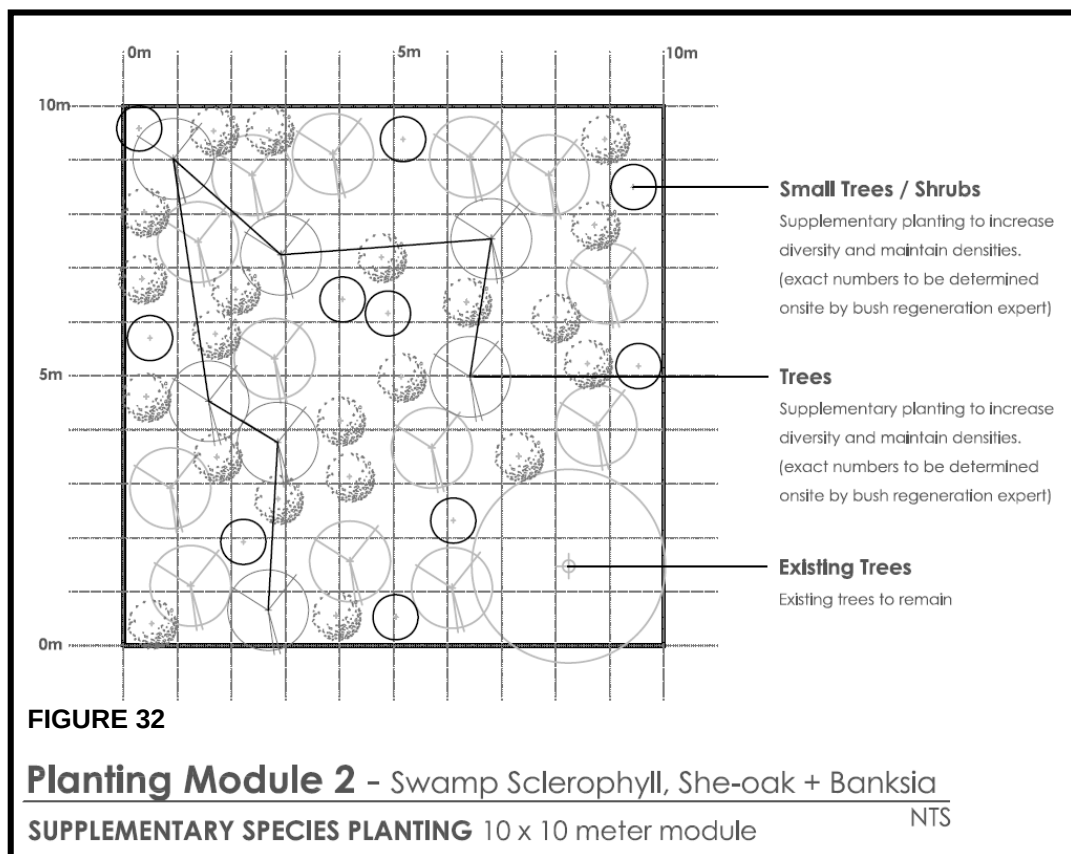
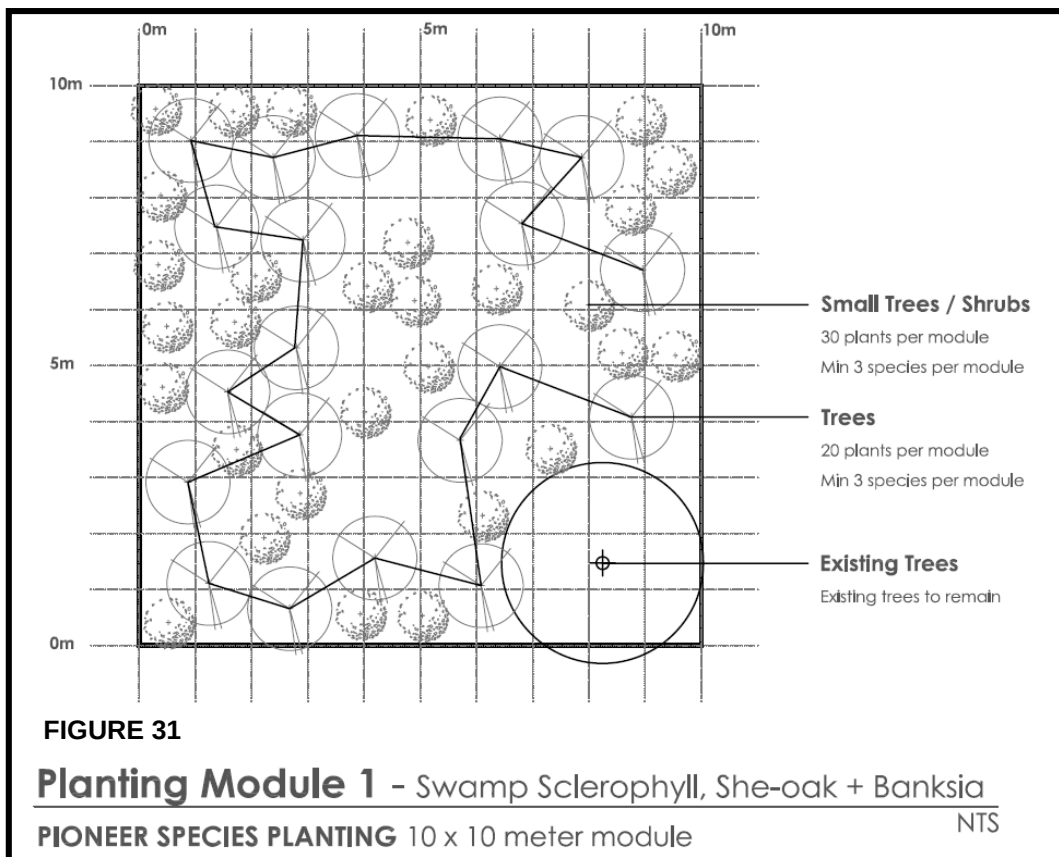
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
ban int	<i>Banksia integrifolia</i>	Coastal Banksia	20 Minimum 3 species selected per module	75MM TUBE
cal sal	<i>Callistemon salignus</i>	White Bottlebrush		
lop sau	<i>Lophostemon sauveolens</i>	Swamp Box		
mel qui	<i>Melaleuca quinquenervia</i>	Paperbark		

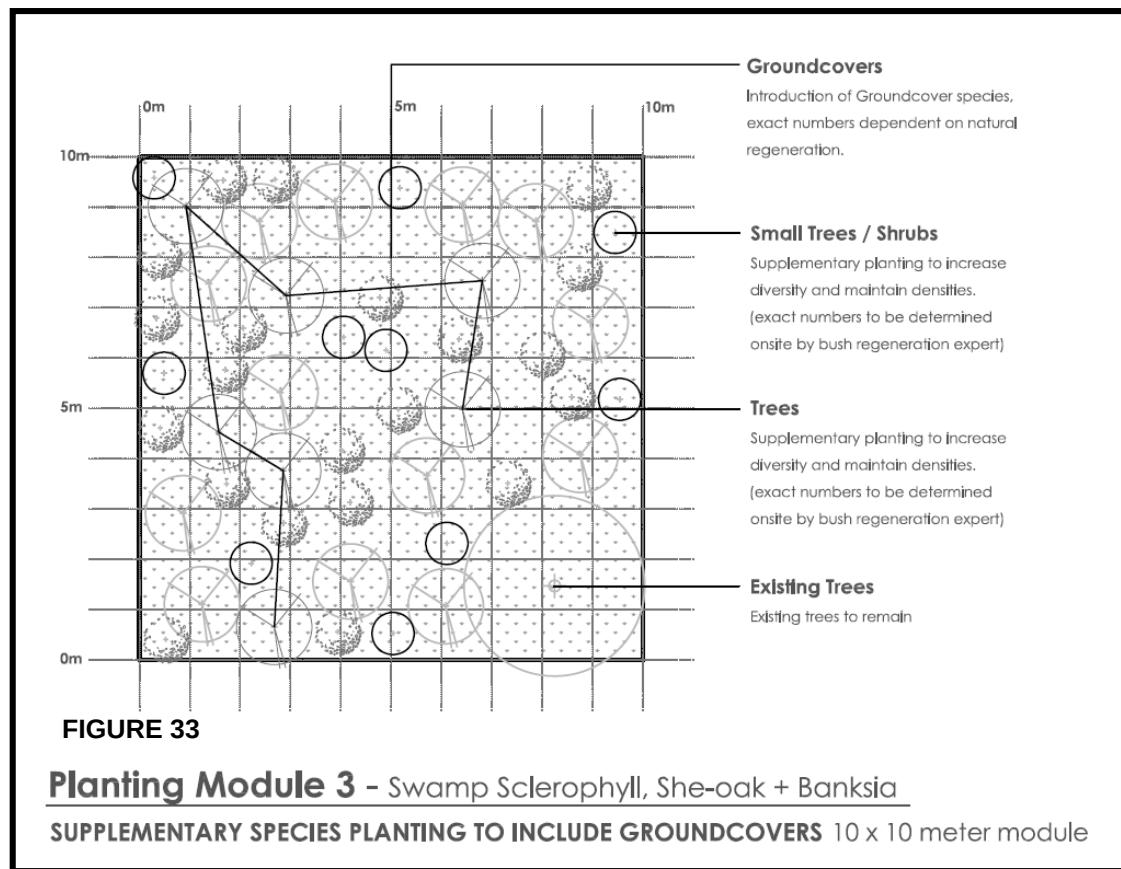
SMALL TREES / SHRUBS - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
acm hem	<i>Acmena hemilampra</i>	Broad-leaved Lillipilli	30 Minimum 3 species selected per module	75MM TUBE
aca sop	<i>Acacia sophorae</i>	Coast Wattle		
ale cor	<i>Alectryon coriaceus</i>	Beach Alectryon		
con bar	<i>Commersonia bartramia</i>	Brown Kurrajong		
cup ana	<i>Cupanopsis anacardioides</i>	Tuckeroo		
dub myo	<i>Duboisia myoporoides</i>	Corkwood		
ela ret	<i>Elaeocarpus reticulatus</i>	Blueberry Ash		
exo lat	<i>Exocarpus latifolius</i>	Broad-leaved Cherry		
per str	<i>Persoonia stradbokensis</i>	Coast Geebung		

GROUNDCOVERS - module 3 only

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
adi his	<i>Adiantum hispidulum</i>	Rough Maidenhair	50 Minimum 5 species selected per module	75MM TUBE
aus dul	<i>Austromyrtus dulcis</i>	Midyim		
ble car	<i>Blechnum cartilagineum</i>	Gristle Fern		
ble ind	<i>Blechnum indicum</i>	Bungwall Fern		
cri pen	<i>Crinum pendunculatum</i>	Swamp Lilly		
gah asp	<i>Gahnia aspera</i>	Saw Sedge		
lom lon	<i>Lomandra longifolia</i>	Matrush		





REHABILITATION ZONE/AREA 3:

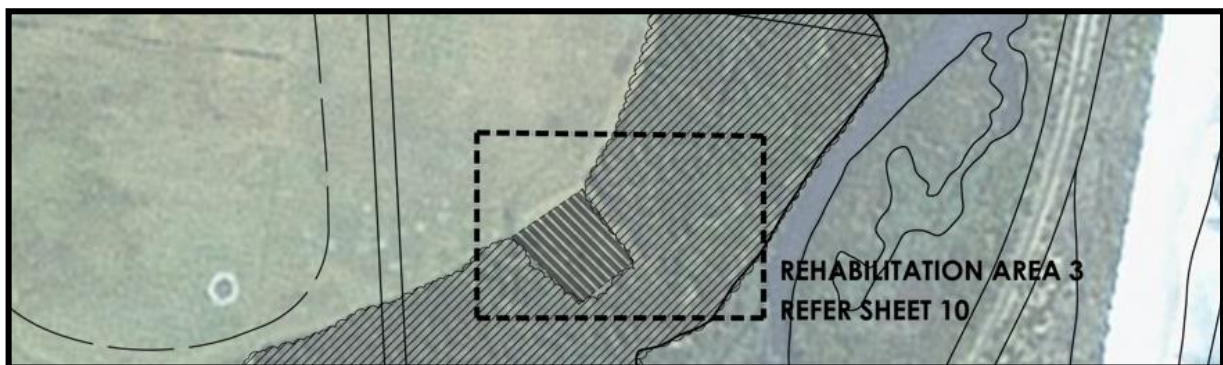


FIGURE 34: REHABILITATION AREA/ZONE 3

This rehabilitation zone covers 0.6 hectares and will consolidate a fragmented corridor of swamp sclerophyll, swamp she-oak and swamp box/littoral rainforest endangered ecological communities located adjacent to Mooball Creek. Cattle have been excluded from this zone to allow rehabilitation.

Species noted include Banksia, Swamp Oak, Paperbark, Bracken and Blady Grass. Whisky grass is also common.



FIGURE 35: IMAGES OF REHABILITATION AREA/ZONE 3 - 2009

The rehabilitation zone (Zone 3) occurs in one management stage of 0.6ha. The zone is managed to establish a combination of Swamp Sclerophyll and Swamp Oak EECs. Littoral Rainforest EEC species is utilized in the sub-canopy and shrub layers.

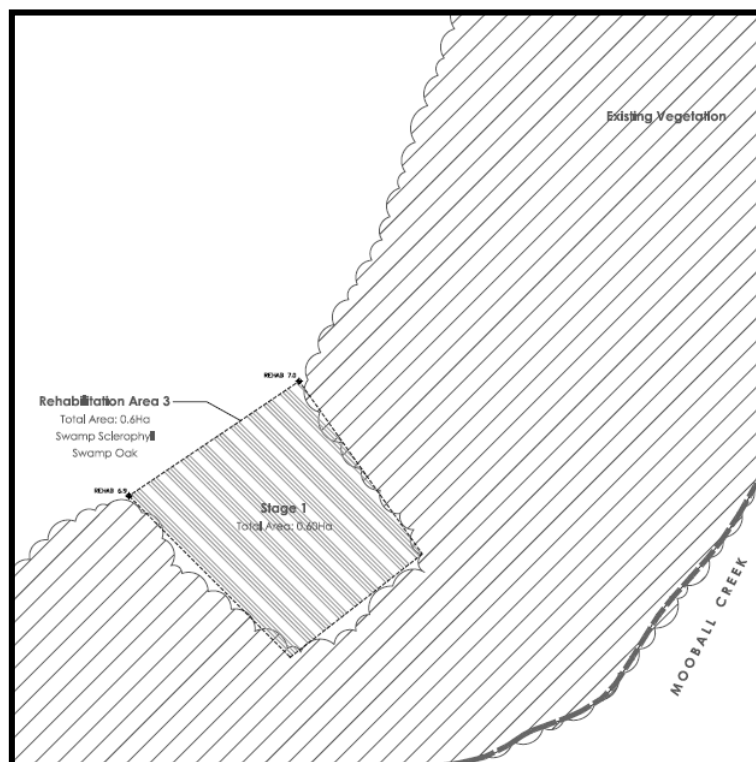


FIGURE 36: STAGING OF ZONE 3

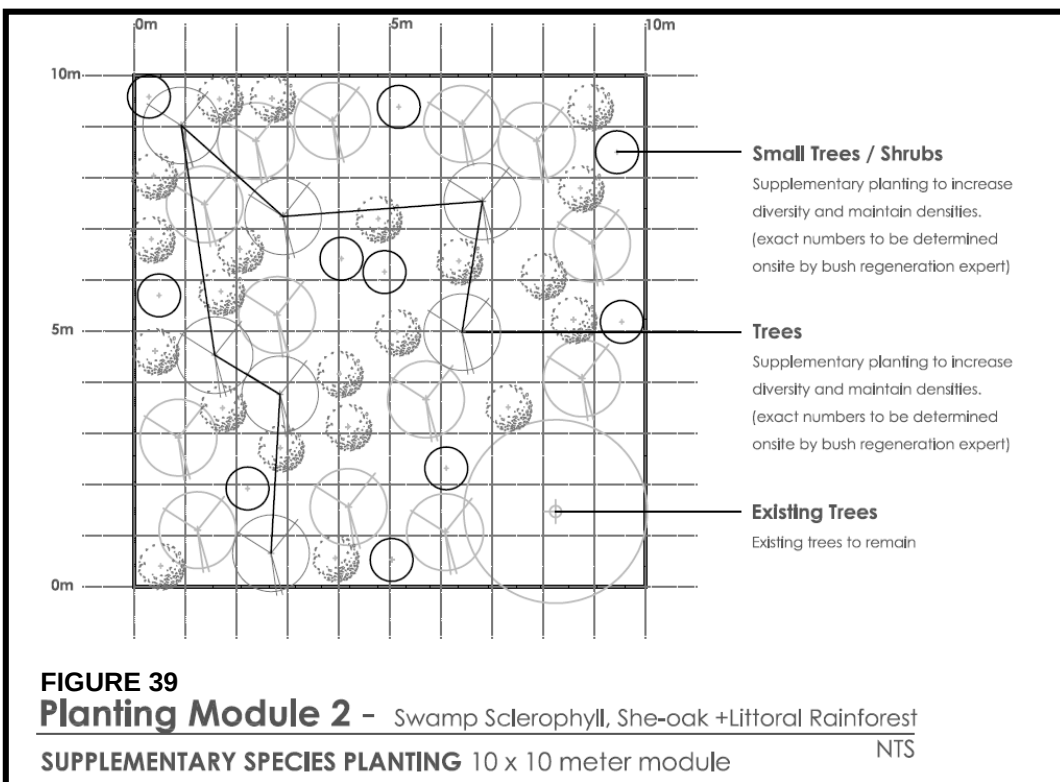
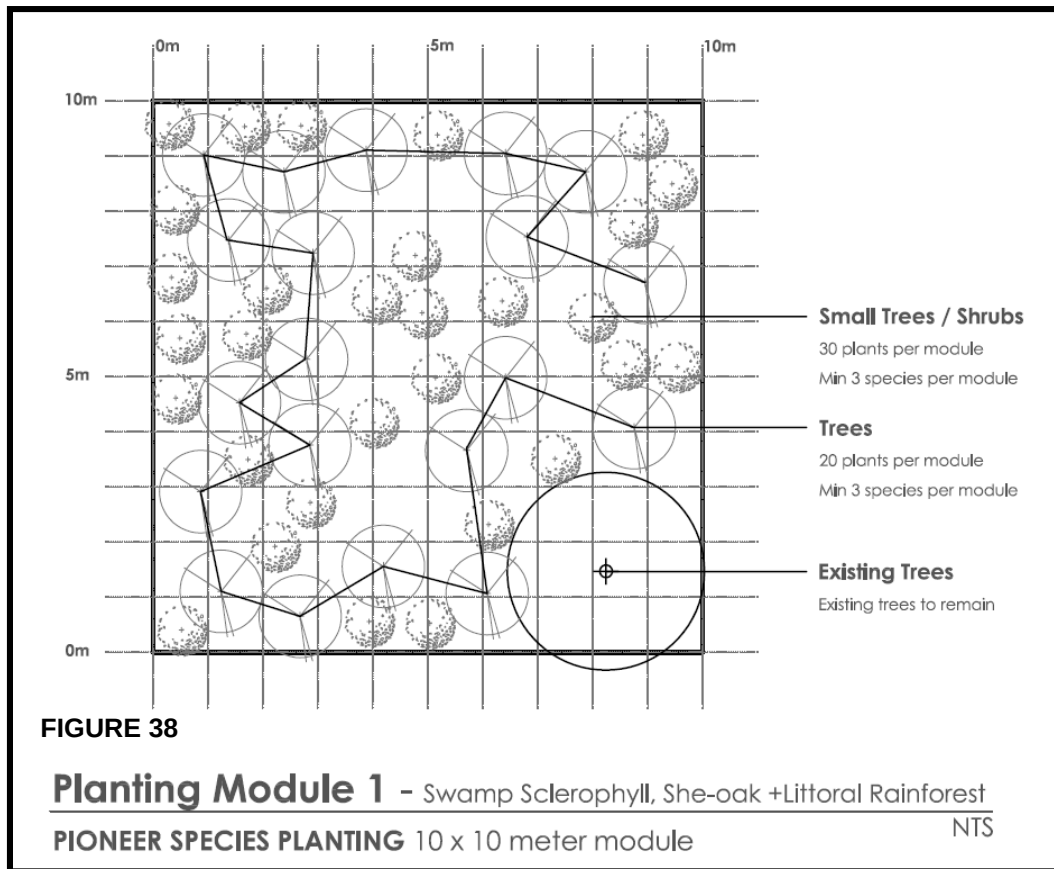
A revegetation module for this community type has been provided for use in association with 'pioneer', 'diversity' and 'groundcover' supplementary plantings if required (as described in Section 4.2.1 above). A full module and quantities (refer below and Attachment 3) are included in the instances that the rehabilitation project for any reason is not performed or is completely unsuccessful (currently not the case).

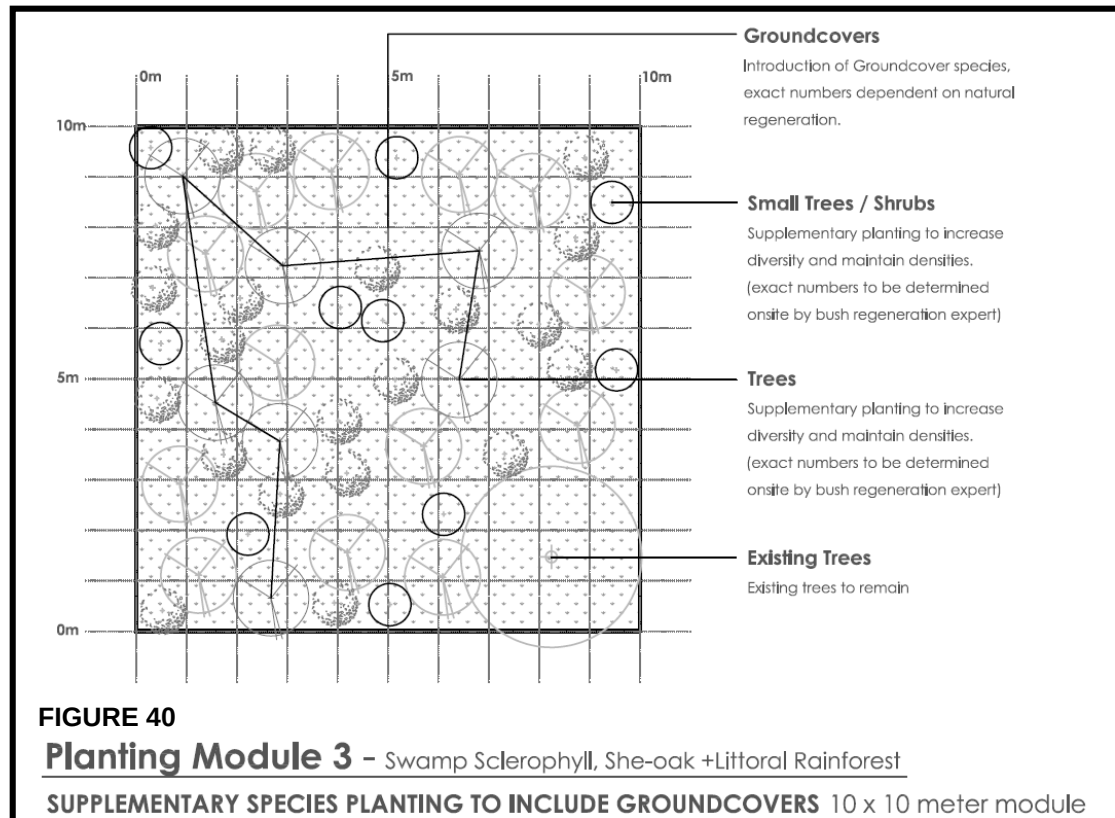
However, the modules shall be utilized to select species and densities from to perform 'pioneer', 'diversity' and/or 'groundcover' supplementary plantings in the instances that the performance requirements for the natural regeneration are not achieved (refer Section 4.5).

Rehabilitation Area 3 - species list			FIGURE 37: SWAMP SCLEROPHYLL/SWAMP OAK COMMUNITY MODULE		
REHABILITATION AREA 3 TOTAL AREA:1.20ha (120 MODULES) TREES - module 1, 2 and 3					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
cas gla	Casuarina glauca	Swamp Oak	20 Minimum 3 species selected per module	75MM TUBE	Stage 1 1200
cal sal	Calistemon salignus	White Bottlebrush			Stage 2 1200
lop sau	Lophostemon sauveolens	Swamp Box			
mel qui	Melaleuca quinquenervia	Paperbark			

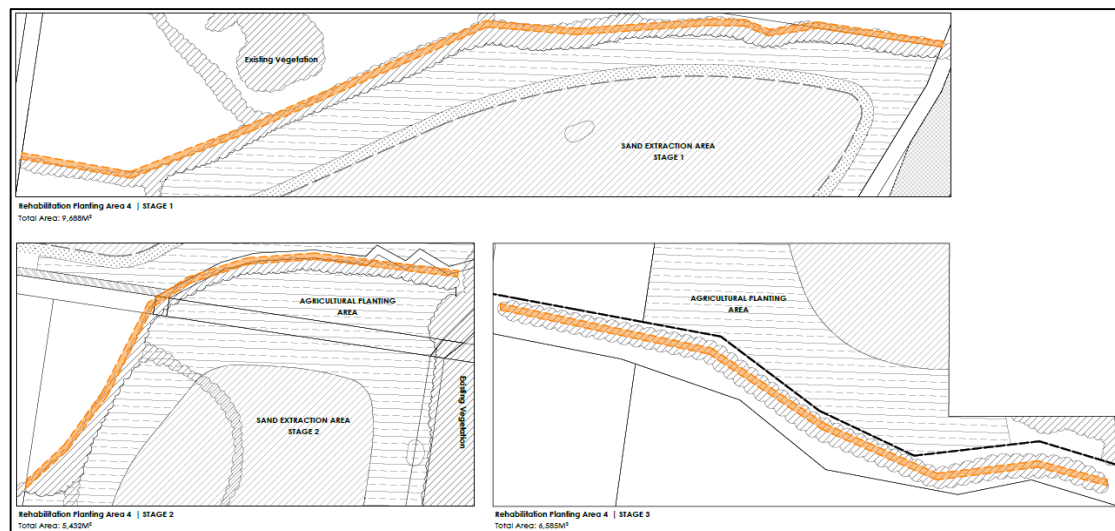
SMALL TREES / SHRUBS - module 1, 2 and 3				
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
acr imp	Acronychia Imperforata	Beach Acronychia	30 Minimum 3 species selected per module	75MM TUBE
all lit	Allocasuarina littoralis	Black She-oak		
ban int	Banksia integrifolia	Coast Banksia		
com bar	Commersonia bartramia	Brown Kurrajong		
dub myo	Duboisia myoporoides	Corkwood		
gou sem	Gouia semiglauc	Wild Quince		
mls pyr	Mischocarpus pyramidalis	Yellow Pearfruit		
per str	Persoonia stradbrokeensis	Coast Geebung		
pil gla	Ptilidostigma glabrum	Plum Myrtle		
pol ele	Polyscias elegans	Celerywood		

GROUNDCOVERS - module 3 only				
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE
adi hls	Adiantum hispidulum	Rough Maidenhair	50 Minimum 5 species selected per module	75MM TUBE
aus dul	Austromyrtus dulcis	Midyim		
ble ind	Blechnum indicum	Bungwall Fern		
chr apl	Chrysocephalum apiculatum	Yellow Buttons		
cri pen	Crinum pendunculatum	Swamp Lilly		
gah asp	Gahnia aspera	Saw Sedge		
goo rot	Goodenia rotundifolia	Star Goodenia		
lom lon	Lomandra longifolia	Matrush		





REHABILITATION ZONE/AREA 4:



This rehabilitation zone covers ~2.1ha hectares and is proposed to provide a wildlife corridor (linkage) between existing habitats within and external to the site and a visual buffer between the Sand Quarry and external properties. The 8m wide vegetated corridors are proposed along the northern sides of Sheens Creek, Warwick Park Rd and the unnamed watercourse between Stage 1 and Stage 2 (refer to Figure 41).

Cattle have been excluded from this zone to allow rehabilitation. Species noted include Paperbark, Swamp Oak, Swampbox, Banksia, Pennywort, Blady Grass, Bunchy Sedge and Sundew.

Each zone/area (4A-4C) has been broken down into management stages of approximately 0.5-1ha to allow staged management as described in Section 4.2.1 above. These zones will be managed to establish a Wet Schlerophyll Forest which will act as a wildlife corridor between habitats within and adjacent the site.

REHABILITATION AREA 4 - STAGE 1
Total Area: 9,688M² (9.7 MODULES)
CANOPY TREES

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coast Banksia	10 min 3 species per mod	45LTR	970
cas gla	Casuarina glauca	Swamp Oak			
cor int	Corymbia intermedia	Pink Bloodwood			
euc gra	Eucalyptus grandis	Flooded Gum			
euc ter	Eucalyptus tereticornis	Forest Red Gum			
euc mic	Eucalyptus microcorys	Tallow Wood			
euc sid	Eucalyptus siderophloia	Ironbark			
lop sau	Lophoslemon saueolens	Swampbox			
lop con	Lophoslemon confertus	Brush Box			
mel qui	Melaleuca quinquenervia	Paperbark			

REHABILITATION AREA 4 - STAGE 2
Total Area: 5,432M² (5.5 MODULES)
CANOPY TREES

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coast Banksia	10 min 3 species per mod	45LTR	550
cas gla	Casuarina glauca	Swamp Oak			
cor int	Corymbia intermedia	Pink Bloodwood			
euc gra	Eucalyptus grandis	Flooded Gum			
euc ter	Eucalyptus tereticornis	Forest Red Gum			
euc mic	Eucalyptus microcorys	Tallow Wood			
euc sid	Eucalyptus siderophloia	Ironbark			
lop sau	Lophoslemon saueolens	Swampbox			
lop con	Lophoslemon confertus	Brush Box			
mel qui	Melaleuca quinquenervia	Paperbark			

REHABILITATION AREA 4 - STAGE 3
Total Area: 6,584M² (6.6 MODULES)
CANOPY TREES

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coast Banksia	10 min 3 species per mod	45LTR	660
cas gla	Casuarina glauca	Swamp Oak			
cor int	Corymbia intermedia	Pink Bloodwood			
euc gra	Eucalyptus grandis	Flooded Gum			
euc ter	Eucalyptus tereticornis	Forest Red Gum			
euc mic	Eucalyptus microcorys	Tallow Wood			
euc sid	Eucalyptus siderophloia	Ironbark			
lop sau	Lophoslemon saueolens	Swampbox			
lop con	Lophoslemon confertus	Brush Box			
mel qui	Melaleuca quinquenervia	Paperbark			

FIGURE 42: REHABILITATION AREA 4 (WET SCHLEROPHYLL FOREST)
MODULE

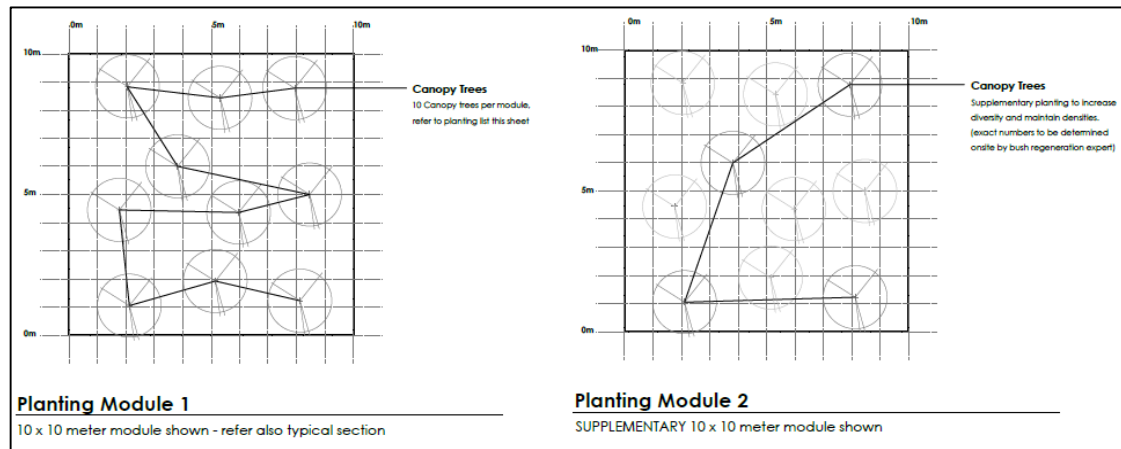


FIGURE 43: AREA 4 PLANTING MODULES

4.3.2 RECONSTRUCTION/BUFFER PLANTING

This type of revegetation has occurred within the western visual buffer to the haul route, processing area, site office and wash plant. In accordance with condition 39 of the Development Consent these buffer areas were established within 12 months. Following planting of the buffers (with endemic native species) the areas are monitored and maintained as per the Rehabilitation Zones and in accordance with Section 4.4 below.

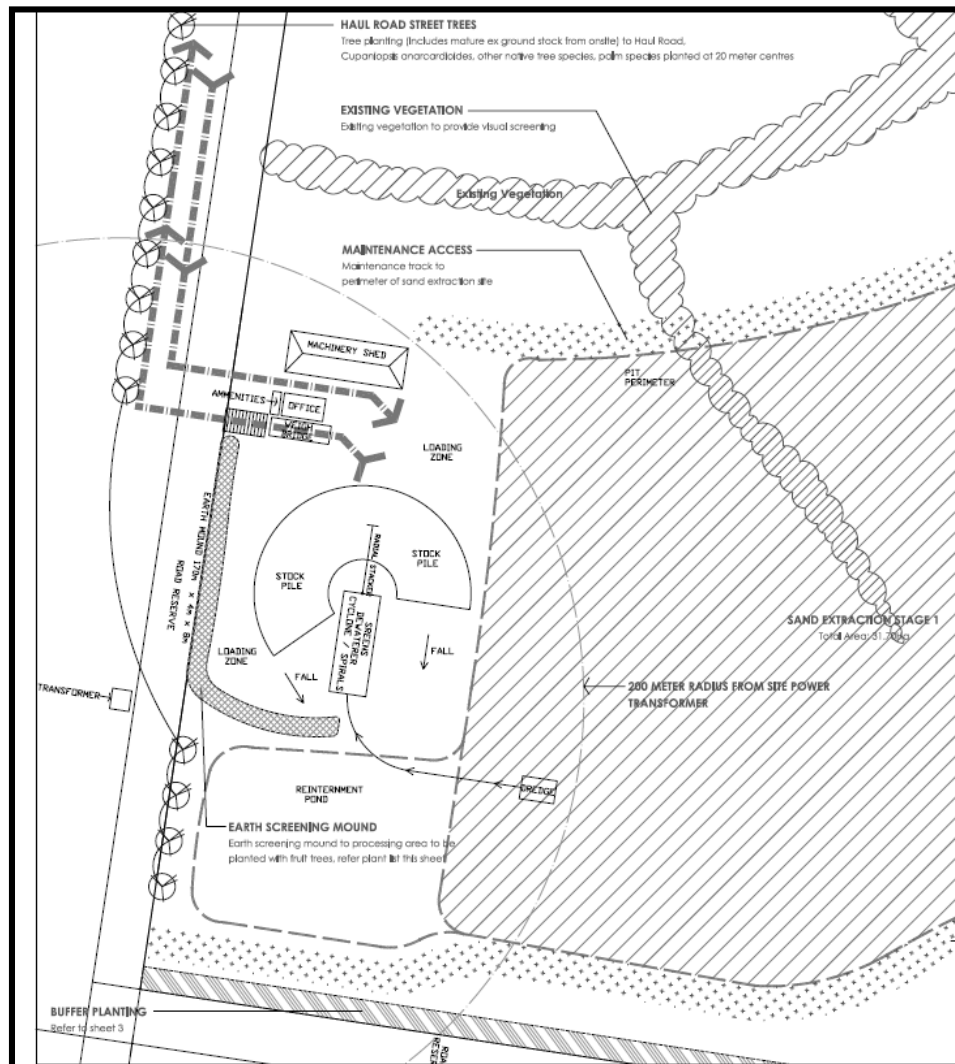
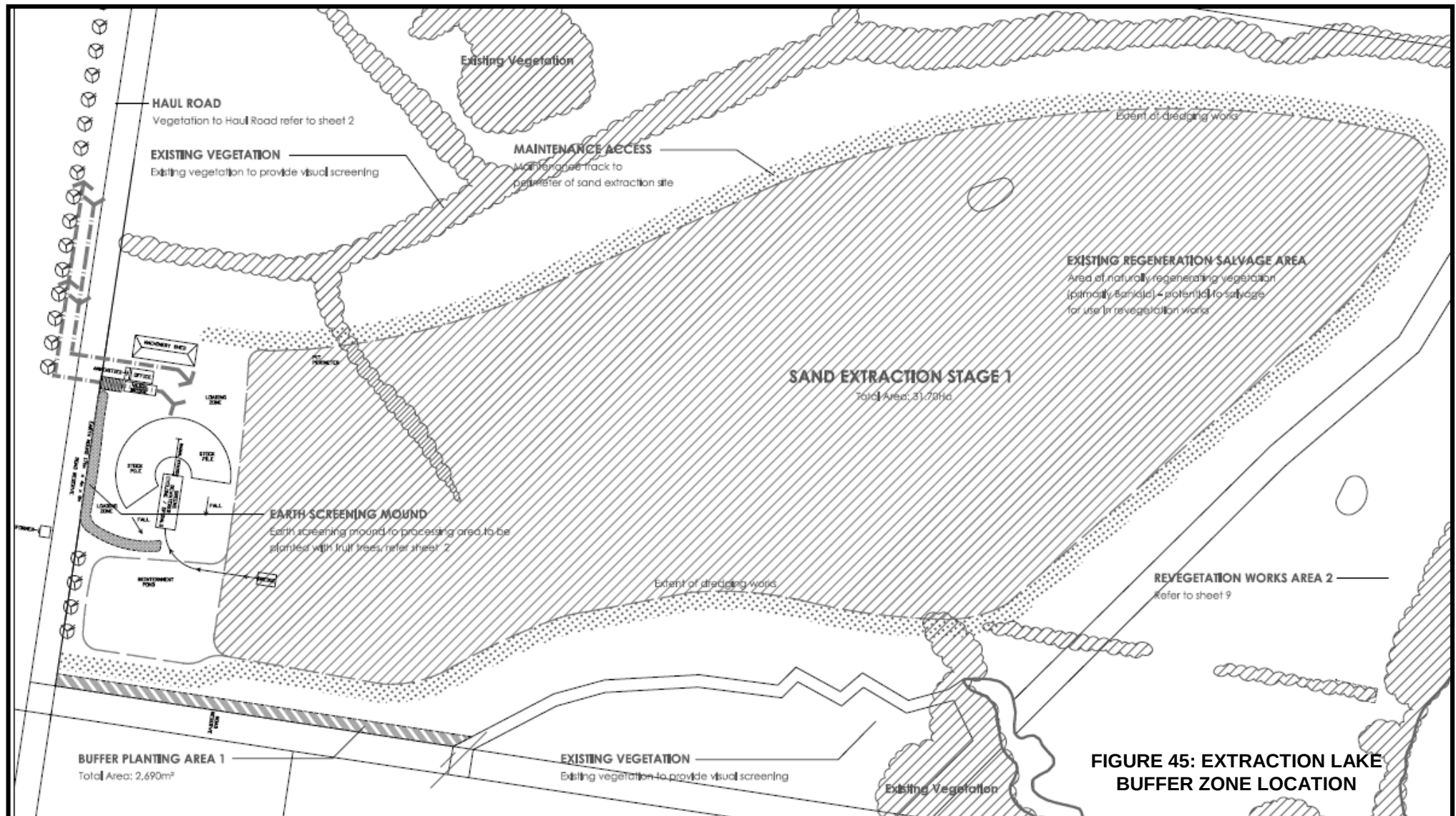


FIGURE 44: 10M WESTERN VISUAL BUFFER LOCATION



**FIGURE 45: EXTRACTION LAKE
BUFFER ZONE LOCATION**

BUFFER PLANTING AREA 1
Total Area: 0.34Ha (34 MODULES)
CANOPY TREES

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coast Banksia	10 min 3 species per mod	45LTR	340
cas gla	Casuarina glauca	Swamp Oak			
cor int	Corymbia intermedia	Pink Bloodwood			
euc gra	Eucalyptus grandis	Flooded Gum			
euc ter	Eucalyptus tereticornis	Forest Red Gum			
euc mic	Eucalyptus microcorys	Tallow Wood			
euc sid	Eucalyptus siderophloia	Ironbark			
lop sau	Lophostemon suaveolens	Swampbox			
lop con	Lophostemon confertus	Brush Box			
mel qui	Melaleuca quinquenervia	Paperbark			
syn glo	Syzygium moorei	Watermelon Tree			

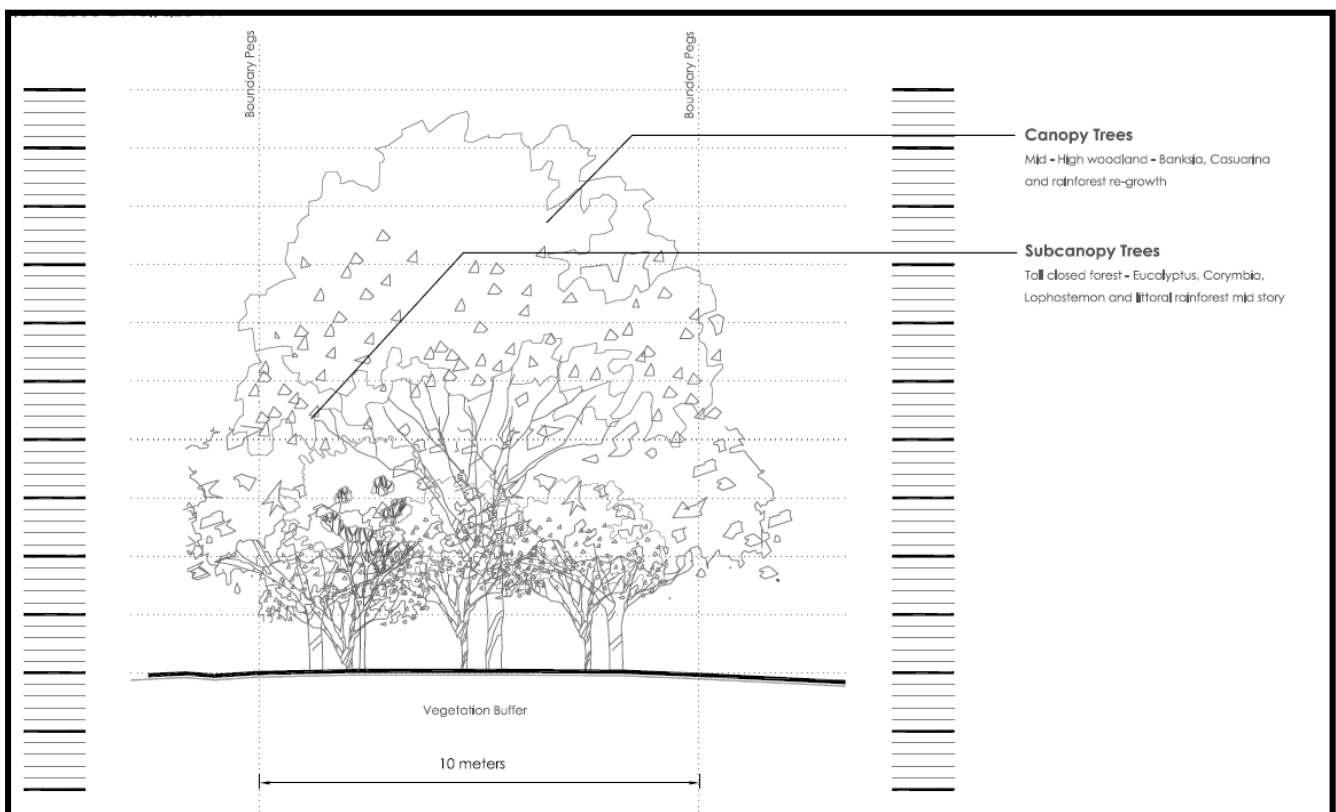
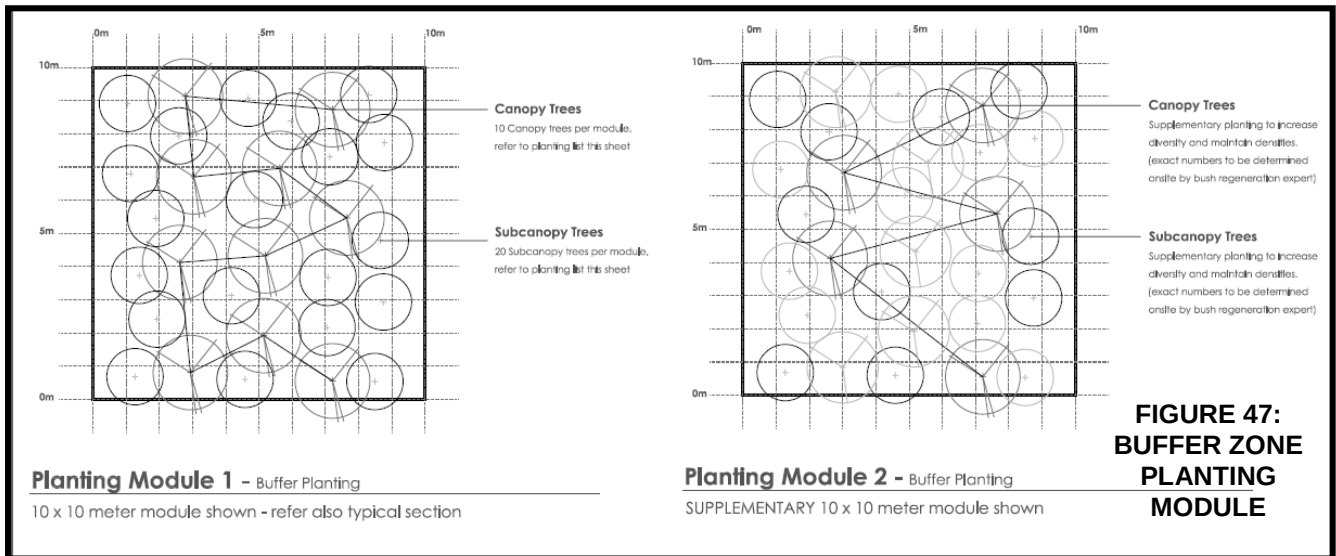
SUBCANOPY TREES

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
alp exc	Alphitonia excelsa	Red Ash	20 min 4 species per mod	300MM	680
acr obl	Acronychia oblongifolia	Yellow Wood			
aca mel	Acacia melanoxylon	Blackwood			
cup ana	Cupanopsis anacardioides	Tuckeroo			
cry foe	Cryptocarya foetida	Cryptocarya			
cal sal	Callistemon salignus	Willow Bottlebrush			
dub myo	Dubautia myoporoides	Corkwood			
ela obo	Elaeocarpus obovatus	Hard Quandong			
ela obo	Elaeocarpus reticulatus	Blueberry Ash			
fic obl	Ficus oblilqua	Small-Heaved Fig			
hib lil	Hibiscus lilaceus	Cotton Tree			
lit aus	Litsea Australis	Laurel			
pol ele	Polyscias elegans	Celerywood			
pit und	Pittosporum undulatum	Sweet Pittosporum			

EARTH SCREENING MOUND
Total Area: 0.14Ha
CANOPY TREES

CODE	PLANT SPECIES	COMMON NAME	SPACING	SIZE
ban int	Citrus sinensis	Orange Tree	3 METER CENTRES	45LTR
cas gla	Davidsonia jerseyana	Davidson Plum		
cor int	Mangifera indica	Mango Tree		
euc ter	Persea americana	Avocado Tree		

FIGURE 46: BUFFER ZONE PLANTING LIST



FUTURE AGRICULTURAL USE

As previously mentioned, the proposed future use for the land surrounding the extraction lakes is for agricultural use, in particularly the plantation of fruiting trees (i.e.

avocado trees). The proposed agricultural use will provide additional foraging and refuge for fauna species within the locality.

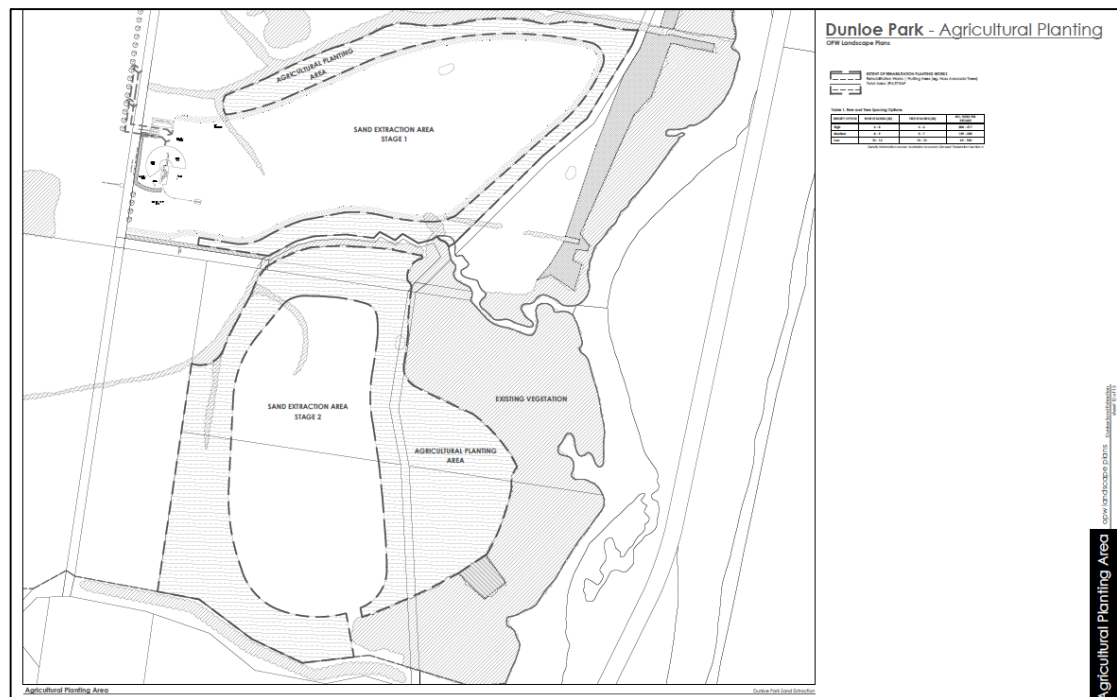


FIGURE 49: AREAS PROPOSED FOR FUTURE AGRICULTURAL USE

4.3.3 REVEGETATION TECHNIQUES

Direct Planting (Landscaping)

Landscaping is the most common method of revegetation, however, it does require establishment, maintenance watering, mulching and weeding and also has the highest cost. The landscaping process within the Buffer Zones should occur as follows:

- Identify areas on site which require planting following completion of initial weed management works;
- Ensure areas identified are appropriately prepared including:
 - Remove all rubbish including any previously dumped vegetative material, building slabs etc. Any existing hollow logs are to be retained in-situ;
 - Scarification of any compacted soil is to be undertaken to a depth of 200mm to promote aeration of the upper soil layer. No ripping is permitted within the drip zone of existing trees or native regeneration with only hand tools to be utilised for the purposes of pocket planting of shrub/groundcover tubestock.
 - Unwanted matter (i.e. stones, concrete, rubbish, rubble, sticks >20mm dia) encountered are to be removed
 - Application of 'osmocote' sustained release fertiliser in granule form or equivalent to topsoil etc).
 - Undertake follow-up weed treatment following a period of two weeks to remove individuals which may have germinated from soil bank resources;
 - Erect temporary fencing/signage to inform that the relevant location is now a rehabilitation area. This will assist in reducing accidental damage to plant stock, introduction of additional weeds and dumping of rubbish. If stock are to be grazed within adjacent paddock areas than an exclusion fence is to be erected to keep cattle out of the rehabilitation zone. Any such fence is to include a minimum 0.5m gap at ground level to allow continued passage of native fauna.
- Plant selected native species at densities documented within Attachment 3 and Figures 45 and 46 above.
- Maintain and monitor area in accordance with section entitled 'Monitoring and Maintenance'.

4.4 MAINTENANCE, MONITORING AND REPORTING

Maintenance

- Planting areas (determined on a staged basis in accordance with Section 4.3 above) are to be regularly watered for a period of twelve weeks. If during routine inspections of the rehabilitation zones there is evidence of plant poor health due to drought stress than additional watering shall be undertaken;

- Recurrent weeds within rehabilitation zones are to be removed as they occur quarterly for the first five years of assisted regeneration for each rehabilitation stage and six-monthly thereafter for the life of the development;
- Fences (where required due to cattle grazing in adjacent paddocks) are to be inspected quarterly for structural integrity and maintained as necessary;
- Locational survey pegs of the rehabilitation zone boundaries are to be inspected quarterly and maintained/replaced as necessary;
- Replacement planting of stock loss shall occur as required to achieve the performance criteria listed in subsequent section of this report;
- Existing 4wd tracks within the environmental protection zones are to be maintained quarterly to allow continued vehicle access for maintenance and emergency rural fire brigade vehicles;
- A slashed/grazed zone of 25-30m is to be maintained on the development side of the rehabilitation zones to reduce to risk of bushfire spread from the pasture grasslands.

Monitoring

The success of a regeneration project can be assessed by systematic visual monitoring of rehabilitation areas. This need not be an overly time-consuming process and the data generated can then be used to compare the success of various treatments. The measurements to be monitored are:

- Average height of plants within rehabilitation areas (height in metres for tree, shrub and groundcover species);
- Dominant species (qualitative description of dominant species within tree, shrub and ground layer);
- Canopy cover %;
- Canopy and upper strata species diversity;
- %cover of ground cover and leaf litter;
- Health of vegetation within rehabilitation areas (per Section 4.5 below);
- Area of ground cover covered by weed species (area in square metres);
- Percentage of planted specimens survived;
- Incidence of recruitment, both exotic and native (species and quantity estimates of new species noted [i.e. A = abundant, .R = relatively common, I = isolated/scarce];
- Native fauna presence (native fauna species recorded via observation, track or trace during vegetation inspections are to be noted)

The simplest of all methods of monitoring a site is to establish permanent photo points and take photographs at regular intervals, and to regularly (i.e. six-monthly, annually) traverse the rehabilitation area(s). In this regard, each management stage of each rehabilitation zone shall be photographed in accordance with the below sections (for the life of the project) to provide a visual indication of plant growth (height and extent) and weed presence. Photographs shall be taken at the SW, SE, NW, NE corners of each monitoring site (50m x 20m quadrat or 50m x 8m quadrat (for rehabilitation area 4)).

The below monitoring forms are to be completed on an annual basis (excluding Forms A: Routine Monitoring & B: Condition Monitoring which are to be completed on a six monthly basis for the first 10 years) for each of the rehabilitation zones.

Note that monitoring form C is to commence inspection and completion similar to the staging schedule contained in Attachment 3. These inspections shall commence in the year prior to the first planting module (pioneer species) trigger and continue thereafter (has already commenced). The table below summarises the trigger for relevant inspections and form completion for forms C. Forms A, B and the visual monitoring photos are to be undertaken every six months for every rehabilitation zone. These monitoring efforts will inform maintenance requirements (particularly with regard to weed management). The relevant staging of monitoring (and assessment against performance criteria, trigger for maintenance and/or correction actions) requirements are tabulated below. Note that a less intensive regime is proposed following a five year period for each stage (i.e. when the rehabilitation zones are likely to be relatively stable):

REHAB ZONE	STAGE	YEAR									
		1	2	3	4	5	6	7	8	9	10+
1A	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	3	R	√R	√R	√R	√R	XS	XS	XS	XS	XS
1B	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	3	R	√R	√R	√R	√R	XS	XS	XS	XS	XS
	4	R	R	√R	√R	√R	√R	XS	XS	XS	XS
	5	R	R	R	√R	√R	√R	√R	XS	XS	XS
1C	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	3	R	√R	√R	√R	√R	XS	XS	XS	XS	XS
2A	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
2B	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
2C	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	3	R	√R	√R	√R	√R	XS	XS	XS	XS	XS
	4	R	R	√R	√R	√R	√R	XS	XS	XS	XS
3	1	R	√R	√R	√R	√R	XS	XS	XS	XS	XS
4	1	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	2	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS
	3	√R	√R	√R	√R	XS	XS	XS	XS	XS	XS

'R' denotes that routine and condition monitoring shall be undertaken six monthly during this year. This shall include assessment against performance criteria and implementation of corrective actions (i.e. further weeding, planting) where required

'√' denotes that quantitative and qualitative inspections shall be undertaken six monthly including completion of forms C. This shall include assessment against performance criteria and implementation of corrective actions (i.e. further weeding, planting) where required

'S' denotes that routine and condition monitoring shall be undertaken annually during this year. This shall include assessment against performance criteria and implementation of corrective actions (i.e. further weeding, planting) where required

'X' denotes that quantitative and qualitative inspections shall be undertaken annually including completion of forms C. This shall include assessment against performance criteria and implementation of corrective actions (i.e. further weeding, planting) where required

Please note that form content has been adapted from Kanowski, J., Catterall, C. P., Freebody, K. and Harrison, D. A. (2008) *Monitoring Revegetation Projects for Biodiversity in Rainforest Landscapes. Toolkit Version 2*. Report to the Marine and Tropical Sciences Research Facility. Reef and Rainforest Research Centre Limited, Cairns.

FORM A: ROUTINE REHABILITATION MONITORING SHEET

General Management	Weeds	Vegetation regeneration
Has there been a fire within the last quarter? _____ Do the bushfire trails or adjacent pasture areas require slashing or maintenance to reduce fire risk? _____ Is there evidence of rubbish dumping within the rehabilitation zones? _____ Is there evidence of plant theft within the rehabilitation zone? _____ Does it appear that the rehabilitation zone has been utilized for stockpiling, vehicle parking, building waste dumping, cattle grazing or person traffic? _____ If yes, acknowledge below what works were undertaken to rectify/restore and the date _____	Have any areas of weeds re-established within the rehabilitation zones during the last quarter? _____ What species? _____ What management was undertaken to eradicate these weeds? _____ If management was undertaken acknowledge that such was performed in accordance with the approved rehabilitation management plan. _____	Natural regeneration is occurring in (record height range estimate): - Tree species _____ - Shrub species _____ - ground covers _____ What are the dominant species within each layer? - Tree _____ - Shrub _____ - ground covers _____ Have you noticed any new native plant species since the last monthly inspection? _____ If yes name the species or take a photograph _____ Acknowledge that the required routine photographs have been taken within the rehabilitation zones _____
Biodiversity Have you spotted native fauna within the rehabilitation zone during inspection? If yes, what types? Koala _____ Kangaroo/wallaby _____ Possums/glidens _____ Small mammal (i.e. bandicoot, echidna) _____ Reptiles (i.e. snakes/lizards) _____ Birds of prey _____ Large nectar feeding birds (i.e. lorikeets, parrots, cockatoos) _____ Small tree and ground birds (i.e. finches, fairy wrens, treecreepers) _____ Glossy Black Cockatoos _____ Other _____	Modifications Have there been any structural additions (eg. new tracks, buildings) to the rehabilitation zones since the last visit? _____ _____ _____ What actions were undertaken to remove any illegal modifications? _____ _____ Condition of fences - Good - Need minor repair - Poor (need replacement)	Are any of the following performance criteria exceeded (refer Section 4.5 below)? Declared Weeds? _____ Extent of other Weeds? _____ Survival Rate of Plants? _____ Condition of Plants? _____ Canopy Coverage? _____ Tree, Small Tree & Shrub Diversity? _____ Groundcover Coverage? _____ General Coverage/Success? _____ If yes, what corrective action was performed (i.e. plant showed drought stress and so watering was undertaken, plant was dead so a replacement plant was pocket planted, canopy plant coverage was not achieved so relevant pioneer plants were pocket planted).

FORM B: SITE CONDITION

(TO BE UNDERTAKEN WITH ROUTINE PHOTO MONITORING, WEED MANAGEMENT AND REVIEW OF COMPLIANCE WITH PERFORMANCE CRITERIA)

Protocol for assessing site condition

The steps in condition assessment are listed below. A pro-forma for assessing site condition, based on this protocol, is provided on the following pages.

1. Obtain any previous condition assessment of the site, and other relevant documentation of the site.
2. Conduct a field inspection of the site. Based on the table below determine whether all or part of the site is:
 - **OK** ('on track' towards target conditions, requires only routine maintenance);
 - **Uncertain** (significant problems identified, requires intervention); or
 - **Poor** (major problems identified, likely to fail without major intervention).

If outcomes vary across a site, divide the site into zones, and record outcomes for each zone separately.

3. Make overall comments on the condition of the site.
4. Determine whether the condition of the site has changed since last assessment, and comment on any changes.
5. Complete the table describing site condition in detail. Where outcomes vary across the site, divide the site into zones ('A' = OK, 'B' = uncertain; 'C' = poor) and record outcomes for each zone separately. Comment on the attributes of each zone, particularly the factors that appear to be affecting outcomes, such as the canopy species mix and cover, regeneration/stocking rates and heights, weeds, disturbance or maintenance.
6. Make recommendations for maintenance, where relevant. The rating system is closely linked to maintenance requirements:
Zone A = routine maintenance only required;
Zone B = additional maintenance required, more than routine (need to describe);
Zone C = major maintenance effort required (need to describe).

Note that what comprises 'routine' maintenance will often change, e.g. from regular spraying to spot-checking and control of weeds, as sites mature. However, after major disturbance, routine maintenance may revert to regular broad-scale weed control.

7. If desired, calculate an overall 'site condition' score. This score reflects the proportion of the site in good, uncertain or poor condition, and ranges from 0% (when the entire site is in poor condition) to 100% (when the entire site is 'on track' to target conditions).

Various intermediate scores are possible (e.g. a score of 50% could mean 50% of the site is 'OK' and the rest 'poor'; it could also mean that 40% is 'OK', 20% 'uncertain', and the rest 'poor').

To calculate the score, multiply the percentage of the site zoned as A, B or C by a suggested 'condition rating' for each zone: Zone A (OK) = 1; Zone B (uncertain) = 0.5; Zone C (poor) = 0, and add the products.

**CRITERIA FOR ASSESSING CONDITION OF YOUNG REVEGETATED SITES,
BEFORE INITIAL CANOPY CLOSURE.**

Rating / zone	Status	Canopy cover	Ground cover	Problem weeds	Tree survival	Maintenance requirements
A	OK On track to target conditions	Developing well towards closed canopy	Leaf litter, mulch or soil around trees; grass/ weeds not suppressing tree growth (i.e. sparse around trees)	Not present or minor occurrence	High (at least 90%)	Routine maintenance only
B	Uncertain if will develop towards target conditions. Significant problems.	Not developing well towards closure, or outcomes are patchy	Grass/ weed cover sufficiently dense to suppress the growth of planted trees, at least in places	If present, have the potential to impede site development	Moderate (60-90%), or patchy	Extra effort required to fix problems, additional to routine maintenance
C	Poor Major problems. Likely to fail.	Poorly developed. Unlikely to achieve closure	Dense cover of grass/ weeds which is likely to strongly suppress tree growth	May be common, or likely to impede site development	Poor (less than 60%)	Major effort required to address problems.

PROFORMA FOR ASSESSING SITE CONDITION

PROJECT DESCRIPTION *Note: where options are given, put an 'X' next to the appropriate term(s):*

Project name:		Project ID:
Site name:		Site ID:
Type of on-grounds: Assisted Natural Regeneration	Years since site commenced:	When was this site last assessed?
Current assessment conducted by:	Date of current assessment:	
Overall comments on site condition:		
Has the condition of the site changed since last assessment? YES or NO If Yes, briefly describe changes in this box, and provide details in table below.		

DETAILED DESCRIPTION OF SITE CONDITION *Complete table as per monitoring schedule, or if conditions have changed since last assessment.*

Rating/ zone	Area (ha)	% of site	Location and factors affecting outcomes	Canopy cover (%)	Ground cover	Problem weeds	Tree survival or Recruitment	Other comments	Suggested maintenance
A = OK on track towards target									(should be routine: describe if necessary)
B = Uncertain									
significant problems									(describe)
C = Poor major problems, likely to fail									(describe)
Overall Condition Score (ranges from 0-100%) Multiply percentage of site occupied by each zone (A, B or C), by the condition rating for each zone (A = 1; B = 0.5; C = 0), and add the products: e.g. (70% x 1) + (20% x 0.5) + (10% x 0) = 80%									 %

FORM C: REVEGETATION/FOREST STRUCTURE

Monitoring Forest Structure is surveyed on a 50m x 20m plot. Given its narrower width, rehabilitation zone 4 will be surveyed on a 50m x 8m plot. The following form is to be filled on a regular basis in accordance with the monitoring schedule table earlier in Section 4.4.

SITE FORM REHABILITATION TRANSECT FORM (50MX20M)

Location

Site No. _____ Recorder: _____ Day/Date: _____
 Purpose _____
 Locality: _____
 GPS coordinates: Zone

--	--

 E

--	--	--	--	--	--

 N

--	--	--	--	--	--

 Datum: _____

Vegetation structure

D = dense; M = mid-dense, S = Sparse
V = Very Sparse

Stratum	Height interval	Est. cover density (D, M, S, V)
E		
T1		
T2		
S1		
G		

Structural formation: (including height)

Ecologically dominant layer:

Plant species

Record relative (numerical) dominance within each stratum;
d – dominant; **c** – codominant; **a** – associated; **s** – suppressed.

[illegible]

other notes

Geology mapping: _____

Geology code and rock types: _____

Noted habitat elements: _____

Noted Environmental Weeds: _____

Photos:

Insert photo	Insert photo
SW	SE

Insert photo	Insert photo
NW	NE

Reporting

An annual report is to be prepared documenting all monitoring/review requirements of this rehabilitation strategy including:

- Six monthly/annual visual monitoring results and photographs as outlined above
- Six monthly/annual completion of the required monitoring forms (Forms A-B)
- Six-monthly/annual rehabilitation monitoring and completion of the required forms (Form C) for relevant stages of the four rehabilitation zones.
- Any incidences of non-compliance with the performance criteria (refer Section 4.5 below)
- Corrective actions implemented in response to performance criteria non-compliance
- A work log of all monitoring/maintenance (and corrective action where required) activities performed during the preceding 12 months. This log shall include type of work (i.e. weed inspection, planting quantities, monthly photo-monitoring etc), the work trigger contained within this rehabilitation strategy (i.e. routine quarterly monitoring/maintenance or corrective action as a result of performance criteria non-compliance etc), number of personnel utilized, hours of work performed and any problems/issues identified through the preceding maintenance/monitoring 12-month period.

4.5 ENVIRONMENTAL PROTECTION ZONE PERFORMANCE CRITERIA

The following performance criteria are to be achieved within the EPZs:

- Existing native vegetation and areas of natural regeneration to be retained
- All rubbish/vegetation dumping, non-approved structures etc are removed from the EPZs
- No declared weeds are present
- Cattle and domestic animals are excluded
- A significant reduction in the presence of weed species is evident. In practice it is noted that the removal of all individuals of all weed species for 100% of the time is unachievable. Therefore, it is considered appropriate that the following performance criteria be adopted:
 - All large weed/ornamental trees are treated;
 - No weed shrubs/trees older than three months of age are present.
 - Densities of such shrubs/trees is not to exceed 1 per 20m²
 - Scattered groundcover weed species may occur but not in any covering an area greater than 5m²
- A survival rate of the following minimum standards are to apply for all planted trees, shrubs and groundcovers:
 - One year following planting: 90%
 - Three years following planting: 90%
 - Five years following planting: 85%
- A growth rate of the following minimum standards is to apply for all planted trees, shrubs and groundcovers and for natural regenerated plants within the rehabilitation zones:

GROWTH RATE TARGETS (HEIGHT)			
Strata	Time following initial planting		
	1 yr	3 yr	5yr
Groundcovers (prostrate)	100mm	100-250mm	250mm+ or mature height (i.e. <i>Xyris</i> at mature height would be below 250mm)
Groundcovers (grasses, sedges etc)	100mm	100-300mm	300-1000mm or mature height (i.e. <i>Sporobolus</i> at mature height would be below 300mm)
Shrubs	250mm	450-500mm	1000-2000mm or mature height
Trees	650mm	2-3m	4m+

- Planted stock to exhibit fair or healthy conditions:

Condition	Descriptor
Healthy	Leaves green, no abnormal leaf loss
Fair	Leaves green, some yellowing of leaves, but <20% of canopy affected
Poor	Many leaves yellow or brown, substantial reduction in canopy extent since last measurement
Dead	Leaves brown or absent, little of the canopy remaining

- Inappropriate public access to the EPZs is to be effectively restricted (through fencing or signage). During routine monitoring (refer section 4.4 above) the EPZs are also to be inspected for the following evidence of access related impacts:
 - Litter and/or rubbish dumping
 - Stock theft
 - Bicycle/pedestrian tracks/trails
 - Soil compaction
 - Fence signage vandalism/removal
 - Cattle access and associated damage (i.e. grazing, trampling etc)

ADDITIONAL PERFORMANCE REQUIREMENTS: ASSISTED NATURAL REGENERATION AREAS

The areas to be managed for natural regeneration area are described in Section 4.3.1. Please note that compliance with the below-listed performance requirements (in which non-compliance will trigger a selected type of supplementary planting) is to be assessed at the specified time-frame for each individual management stage within each of the defined three Rehabilitation Zones/Areas (refer Attachment 3 for staging schedules).

Performance requirements: Canopy Coverage

Natural regeneration canopy coverage will not be considered achieved for any one area if it does not contain a canopy or small tree typical to the community (refer Section 4.3.1 modules) within an area equal to or greater than 4sqm (i.e. if an area 2m x 2m does not contain any juveniles of required canopy tree/small tree than natural regeneration canopy cover is considered to be unsuccessful at that particular location).

In the event that such a location is deemed to occur then supplementary (pioneer species) planting shall be undertaken within the patch in accordance with Section 4.3.1.

For example, a patch of 10sqm within Rehabilitation Zone 1B is noted to be regenerated with native ground covers and/or shrubs but no tree species typical to the listed 'Swamp Sclerophyll' community occur. In this instance 5 x trees/small trees from the Rehabilitation Zone 1B are to be pocket planted at 75mm pot sizes within the patch.

N.B. Please note that the trigger for pioneer plantings for Rehabilitation Zones 1A and 2B shall relate to an area of 4sqm having less than 4 plants of rush/sedge/fern (due to the ecologically dominant layer being rush/sedges rather than trees). In this instance pocket planting of 75mm tubes of the listed rush/sedge/ferns from the 'Wetland' community shall be undertaken at 1 metre centres within the identified gap.

Performance requirements: Tree, Small Tree and Shrub Diversity within Natural Regeneration

Diversity within the upper strata (trees, small trees and shrubs) of natural regeneration shall be required to achieve the following:

Community Type (Forests/Open Forests)	Canopy Tree minimum Diversity per 100sqm	Small Trees/Shrubs minimum Diversity per 100sqm	Applicable Rehabilitation Zones
Swamp Sclerophyll	3	3	1B, 1C, 2C
Swamp Sclerophyll, Swamp She-oak, Banksia	3	3	2A,
Swamp Sclerophyll, Swamp-oak	3	3	3

Community Type	Rushes/sedges/ferns Per 100sqm	Applicable Rehabilitation Zones
Coastal Wetland	Not applicable*	1A, 2B

*Please note that Rehabilitation Zones 1A and 2B shall be exempt from this diversity performance requirement given that wetland communities naturally exhibit areas of mono-specific aquatic plant growth.

Performance requirements: Groundcover Coverage

Natural regeneration groundcover coverage will not be considered achieved for any one area if it does not contain native ground cover or leaf litter from the upper strata (grass, sedge, fern, bracken etc) within an area equal to or greater than 2.25sqm (i.e. if an area 1.5m x 1.5m does not contain any ground covers or natural leaf litter layer than natural regeneration of ground covers is considered to be unsuccessful at that particular location). In this instance groundcovers from the relevant Rehabilitation Zone module are to be planted at 75mm pot sizes within the patch.

Please note that this performance requirement does not apply to Rehabilitation Zones 1A and 2B. Rush/sedge/fern coverage within these coastal wetland regeneration zones are addressed through 'canopy coverage' above.

Performance requirements: General Coverage/Success of Natural Regeneration

Natural regeneration coverage will not be considered achieved for any one area if it contains a bare or denuded area greater than 6.25sqm (i.e. if an area 2.5m x 2.5m is bare than natural regeneration has been unsuccessful at that particular location). In this instance full planting of the relevant module for that particular Rehabilitation Zone shall be required.

4.6 CORRECTIVE ACTIONS

The following corrective actions are to be implemented in instances of non-compliance with the performance requirements:

- If rubbish or litter is found within an EPZ it is to be immediately removed

- Where weed re-establishment is noted additional removal/management works are to be instigated in accordance with Section 4.1
- Where planted specimens fail to strike or plantings do not achieve the set survival percentages then supplementary plantings are to be undertaken. Where it is considered that a particular species has failed due to non-suitability or repeated failure within the planting environment a suitable native plant replacement species is to be discussed with and approved by Council's ecologist;
- If regular increases in height and crown cover extend are not recorded within the monitoring period a horticulturalist/arborist is to be employed to identify likely causes and to recommend measures (i.e. fertiliser application, increased watering etc) to encourage increased growth.
- If retained or planted vegetation show signs of ill health (i.e. poor or dead), a horticulturalist/arborist is to be employed to identify likely causes and to recommend mitigation measures to improve regeneration conditions
- If access related impacts are evident (refer 4.5 above) the following actions are to be implemented:
 - Cattle are to be removed
 - Removed/damaged plants is to be via planting the relevant module to the rehabilitation area/zone
 - If damaged to fencing or signage or the viewing platform is recorded the structures are to be repaired to pre-existing condition and Council notified regarding the recorded damage/vandalism.
- In the event that a location within a Rehabilitation Zone is deemed not to comply with the 'canopy coverage' requirements then supplementary (pioneer species) planting shall be undertaken in accordance with Section 4.3.1.
- In the event that a location within a Rehabilitation Zone is deemed not to comply with the 'diversity' requirements then supplementary (tree, small tree and shrub diversity species) planting shall be undertaken in accordance with Section 4.3.1.
- In the event that a location within a Rehabilitation Zone is deemed not to comply with the 'groundcover coverage' requirements then supplementary (groundcover species) planting shall be undertaken in accordance with Section 4.3.1.
- In the event that a location within a Rehabilitation Zone is deemed not to comply with the 'general coverage' requirements then full planting of the relevant module for that particular Rehabilitation Zone shall be required.

Please note that compliance against the relevant 'assisted regeneration' performance requirements (in which non-compliance will trigger a selected type of supplementary planting) is to be assessed at the specified time-frame for each individual management stage within each of the defined three Rehabilitation Zones/Areas (refer Attachment 3 for staging schedules).

N.B. Please note that it is considered likely that unanticipated adaptive management procedures may be necessary throughout the course of the rehabilitation program (i.e. extension of watering regime during times of low rainfall, alteration to weed management measures if unsuccessful for a certain species, etc). Any such amendment to the management regime contained within this document shall be undertaken in consultation with qualified ecologist.

5.0 FAUNA HABITAT ENHANCEMENT

Enhancement of fauna habitat values within the EPZ is proposed to increase the potential for native fauna to continue to utilise the area. This will be achieved through the implementation of the following mechanisms:

- **Suitable habitat:** it is considered that revegetation of Swamp Sclerophyll, Swamp Oak and Banksia Open Forests with Littoral Rainforest elements will (over time) provide potential habitat for a number of threatened fauna species recorded onsite and elsewhere in the region including:

Species	Habitat Requirements
Osprey (<i>Pandion haliaetus</i>)	This species is associated with waterbased habitats including estuaries, coastal wetlands, rivers and streams. The Osprey is predominately a coastal raptor frequenting estuaries, bays, inlets, islands and rocky cliffs within all Australian states except for Tasmania and sporadically within Victoria (DEC, 2005; NPWS, 2002). It is noted however, that the species sometimes inhabits inland islands (Pizzey and Knight, 1997; Readers Digest, 2002). Within suitable environment it usually constructs a nest in an overhanging large tree or upon elevated man made structures such as platforms or telegraph poles. The species preys almost exclusively on fish by usually hunting alone and traversing the water's surface for prey which it secures by swooping over the waters surface or plunging below (Readers Digest, 2002; Clancy, 2005). Studies of prey middens on Lizard Island within the Great Barrier Reef also noted that occasional Terns and crustaceans are sourced for food (Smith, 1985). The eastern forests (Communities 1 & 4-9) fringing Mooball Creek and the surrounding estuarine/riparian habitats including Wooyung Nature Reserve are considered to provide suitable habitat for the Osprey. The 15ha of rehabilitation proposed is unlikely to significantly benefit the osprey with the exception of expanding the width of existing riparian buffers to Mooball Creek.
Glossy Black-Cockatoo (<i>Calyptorhynchus lathamii</i>)	Minor potential occurs for the Glossy Black Cockatoo to frequent the site due to the limited presence of foraging materials (<i>Allocasuarina</i> spp.) and suitable nesting trees (large hollow within a live or dead Eucalypt: 10-20m, Depth: 40-120cm, Entry: ~21cm: Inside Dia: ~23cm (Forshaw, 1981; Gibbons & Lindenmayer, 2002)) are considered to be largely absent. Suitable habitat is considered to be limited to the NW Brushbox/Blackbutt Forests on Bedrock although <i>Allocasuarina</i> presence is very sparse. Over the balance of the site <i>Allocasuarinas</i> are generally absent although <i>Casuarina glauca</i> is very common. Plantings of <i>Allocasuarina</i> will increase foraging resources for the cockatoo onsite. Plantings of eucalypts may also provide potential nest hollows in the 60-100 year timeframe.
Black-necked Stork (<i>Ephippiorhynchus asiaticus</i>)	The species is generally associated with wetlands, mudflats, mangroves, swamps and floodplains while it may also sometimes be found in open woodland environs where a grassy understorey is present (NPWS, 2002, Readers Digest, 2002; DEC, 2005). Irrigated lands are also occasionally a foraging resource and it has also been recorded foraging in artificial wetlands of sewerage treatment plants (ERM, 2001). Suitable habitat for the species is considered to occur within the eastern interconnected forest remnants adjacent Mooball Creek (Communities 1 & 4-9) although there is an absence of large areas standing water within these communities. The shallow reaches of the creek itself may function as a foraging locality for the species and overhanging trees may be utilized as nest sites.

	The 15ha of rehabilitation proposed is unlikely to significantly benefit the stork with the exception of expanding the width of existing riparian buffers to Mooball Creek and providing alternate future options for nesting trees. Creation of large lakes may increase potential foraging in the future (following completion of extraction).
Koala (<i>Phascolarctos cinereus</i>)	This species primarily occurs within Eucalypt Forest and Woodlands containing a suitable density of favoured food trees within coastal eastern and southeastern Australia. The suitability of forest and woodland communities as habitat for Koalas is influenced by the size and species of trees present, soil nutrients, climate, rainfall and the size and disturbance history of the habitat patches (Reed <i>et al.</i> 1990 in NPWS, 1999). Whilst a limited abundance of favoured Koala foraging trees (principally <i>E. robusta</i>, <i>E. tereticornis</i>, <i>E. microcorys</i>) were recorded on site and favoured habitat (Eucalypt Forest) was restricted to the fragmented patches of Brushbox Forest on Bedrock (Community 3) and small copses of Blackbutt Forest (Community 2) the Koala was recorded during survey. Two individuals were recorded during spotlighting within the largest of the western Brushbox Forest remnants with an additional individual recorded during diurnal survey. Surveying of the eastern forest remnants (interconnected Communities 1 & 4-9) did not locate any Koalas with a general absence of suitable foraging resources and preferred habitat type noted. Extension of forest remnants through revegetation and incorporation of favoured foraging trees will increase potential habitat for the koala.
Little Bentwing Bat (<i>Miniopterus australis</i>)	This species utilises well-timbered habitats including rainforest, <i>Melaleuca</i> swamps and dry sclerophyll forests where it feeds on insects within the canopy and requires caves, mines, stormwater drains and/or tree hollows to roost (Strahan eds, 2002). Potential habitat for the species occurs in association with the remnant forest patches on site (Communities 1-3 & 4-6). 15ha of potential habitat for the bentwing bat will occur in association with revegetation works.

Species	Habitat Requirements
Red Goshawk (<i>Erythrotriorchis radiatus</i>)	This raptor utilises coastal-subcoastal tall forests/woodlands, savanna traversed by forested rivers and rainforest fringes (Marchant & Higgins, 1993; NPWS, 2002; NPWS, 1999). In NSW, the goshawk is associated with frequent mixed subtropical rainforest, <i>Melaleuca</i> swamp forest and open eucalypt forest along coastal rivers (Debus 1993 in NPWS, 2002). Nesting is restricted to tall trees within proximity of a creek, river or wetland (NPWS, 1999; NT Parks & Wildlife Commission, 2002). Hunting occurs for medium-large birds within open forests and riparian/gallery forests over a very large home range of up to 200km² (Blakers <i>et al.</i>, 1984, Aumann and Baker-Gabb, 1991, Czechura and Hobson, 2000; NPWS, 2002). It is considered that potential habitat for this species occurs in association with the eastern connected forests fringing Mooball Creek. It is noted that these remnants (~27ha) are highly unlikely to sustain an individual goshawk which would occupy a much larger home range. It is noted that previous records of Goshawks from the region (NPWS database) are limited to a 1957-87 record within Billinudgel Reserve to the south. If this was an accurate record and Red Goshawks persist it could be considered reasonably likely that they would hunt within the Mooball Creek environments to the east of the site. The 15ha of rehabilitation proposed is unlikely to significantly benefit the goshawk with the exception of expanding the width of existing riparian buffers to Mooball Creek. However, provision of an additional 15ha of forest is, over time, likely to result in an increased abundance of forest birds which provide potential prey for the goshawk.
Long-nosed Potoroo (<i>Potorous tidactylus</i>)	Long-nosed Potoroos are generally restricted to areas with an annual rainfall greater than 760 mm where they inhabit dry and wet sclerophyll forests and woodland with a heathy understorey (Johnson in Strahan, 2002; DEC, 2005). The preferred habitat in north eastern NSW is dry and wet open shrubland (Mason 1997, DEC, 2005, Johnston in Strahan, 2002). In all habitats the species requires relatively thick groundcover growing on friable soils (Bennett, 1993). Within these areas the Potoroo digs for its food the main component of which is hypogeal fungi with other important items including hard-bodied arthropods, vascular plant tissues, seeds and fleshy fruits (Bennett & Baxter, 1989; Claridge <i>et al</i>, 1993) Within the site the eastern forests occur on sandy, friable soils although a thick, heathy groundcover is mostly absent. Some areas of Casuarina Forest (Community 8) and Swampbox Forest on sand (Community 4) do have small patches of dense grass, bracken and lantana growth which may provide potential habitat. Trapping, spotlighting and regular traverse of such areas failed to record the species. One noted recorded occurs from the region in association with Billinudgel Reserve further south which is mapped as containing more suitable shrubland/heathland complexes on sand (NPWS, 2001). The 15ha of revegetation is considered unlikely to be beneficial for potoroos given their absence from the site and absence of terrestrial corridors of favoured habitat between the site and existing known population locations.
Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>)	This species forages on a variety of fruits, flowers and pollen. It occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps (Eby 1995). It additionally utilises cultivated fruit crops and urban gardens. This species was recorded mostly within the interconnected eastern forests (Communities 1 & 4-9) on flowering <i>Melaleucas</i> and <i>Banksias</i> and fruiting Figs and <i>Acronychias</i>. It was also recorded within the western forests on bedrock (Communities 2 & 3) and the open grassland/pasture with scattered trees (Community 10) on flowering <i>Eucalypts</i> and fruiting Figs. 15ha of potential habitat for the flying fox will occur in association with revegetation works. Favoured heavily flowering trees and fruiting species will provide an additional source for foraging.

Species	Habitat Requirements
Red-legged Pademelon (<i>Thylogale stigmata</i>)	This macropod species is known to inhabit dense forest vegetation (usually rainforest) but is also known from wet sclerophyll forest and occasionally in dry vine-thickets (DEC, 2005; Vernes et al, 1995, Johnson & Vernes, 1994). A dense understorey is required for shelter and refuge from predators although it will forage in pastures adjacent the forested edges as well as browse grasses, fruits, fungi and shrubs within the forest interior (DEC, 2005). The home range individual is 1-4ha (Johnson & Vernes in Strahan, 2002) with a study of fragmented rainforest in north Qld noting the range to be larger during diurnal periods than nocturnal periods. Within the site potential habitat is considered to be limited to the eastern patches of Littoral Rainforest although the understorey whilst structurally diverse in the mid and upper strata is not as dense within the ground layer which is dominated by leaf litter and woody debris. Thickets of grass, shrub/heath, bracken/fern and/or rushes/sedges are isolated. Spotlighting and regular diurnal traverses (particularly proximate to mammal trapping lines) failed to detect the species presence. The 15ha of revegetation is considered unlikely to be beneficial for pademelons given their absence from the site and absence of terrestrial corridors of favoured habitat between the site and existing known population locations.
Black Flying-fox (<i>Pteropus alecto</i>)	The Flying-fox forages on the nectar and pollen of native trees and fruits of native rainforest trees and vines as well as ornamental and orchard trees/crops. The preferred food includes the blossoms of Eucalypts, paperbarks and turpentines. Other native and introduced blossoms and fruits are also eaten (Strahan eds, 2002; Nicola and Hall, 2004). 15ha of potential habitat for the flying fox will occur in association with revegetation works. Favoured heavily flowering trees and fruiting species will provide an additional source for foraging.
Square-tailed Kite (<i>Lophoictinia isura</i>)	This species typically prefers the coastal forested and wooded lands of tropical and temperate Australia where it appears to occupy large hunting ranges of more than 100km² (Marchant & Higgins 1993; NPWS, 1999; DEC, 2005). A common feature of the kite's habitat is the presence of profuse eucalypt blossom and attendant nectarivorous/passerine birds which are the favoured prey of the kite (Readers Digest, 2002, NPWS, 1999). It is considered unlikely that the species would inhabit the site due to the absence of large tracts of eucalypt forest/woodlands. Some potential occurs in association with the eastern connected forests fringing Mooball Creek which at its upper extent is proximate to the previous record of the kite in the region at Billinudgel Reserve (NPWS database). If this was an accurate record and the Kite persists in this habitat it could be considered likely that they would hunt within the Mooball Creek environments to the east of the site. The 15ha of rehabilitation proposed is unlikely to significantly benefit the kite with the exception of expanding the width of existing riparian buffers to Mooball Creek. However, provision of an additional 15ha of forest is, over time, likely to result in an increased abundance of nectarivorous/passerine birds which provide potential prey.

Species	Habitat Requirements
Rose-crowned Fruit Dove (<i>Ptilinopus regina</i>)	This species generally occurs within sub-tropical rainforest, camphor laurel and occasionally wet sclerophyll and swamp forests which contain suitable fruiting species for foraging (DEC, 2005; Recher et al, 1995). As an obligate frugivore a high proportion of fruiting species (figs, lillipillis, laurels etc) is necessary and as such rainforest habitats are favoured. The species is considered a partial migrant and moves north in autumn/winter and returning in spring/summer to breed (Recher et al, 1995). Within the site it is considered that preferred habitat is limited to the Littoral Rainforest (Community 1) in the eastern areas of the site which contain the highest density of fruiting species. Avifauna survey including call playback failed to detect the species although the survey was limited by the time of year performed. Incorporation of littoral rainforest type fruiting species will provide an additional source for foraging within the rehabilitation zone.
Common Planigale (<i>Planigale maculata</i>)	This species is known to inhabit a broad range of habitats incorporating a dense ground cover layer including rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas (Redhead in Strahan, 2002; Lewis, 2005). Potential habitat is considered to occur within the interconnected eastern forests on sand (Communities 1 & 4-9) which incorporate suitable understorey cover and diversity. Pitfall trapping within these areas failed to record the species. The 15ha of revegetation is considered unlikely to be beneficial for planigales given their absence from the site and absence of terrestrial corridors of favoured habitat between the site and existing known population locations. However, if planigales occur (but were unrecorded during previous survey) the rehabilitation of 15ha of native vegetation on sandy, friable soils will provide increase potential habitats and dispersal zones for the species.
Common Blossom Bat (<i>Syconycteris australis</i>)	This species is one of the smallest members of the flying fox family (Pteropodidae) and is considered to be a specialist pollen feeder favouring Banksia, Melaleuca, Callistemon and certain species of Eucalypt (Strahan eds, 2002). Required habitats include Coastal rainforest, heathlands and Melaleuca swamps. The presence of Melaleuca Forest (Community 6) on site and extensive areas of Melaleuca Forest and Eucalypt Forest within the adjacent reserve indicates the species may be a potential occurrence. 15ha of potential habitat for the blossom bat will occur in association with revegetation works. Favoured heavily flowering trees (particularly banksias) will provide an additional source for foraging.
Eastern Bentwing (<i>Miniopterus schreibersii oceanensis</i>)	This species usually forages on insects within intact, well timbered forest complexes and have been found to roost within caves, tunnels, stormwater culverts or disused mining areas (Strahan eds, 2002; DEH, 2005). They utilise a broad range of habitats including wet and dry sclerophyll forest, open woodland, paperbark forests, rainforests and open grasslands (North & Pasic, 2006). 15ha of potential habitat for the bentwing bat will occur in association with revegetation works.
Mangrove Honeyeater (<i>Lichenostomus fasciularis</i>)	In NSW this species primary habitat is mangrove forest where a few colonies exist at scattered localities, including the Tweed, Richmond and Clarence River estuaries and Stuarts Point south of Macksville (DEC, 2005). The honeyeater has also been recorded from other coastal forest types including casuarinas and paperbark forest (DEC, 2005). Within the site the eastern Mangrove areas (Community 9) fringing Mooball Creek is considered to provide suitable habitat for the species. The 15ha of rehabilitation proposed is unlikely to significantly benefit the honeyeater with the exception of expanding the width of existing riparian buffers to Mooball Creek

Species	Habitat Requirements
Brolga (<i>Grus rubicunda</i>)	The Brolga inhabits the large open swamplands/wetlands of coastal and subtropical coastal Australia where it may form flocks of several hundred individuals during the breeding season (Readers Digest, 2002). Studies conducted in southern NSW and Northern Victoria (Charles Sturt University, 2000) indicates that most Brolga breeding sites were large (>50 ha) remnant wetlands with extensive areas of water around 30 cm deep. More than 90% of breeding sites were dominated by Canegrass (<i>Eragrostis australasica</i>, <i>E. infecunda</i>) or Spike-rushes (<i>Eleocharis</i> species), with emergent vegetation cover usually around 25% and 90 cm in height. DEC (2005) notes that the species may also forage within grassed paddocks or ploughed fields. The 15ha of rehabilitation proposed is unlikely to significantly benefit the brolga with the exception of expanding the width of existing riparian buffers to Mooball Creek. Creation of large lakes may increase potential foraging in the future (following completion of extraction).
Bush-hen (<i>Amaurornis olivaceus</i>)	This species favors coastal rivers and inlets from the Clarence River, north. It prefers densely overgrown margins of permanent terrestrial freshwater wetlands such as creeks and rivers, billabongs, ponds, swamps, waterholes, dams, lakes and roadside ditches (Muranyi and Baverstock, 1996). Potential habitat is considered to occur within the area in association with Mooball Creek and adjacent forest remnants (Communities 1 and 4-9). The 15ha of rehabilitation proposed is unlikely to significantly benefit the hen with the exception of expanding the width of existing riparian buffers to Mooball Creek. Creation of large lakes may increase potential foraging in the future (following completion of extraction).
Bush Stone-curlew (<i>Burhinus grallarius</i>)	This species is widespread throughout predominately coastal Australia where its preferred habitat consists of open forest-woodlands containing a grassy understorey with fallen timber and leaf litter (Readers Digest, 2002; NPWS, 2006). Foraging however, has been noted to occur over a broader spectrum of habitats including paddocks, grasslands, domestic areas (gardens, sports fields, [golf courses, residential areas pers. obs] etc), estuarine areas (mudflats, saltmarsh, mangrove forest, swamp oak, melaleuca forest) (NPWS, 1999; 2006). Potential habitat is present on the site in association with the eastern and western forested remnants (Communities 1-8). It is also considered that the open paddock/pasture areas (Community 10) provide potential foraging habitat as the species is known to utilize domestic areas and be tolerant of human presence/disturbance. 15ha of potential habitat for the curlew will occur in association with revegetation works.
Beach Stone-curlew (<i>Esacus neglectus</i>)	This species is distributed throughout coastal western, northern and eastern Australia from Norwest Cape to the Manning River (Readers Digest, 2002). Within this area it utilised open beaches, islands, reefs and sand/mudflats (NPWS, 2005; 1999; 2002) where it forages on crabs and other hard shelled marine invertebrates (Readers Digest, 2002). Mudflat and sandy beach areas are present adjacent the site to the east in association with Mooball Creek and Wooyung Nature Reserve. The 15ha of rehabilitation proposed is unlikely to significantly benefit the curlew with the exception of expanding the width of existing riparian buffers to Mooball Creek.

Species	Habitat Requirements
Grass Owl (<i>Tyto capensis</i>)	This species is generally recorded within tussock-grasslands but has also been noted to occur within heathland, swamps, coastal dunes, tree-lined creeks, treeless plains, mangrove fringes, grassy gaps between trees and crops and sugar cane plantation (Garnett and Crowley 2000; Pizzey and Knight, 1997). Within these habitats it sources a wide range of prey including birds, insects and terrestrial mammals. However, it feeds predominately on rodents and its population numbers can fluctuate wildly with the rise and fall of prey populations (Olsend and Doran, 2002). The fall of primary prey species following plague events (during which owl breeding increases) can result in widespread dispersal by the Owls with starvation also noted as the forage base reduces (Debus et al, 1998). The 15ha of rehabilitation proposed is unlikely to significantly benefit the grass owl with the exception of expanding the width of existing riparian buffers to Mooball Creek which contains marginal areas of habitat.
Large-footed Myotis (<i>Myotis adversus</i>)	The Myotis roosts within caves, tunnels, hollow-bearing trees, bridges, buildings and dense tree foliage always in close proximity to permanent water (NPWS, 2002; Richards, 2002). It forages over waterbodies where it scoops insects and small fish from the water surface or catches insects aerially (DEH, 2005; Menkhorst, 1996; Richards, 2002). It has been recorded foraging over small creeks, coastal rivers, estuaries, lakes and inland rivers (Law & Anderson, 1999) and other smaller waterbodies including farm dams (Law et al, 1998). Within the site potential foraging habitat is associated with the eastern forests fringing Mooball Creek (Communities 1 & 4-9) and the creekline itself. The 15ha of rehabilitation proposed is unlikely to significantly benefit the myotis with the exception of expanding the width of existing riparian buffers to Mooball Creek. Creation of large lakes may increase potential foraging in the future (following completion of extraction).
Wallum Froglet (<i>Crinia tinnula</i>)	This species is generally associated with Melaleuca Forest, Heathland or sedgeland containing acidic tannin-stained water in the coastal zone of SE Qld and NE NSW (Robinson, 1993; Qld Frog Society, 1999). Potential habitat is considered to occur in the eastern portions of the site in association with Paperbark and Paperbark/Swamp Oak Forests (Communities 6 and 7) which contain occasional freshwater soaks with sedge/rushes (<i>Baumea</i>, <i>Juncus</i>, <i>Phragmites</i> etc). Significant areas of Paperbark Forest are also present to the north of the site in association with an extensive SEPP 14 wetland area. Expansion of swamp sclerophyll habitats on coastal sands may increase the extent of potential habitat in the local area for the froglet.
Wallum Sedge-frog (<i>Litoria olongburensis</i>)	This species is known from ephemeral wetlands and acid swamps containing sedgeland, banksias (wallum) and melaleuca forest/woodland within the coastal sandy zones of NE NSW and SE QLD (DEH, 2005; NPWS, 2002). During wet periods the frog can be found on emergent vegetation (rushes, sedges, ferns) whilst during drier periods it may be found at the base of such vegetation (DEH, 2005). Potential habitat is considered to occur in the eastern portions of the site in association with Paperbark and Paperbark/Swamp Oak Forests (Communities 6 and 7) which contain occasional freshwater soaks with sedge/rushes (<i>Baumea</i>, <i>Juncus</i>, <i>Phragmites</i> etc). Significant areas of Paperbark Forest are also present to the north of the site in association with an extensive SEPP 14 wetland area. Expansion of swamp sclerophyll habitats on coastal sands may increase the extent of potential habitat in the local area for the sedge frog.

Species	Habitat Requirements
Squirrel Glider (<i>Petaurus norfolcensis</i>)	This species of Glider is associated with dry sclerophyll forest and woodlands although in northern NSW and Qld it has been recorded from wet sclerophyll environments (Suckling in Strahan eds, 2002; Lindenmayer 2002). It is considered to be most abundant in associations containing winter flowering Eucalypts and/or environments with a high abundance of Acacia, Banksia species in the lower layers (Smith & Murray, 2003; Menkhorst et al, 1998; Quinn, 1995). Within the canopy of the preferred habitat numerous trees bearing hollows are critical habitat values required to support populations of the species (Quinn, 1995; Smith & Murray, 2003; Lindenmayer, 2002). Gliders are known to regularly swap den trees and utilise a number of such dens (between 6 and 19 den trees per Glider) within their home range (van der Ree, 2000). These results are supported by survey work undertaken by Southern Cross University (June/July 2002) which indicated that 12 radio tracked gliders utilised 37 den trees incorporating live hollow bearing trees and stags (Cited in Warren, 2004). Within the site, favoured habitats are considered to be restricted to the eastern forests (some minor presence of bloodwood and ironbark with <i>Banksia integrifolia</i> relatively common) although the low abundance of suitable hollowbearing trees and general dry sclerophyll forest may limit the potential of this area to be of significance for the species. Rehabilitation/planting of eucalypts and banksias will increase foraging resources for the glider onsite. Eucalypts may also provide potential nest hollows in the 60-100 year timeframe.
Eastern Long-eared Bat (<i>Nyctophilus bifax</i>)	This species of bat inhabits lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest with coastal rainforest and patches of coastal scrub particularly favoured (DEC, 2005; NPWS, 2002). Roosting occurs within tree-hollows, under bark and/or palm fronds and within dense foliage with a seasonal shift in roost sites from rainforest edges (summer) to the rainforest interior (winter) (NPWS, 2002; Parnaby in Strahan, 2002; Lunney et al, 1995). It is considered that the potential habitat for the species on site occurs within the swamp and coastal forests in the eastern areas of the site (Communities 1 & 4-9) which will be retained in association with the proposal. 15ha of potential habitat for the long-eared bat will occur in association with revegetation works
Barred Cuckoo-shrike (<i>Coracina lineata</i>)	This species has been recorded from a variety of habitats including rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses within Coastal NSW (NPWS, 2002). Foraging requirements include fruiting tree species within in rainforest, wet sclerophyll forest, vegetation remnants or isolated trees (DEC, 2005) and insects captured among foliage (NPWS, 2002). Incorporation of littoral rainforest type fruiting species will provide an additional source for foraging within the rehabilitation zone.
Magpie Goose (<i>Anseranas semipalmata</i>)	This species favours coastal wetlands and swamps with prolific reed/sedge growth mostly within northern Australia (NPWS, 2002; Tulloch et al, 1981). Breeding is confined to the northern areas in association with large floodplains of creeks/rivers generally within 80km of the coast (Frith and Davies, 1961). Dense sedge/rush growth within shallow waters in these locations is favoured for nest formation (Tulloch et al, 1981; Bayliss and Yeoman, 1990). The 15ha of rehabilitation proposed is unlikely to significantly benefit the goose with the exception of expanding the width of existing riparian buffers to Mooball Creek. Creation of large lakes may increase potential foraging in the future (following completion of extraction).

Species	Habitat Requirements
Black Bittern (<i>Ixobrychus flavicollis</i>)	The species is widely distributed throughout the coastal regions of Australia but is more common in the northern extent of the country. Within its distribution, the species shows a preference for densely vegetated areas within terrestrial and aquatic wetlands. It has been recorded from a variety of vegetation types (including grassland, mangroves, wet sclerophyll forest, rainforest) where permanent water is present (Marchant & Higgins, 1990; Simpson & Day, 1996; NPWS, 2001). Suitable habitat is considered to occur in proximity to the site in association with Mooball Creek and the adjacent estuarine/freshwater communities (Mangroves, Paperbark Forest). The 15ha of rehabilitation proposed is unlikely to significantly benefit the bittern with the exception of expanding the width of existing riparian buffers to Mooball Creek.
Collared Kingfisher (<i>Todiramphus chloris</i>)	This species is recorded in coastal Australia from Shark Bay to the Clarence River where it is almost exclusively associated with mangrove and estuarine areas (NPWS, 2005; Readers Digest, 2002). The species is considered possible to occur given the presence of mangrove forest and estuarine communities both on and adjacent the eastern areas of the site. The 15ha of rehabilitation proposed is unlikely to significantly benefit the honeyeater with the exception of expanding the width of existing riparian buffers to Mooball Creek
Wompoo Fruit Dove (<i>Ptilinopus magnificus</i>)	This species is confined to mature rainforest and adjacent wet sclerophyll environments in eastern Australia from Cape York to around Coffs Harbour. As an obligate frugivore it requires a high availability of fruiting materials which it generally feeds on in the high canopy (Recher et al, 1995). Suitable habitat for this species is considered to be largely absent from the site although Community 1: Littoral Rainforest contains species typically favoured by the species (Figs, palms, laurels, lillipillis, barbed-wire vine). Previously clearing of the site in the 1950s limits the height of the canopy (15-20m) of this association which is considered to be lower than typically favoured by the species. Incorporation of littoral rainforest type fruiting species will provide an additional source for foraging within the rehabilitation zone.

Reviewing the above habitat requirements, it is considered that rehabilitation and restoration proposed likely to increase the potential habitat and refuge available for the listed species within the sub-region through the provision of:

- **Foraging resources:** Identified food resources for various significant fauna species will be incorporated within revegetated/rehabilitated areas (i.e. *Allocasuarina* species for glossy black cockatoos, nectar and fruit producing flora species for birds and bats, eucalypts for koalas etc);
- **Cover:** Native understorey regeneration and additional supplementary plantings will provide cover for small native species from predators whilst moving throughout the rehabilitation zones. The locations of the Rehabilitation Zones which aim to close canopy gaps, increase corridor widths, close the gaps between currently isolated remnants and rejoin the riparian habitats of Mooball Creek to the western eucalypt forests on bedrock, will significantly increase dispersal options for native fauna;

5.1 FAUNA MANAGEMENT DURING VEGETATION CLEARING

The approved quarry development requires only the minor removal of semi-mature Swamp Oaks and isolated blue gums and areas of pasture grassland in association with preparation and ongoing sand extraction procedures (refer Figure 50 below).

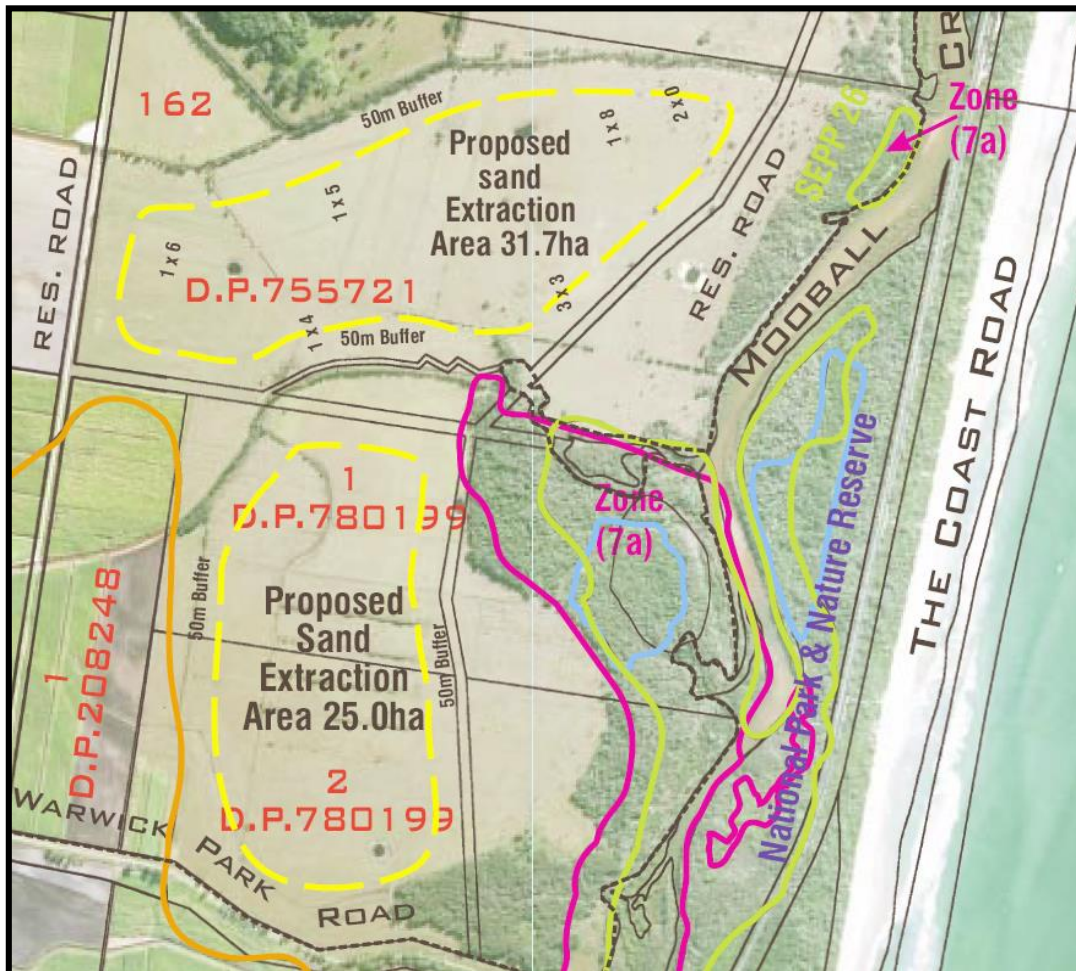


FIGURE 50: CLEARING ZONES

Notwithstanding the minor extent of native vegetation removal required, best management practice requires that wildlife whose habitat has been destroyed by human activity, must be considered, through the formation of a fauna management plan (FMP) to address the issue. The following actions will effectively reduce potential fauna mortality due to removal of habitat as part of the proposed vegetation clearing works and through the ongoing operation of the quarry.

5.1.1 GENERAL FAUNA MANAGEMENT

It is intended that, in regard to the clearing process and associated staff, a wildlife spotter-catcher shall confirm that the tree felling operation shall occur in a manner set out below that allows safe dispersal or capture of fauna:

- Clearing of trees, will occur after inspection to confirm absence of current or anticipated fauna activity (e.g. active bird nests, arboreal mammals).
- All static fauna valued trees will be clearly identified with high visibility tape or marker spray paint.
- The static fauna values, specifically hollow-bearing trees, termite mounds or birds nests, will be isolated for a period of 24 hrs to encourage dispersal prior to being removed. Techniques applicable to this stage of spotter-catcher duties vary due to the site specifics regarding topography, structure and stature of trees and OHS limitations.
- Hollow-bearing trees will be accessed and examined with torch, chainsaw, buffer rags with all fauna located during spotter-catcher duties to be assessed for species, injury and maturity prior to immediate release or being placed in a cotton capture bag

Captured fauna will be held in suitable ambient conditions prior to release within normal activity times for the animal concerned. All fauna captured will be released in adjacent bushland, containing suitable habitat, outside and within 500 m of the proposed clearing zone.

Insect bat species located during clearing will be identified prior to release at an appropriate crepuscular time with Anabat recording of calls.

- Any diseased, injured or juvenile fauna located that is incapable of dispersal or release will be taken to an experienced wildlife vet, Wildcare or Currumbin Wildlife Sanctuary for treatment or fostering prior to release.

5.1.2 SUCCESSIONAL CLEARING PROTOCOL

As koalas have been previously recorded on the site sequential clearing is recommended despite the unlikelihood of any koalas being present within the clearing zones. In this regard clearing of trees is carried out in a way that ensures koalas (and other animals) living in or near the area being cleared (the clearing site) have enough time to move out of the clearing site without human intervention by:

Clearing of trees is carried out in a way that ensures, while the clearing is being carried out, appropriate habitat links are maintained within the clearing site and between the site and its adjacent areas, to allow koalas/fauna living on the site to move out of the site

In this regard it is recommended that clearing be undertaken generally in a south-north (northern sand extraction area) & west-east (southern sand extraction area) direction to enable dispersal to retained bushland. Importantly clearing must not disperse fauna to the south or the west where they may become trapped or disperse into adjacent construction sites and roadways]

No tree in which fauna is present, and no tree with a crown overlapping a tree in which fauna is present, is cleared. A fauna spotter means a person who has demonstrated experience in locating koalas in koala habitats or conducting fauna surveys. Prior to the commencement of, and during felling operations, it is the responsibility of the spotter to identify trees in which a koala or other fauna are present and any trees where

their crown overlaps trees in which a koala or other fauna is present and convey this information to the person(s) conducting the clearing.

During this identification process, there will a differentiation between *Complete cover trees* and *See-through trees* where *Complete cover trees* will be retained until the spotter-catcher responsible is certain of absence of fauna prior to the tree being felled.

A *Complete cover tree* is defined as a tree with abundant foliage that does not allow confirmation of absence of fauna without a full 360 degree viewing and if required extended viewing during peripheral clearing operations to detect movement.

A *See-through tree* is defined as sparsely foliated tree where a 360 degree viewing confirms the absence of fauna.

Any tree in which fauna is located (and any adjacent overlapping tree) is to be tagged and excluded from clearing until the fauna has safely dispersed (over the period, to be a minimum of 12 hours, between cessation of works on that day and commencement of works on the subsequent day)

When located, clearing exclusion zones (20m minimum) around the active fauna tree will be set out where no activity can occur for the day's duration to confirm animal safety and allow dispersal. Secondly, fauna response to peripheral human activity will be monitored by spotter-catcher to confirm acceptable disturbance and if required cessation of clearing process within a larger radius (i.e. 50m) to reduce stress to the observed fauna.

The site contractor/foreman is to be clearly shown the identification of all trees and exclusions zones which are not permitted for any day's clearing prior to starting the first piece of construction equipment on that day of clearing.

Opportunistic capture/release is only permitted where an *Un-located Koala/Fauna* interaction occurs. If or when this occurs, all clearing will cease until the spotter-catcher responsible has determined the severity of incident. In circumstances where the animal has had a major stress reaction from close proximity to the clearing process, clearing will be directed away from proximity and the animal's reaction monitored until stress reaction is deemed acceptable. In circumstances where the tree containing the animal has been felled, it will be examined for general alertness, potential injuries to paws, limbs, body, vision, wings, claws, etc prior to the decision to vet check the animal or hold with observations repeated prior to release and post release monitoring to confirm successful dispersal out of the clearing zone.

An *Un-located Koala/Fauna* is defined as a Koala or other animal that has eluded detection, despite the defined actions of the spotter-catcher responsible occurring (as outlined within the preceding points) and is generally associated with dense vegetation areas or canopies exhibiting dense coppicing.

5.1.3 ONGOING FAUNA MANAGEMENT DURING QUARRY OPERATIONS

Although the quarrying use is well separated from retained fauna habitat areas potential does exist for fauna injury/mortality during ongoing operation of the use as follows:

- Potential occurs for vehicle strike along the haulage road, particularly in the northern areas proximate to koala habitat.

The following actions are recommended to minimize the above listed potential impacts:

- In accordance with the Development Consent issued, trucks and machinery are to be confined to defined haulage routes and operate during daylight hours only (7am-5pm weekdays, 7am-12pm weekends) at a maximum speed of 25km/hr (as signed within the site).
- A registered wildlife spotter/catcher is to be contacted regarding the presence of any fauna trapped or injured within the quarry zone (including snakes). Any such fauna is to be inspected for species, injury and maturity prior to immediate release in adjacent bushland (depending on time of day) or being placed in a cotton capture bag.

Captured fauna will be held in suitable ambient conditions prior to release within normal activity times for the animal concerned. All fauna captured will be released in adjacent bushland, containing suitable habitat, outside but within 500m of the quarry zone.

- Any diseased, injured or juvenile fauna capture that is incapable of dispersal or release will be taken to an experienced wildlife vet, Wildcare or Currumbin Wildlife Sanctuary for treatment or fostering prior to release.

5.2 FAUNA NESTBOXES

In accordance with the Development Consent issued fauna boxes are to be installed onsite to increase potential nesting options for the existing assemblage. To potentially allow for a wider range of species to utilize the fauna boxes to be provided it is recommended that boxes be designed in accordance with a variety of specifications. In particular, the following is to be provided targeting a range of arboreal mammals and avifauna:

- 2 x squirrel/sugar glider boxes
- 2 x cockatoo/parrot boxes
- 2 brushtail/ringtail possum boxes
- 1 rosella/orikeye boxes
- 1 microbat boxes
- 1 owl box
- 1 kingfisher boxes

The purchase, installation and monitoring of the above fauna boxes is to comply with the below requirements:

- Fauna boxes are only to be sourced from a reputable supplier
- Boxes are to be well-insulated, rainproof and facing away from prevailing winds and direct midday summer sunlight

- Boxes are to be located where casual access is difficult to reduce potential vandalism
- Boxes are to be maintained and inspected on an annually basis

Fauna Box Reporting

Within six months of the commencement of the use a brief report is to be prepared containing the following information:

- An accurate graphical representation of each fauna box within the retained vegetation communities and its associated GPS coordinates
- Detail of the type, number and location of each of the 10 fauna boxes
- The installed height of the box from the ground

Every twelve months an inspection and a brief report shall be prepared/undertaken for each of the boxes including:

- A discussion of the maintenance of the fauna boxes over the preceding quarterly period and any associated problems encountered (i.e. vandalism, presence of feral insects, birds or mammals etc) and any resultant corrective actions implemented
- Documentation of any changes to the location of fauna boxes as a result of corrective actions implemented
- Completion of the below monitoring form

ROUTINE FAUNA BOX MONITORING FORM			
Location/Number of Fauna Box			
Description of Fauna Box			
Inspected by		Name:	Signature:
Inspection date		/ /	
Element	N/Y?	Comments/description	Action Required
Empty Box			
Native Fauna Present			
Eggs Present			
Number of eggs			
Colour/description of eggs			
Nest present			
Partial nest present			
Hatchlings/fledglings present			
Box empty but scats/trace present			
Box occupied by pest species (i.e. bees, myna, black rat etc)			
Roof, hinges and/or supports broken or in need of repair/replacement			
Evidence of warping			
Evidence of vandalism			
Other comments/maintenance performed?:			

5.3 ANNUAL FAUNA SURVEY

In accordance with the previous commitments of the Planit (2006) Flora and Fauna Assessment an annual fauna survey (between November and March) of the Rehabilitation Zones (and immediately adjacent areas) is to be undertaken in accordance with Section 4 of the 2006 report. Results of the survey are to be recorded including new species (to that originally recorded) and discussions of any threatened fauna recorded. Particular mention is to be made of any threatened fauna utilizing the Rehabilitation Zones or installed fauna boxes.

6.0 ATTACHMENTS

- ATTACHMENT 1:** APPROVED PLAN OF DEVELOPMENT
- ATTACHMENT 2:** DEVELOPMENT CONSENT CONDITIONS
- ATTACHMENT 3:** LANDSCAPING PLANS
- ATTACHMENT 4:** VEGETATION MANAGEMENT PLAN

ATTACHMENT 1 – APPROVED PLAN OF DEVELOPMENT



LOCATION MAP

LEGEND

- EXISTING DWELLING HOUSE
- STOCKPILE / PLANT AREAS
- SCREEN PLANTINGS
- REHABILITATION AND ENHANCEMENT PLANTINGS TOTAL AREA: 15 Ha
- OUTGOING HAUL ROUTE
- INCOMING HAUL ROUTE
- DUNLOE PARK BOUNDARY
- STAGE 1 PROPOSED SAND EXTRACTION AREA TOTAL AREA: 31.7 Ha
- STAGE 2 PROPOSED SAND EXTRACTION AREA TOTAL AREA: 25.1 Ha



ATTACHMENT 2 – DEVELOPMENT CONSENT OF CONDITIONS

Project Approval

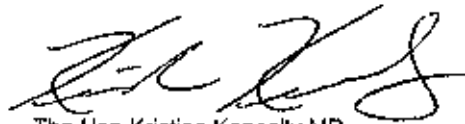
Section 75J of the *Environmental Planning and Assessment Act 1979*

I approve the project application referred to in schedule 1, subject to the conditions in schedules 2 to 5.

The reason for these conditions is to:

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

24 NOV 2008



The Hon Kristina Keneally MP
Minister for Planning

Sydney

2008

SCHEDULE 1

Project Application:	06_0030
Proponent:	Ramtech Pty Ltd
Approval Authority:	Minister for Planning
Land:	Lot 1 DP208249; Lot 182 DP755721; Lot 183 DP755721; Lot 44 DP755721; Lot 81 DP755721; Lot 162 DP755721; Lot 2 DP 780199; Lot 1 DP780199; Lot 1 DP780200; Lot 2 DP785895
Project:	Dunloe Park Sand Project

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DEFINITIONS

AEMR	Annual Environmental Management Report
BCA	Building Code of Australia
CCC	Community Consultative Committee
Council	Tweed Shire Council
Day	The period from 7.00am to 5.00pm, Monday to Friday, and 8.00am to 1.00pm on Saturdays
DECC	Department of Environment and Climate Change
Department	Department of Planning
Director-General	Director-General of the Department of Planning, or delegate
DPI	Department of Primary Industries
DWE	Department of Water and Energy
EA	Environmental Assessment of the project titled <i>Environmental Assessment Part 3A – Environmental Planning and Assessment Act, 1979, Dunloe Sands – Ramtech P/L, prepared by PLANIT Consulting dated 17 September 2007</i> , including the response to issues raised in submissions, dated March 2008
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
EPL	Environment Protection Licence under the <i>Protection of the Environment Operations Act 1997 (POEO Act)</i>
Land	Land means the whole of a lot, or contiguous lots owned by the same landowner, in a current plan registered at the Land Titles Office at the date of this approval
Minister	Minister for Planning, or delegate
Privately-owned land	Land that is not owned by a public agency or a quarrying company
Project	The development as described in the EA
Proponent	Ramtech Pty Ltd, or its successors in title
RTA	Roads and Traffic Authority
SEPP	State Environmental Planning Policy
Statement of Commitments	The Proponent's commitments in Appendix 3
Site	Land to which the Project Approval applies

SCHEDULE 2 ADMINISTRATIVE CONDITIONS

Obligation to Minimise Harm to the Environment

1. The Proponent shall implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the project.

Terms of Approval

2. The Proponent shall carry out the project generally in accordance with the:
 - (a) EA;
 - (b) statement of commitments; and
 - (c) conditions of this approval.

Note: The general layout of the project is shown in the figure in Appendix 1.

3. If there is any inconsistency between the documents referred to above, the conditions of this approval shall prevail to the extent of the inconsistency.
4. The Proponent shall comply with any reasonable requirement/s of the Director-General arising from the Department's assessment of:
 - (a) any reports, plans, programs or correspondence that are submitted in accordance with this approval; and
 - (b) the implementation of any actions or measures contained in these reports, plans, programs or correspondence.

Limits on Approval

5. Sand extraction operations may take place until 1 January 2035.

Note: Under this Approval, the Proponent is required to rehabilitate and revegetate the site to the satisfaction of the Director-General. Consequently this approval will continue to apply in all other respects other than the right to conduct quarrying operations until the site has been rehabilitated and revegetated to a satisfactory standard.

6. The Proponent shall not extract to a depth of more than 12 m below the natural ground surface.

Notes: The Department acknowledges that this limit may have a variance of +/- 1m.

7. The Proponent shall not transport more than 300,000 tonnes of sand material a year from the site.
8. The Proponent shall ensure that heavy vehicle movements (in and out) associated with the project do not exceed 8 per hour.

Management Plans/Monitoring Programs

9. With the approval of the Director-General, the Proponent may submit any management plan or monitoring program required by this approval on a progressive basis.

Structural Adequacy

10. The Proponent shall ensure that any new buildings and structures, and any alterations or additions to existing buildings and structures, are constructed in accordance with the relevant requirements of the BCA.

Notes:

- Under Part 4A of the EP&A Act, the Proponent is required to obtain construction and occupation certificates for the proposed building works.
- Part 8 of the EP&A Regulation sets out the requirements for the certification of the project.

Demolition

11. The Proponent shall ensure that all demolition work is carried out in accordance with AS 2601-2001: *The Demolition of Structures*, or its latest version.

Operation of Plant and Equipment

12. The Proponent shall ensure that all plant and equipment used at the site is:
 - (a) maintained in a proper and efficient condition; and
 - (b) operated in a proper and efficient manner.

Section 94 Contributions

13. Prior to carrying out any development, or as otherwise agreed by Council, the Proponent shall pay Council \$47,250 in accordance with Council's Tweed Road Contribution Plan and \$399.40 in accordance with Tweed Council Section 94 Plan No.18.

SCHEDULE 3 ENVIRONMENTAL PERFORMANCE CONDITIONS

GENERAL EXTRACTION AND PROCESSING PROVISIONS

Identification of Boundaries

1. Within 1 month of the date of approval of the Landscape Management Plan (see condition 27 below), the Proponent shall:
 - (a) engage a registered surveyor to mark out the boundaries of the approved limits of extraction;
 - (b) submit a survey plan of these boundaries to the Director-General; and
 - (c) ensure that these boundaries are clearly marked at all times in a permanent manner that allows operating staff and inspecting officers to clearly identify those limits.

Note: The limit of extraction includes the area described in the EA and shown conceptually on the plan in Appendix 1.

NOISE

Impact Assessment Criteria

2. The Proponent shall ensure that the noise generated by the project does not exceed the noise impact assessment criteria in Table 1.

Receiver Location	Day L_{Aeq} (15 min) dB(A)
Residences on privately-owned land	48

Table 1: Noise Impact Assessment Criteria

Notes:

- Noise from the site is to be measured at the most affected point within the residential boundary, or at the most affected point within 30 metres of the dwelling where the dwelling is more than 30 metres from the boundary, to determine compliance with the identified noise limits, except where otherwise specified below.
- Where it can be demonstrated that direct measurement of noise from the project is impractical, alternative means of determining compliance may be acceptable (see Chapter 11 of the NSW Industrial Noise Policy).
- The modification factors presented in Section 4 of the NSW Industrial Noise Policy shall also be applied to the measured noise level where applicable.
- The identified noise emission limits apply under meteorological conditions of wind speed up to 3m/s at 10 metres above ground level, and temperature inversion conditions.

Hours of Operation

3. The Proponent shall comply with the operating hours in Table 2.

Activity	Day	Time
Sand extraction and processing, delivery and distribution, and other quarry related activities	Monday – Friday	7:00am to 5:00pm
	Saturday	7:00am to 12:00pm
	Sunday and Public Holidays	Nil
Maintenance (if inaudible at neighbouring residences)	Any day	Any time

Table 2: Operating Hours

Continuous Improvement

4. The Proponent shall:
 - (a) implement all reasonable and feasible best practice noise mitigation measures;
 - (b) investigate ways to reduce the noise generated by the project; and

- (c) report on these investigations and the implementation and effectiveness of these measures in the AEMR, to the satisfaction of the Director-General.

Noise Monitoring Program

5. The Proponent shall prepare and implement a Noise Monitoring Program for the project to the satisfaction of the Director-General. This program must:
- (a) be submitted to the Director-General prior to carrying out any development on the site;
 - (b) be prepared in consultation with the DECC;
 - (c) include details of how the noise performance of the project would be monitored, and include a noise monitoring protocol for evaluating compliance with the relevant noise limits in this approval; and
 - (d) include a protocol of monitoring haulage truck noise on Pottsville Road.

AIR QUALITY

Impact Assessment Criteria

6. The Proponent shall ensure that dust generated by the project does not cause additional exceedances of the criteria listed in Tables 3 to 5 at any privately owned land.

Pollutant	Averaging period	Criterion
Particulate matter < 10 µm (PM ₁₀)	24 hour	50 µg/m ³

Table 3: Short Term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging period	Criterion
Total suspended particulate (TSP) matter	Annual	90 µg/m ³
Particulate matter < 10 µm (PM ₁₀)	Annual	30 µg/m ³

Table 4: Long Term Impact Assessment Criteria for Particulate Matter

Pollutant	Averaging period	Maximum increase in deposited dust level	Maximum total deposited dust level
Deposited dust	Annual	2 g/m ² /month	4 g/m ² /month

Table 5: Long Term Impact Assessment Criteria for Deposited Dust

Note: Deposited dust is assessed as insoluble solids as defined by Standards Australia, 1991, AS/NZS 3580.10.1-2003: Methods for Sampling and Analysis of Ambient Air - Determination of Particulates - Deposited Matter - Gravimetric Method.

Dust Monitoring Program

7. The Proponent shall prepare and implement a Dust Monitoring Program for the project to the satisfaction of the Director-General. This program must:
- (a) be submitted to the Director-General prior to carrying out any development on the site;
 - (b) be prepared in consultation with DECC; and

- (c) include details of how the air quality performance of the project would be monitored, and include a protocol for evaluating compliance with the relevant air quality criteria in this approval.

Note: Initially, this program may concentrate on monitoring the dust deposition impacts of the project. However, in time, it may be expanded to include other pollutants.

SOIL AND WATER

Discharges

8. Except as may be expressly provided for by an EPL, the Proponent shall not discharge any water from the project or ancillary operational areas. The Proponent shall ensure that the extraction pit subject to dredging is maintained and operated to prevent discharges of any surface water from these ponds.

Water Quality Objectives

9. The Proponent shall aim to meet the water quality objectives in Table 6 for water in the dredge ponds and in groundwater adjacent the dredge ponds, unless otherwise approved by the Director-General.

Pollutant	Unit of Measure	Water Quality Objectives
Turbidity	NTU	5 - 20
pH	pH	6.5 – 8.5
Oil and Grease	mg/L	10
Salinity	µS/cm	<3,000
Dissolved oxygen	mg/L	>6
Chlorophyll-a	µg/L	2-10
Faecal coliforms	Median No./100mL	<1000
Enterococci	Median No./100mL	<230
Algae and blue-green algae	No.cells/mL (M.aeruginosa)	<50,000
	mm ³ /L (total biovolume)	<4
Sodium	mg/L	500
Potassium ion	mg/L	40
Magnesium ion	mg/L	100
Chloride ion	mg/L	1000
Sulphate ion	mg/L	800
Bicarbonate ion	mg/L	400
Soluble ion	mg/L	20
Soluble aluminium ion	mg/L	0.5
Ammonium ion	mg/L	20

Table 6: Water Quality Objectives

Notes:

- The objectives for dissolved oxygen, turbidity and algae are relevant to surface water only.
- The Department acknowledges that short term exceedances of these objectives may occur during natural events such as flooding.
- The Department acknowledges that pre-existing water quality may not meet the objectives for some analytes, including salinity. The proponent shall strive to meet the water quality objectives through implementation of the Soil and Water Management Plan (see condition 18 below), as far as is reasonable and feasible and within the Proponent's control, to the satisfaction of the Director-General.

Fines Management

10. The Proponent shall ensure that all excavated potential acid sulfate soil fines material is returned back to below the watertable as soon as possible to prevent oxidation. No potential acid sulfate soil shall be removed from the site, unless adequately neutralised in accordance with methods approved under the Soil and Water Management Plan.
11. The Proponent shall ensure that all potential acid sulfate soil fines material is discharged into the pond at a depth of no less than 3 metres from the water surface, and that all fines are deposited to a final depth of at least 8 metres from the water surface, unless an alternative method(s) is approved by DWE and the Director-General.

Wastewater Treatment

12. The Proponent shall manage on-site sewage to the satisfaction of Council and DECC. The facility must comply with the requirements of the *Environment and Health Protection Guidelines – On-site Sewage Management for Single Households (1998)*.

Flood Management

13. The Proponent shall ensure that flood bunding around the Stage 1 and Stage 2 works does not exceed 300 mm in height above natural surface level, to a maximum height of 2.0 m AHD, unless otherwise approved by the Director-General.
14. The Proponent shall ensure that perimeter drainage must be installed and operational prior to the construction of bunding or the placement of fill on site.
15. All earthworks, including flood and acoustic bunding works, shall be contained wholly within the site.
16. The Proponent shall cease dredging and processing activities not less than 24 hours prior to the commencement of overflow from any dredge pond. No dredging or processing shall occur when the dredge ponds are overflowing.
17. The Proponent shall ensure that the flood storage capacity of the site is no less than the pre-existing flood storage capacity at all stages of the project. Details of the available flood storage capacity shall be reported in the AEMR.

Management and Monitoring

18. The Proponent shall prepare and implement a Soil and Water Management Plan for the project to the satisfaction of the Director-General. This plan must:
 - (a) be prepared in consultation with DWE and DECC;
 - (b) include a:
 - Water Balance;
 - Erosion and Sediment Control Plan;
 - Acid Sulfate Soil Management Plan;
 - Blue-Green Algae Management Plan;
 - Surface Water Monitoring Program; and
 - Groundwater Monitoring Program; and
 - (c) be submitted to the Director-General prior to starting quarrying operations, and prior to carrying out any development site in the case of the Erosion and Sediment Control Plan.
19. The Water Balance shall include:
 - (a) details of all water extracted, transferred, used and/or discharged by the quarry;
 - (b) the source of all water collected or stored on the site, including rainfall, stormwater and groundwater; and
 - (c) measures to minimise water use by the project.
20. The Erosion and Sediment Control Plan shall:
 - (a) be consistent with the requirements of *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Edition, 2004* (Landcom), and Council's codes including its *Code of Practice for*

Soil and Water Management on Construction Sites, Development Design Specification D7 – Stormwater Quality and Tweed Urban Stormwater Quality Management Plan;

- (b) identify activities that could cause soil erosion and generate sediment;
 - (c) describe measures to minimise soil erosion and the potential for the transport of sediment to downstream waters;
 - (d) describe the location, function, and capacity of erosion and sediment control structures; and
 - (e) describe what measures would be implemented to maintain these structures over time.
21. The Acid Sulfate Soil Management Plan shall:
- (a) be consistent with the *NSW Acid Sulphate Soil Advisory Committee's Acid Sulfate Soil Manual*; and
 - (b) define procedures for managing the potential acid sulfate soils on the site, including sample testing and procedures.
22. The Blue-Green Algae Management Plan shall:
- (a) be prepared by a suitably qualified blue-green algae expert, whose appointment has been approved by the Director-General;
 - (b) be consistent with extant guidelines for blue-green algae management including the NHMRC's *Guidelines for Managing Risks in Recreational Water*;
 - (c) describe the measures that would be implemented to prevent and control the sources of algal blooms over the short, medium and long term; and
 - (d) define procedures for the management and notification of identified algal blooms.
23. The Surface Water Monitoring Program shall include:
- (a) detailed baseline data on surface water quality;
 - (b) surface water impact assessment criteria;
 - (c) a program to monitor surface water flows and quality;
 - (d) a program to manage water releases from the site;
 - (e) a program to monitor bank and bed stability; and
 - (f) a protocol for the investigation, notification and mitigation of identified exceedances of the surface water impact assessment criteria.
24. The Ground Water Monitoring Program shall include:
- (a) detailed baseline data on groundwater levels and quality, based on statistical analysis;
 - (b) groundwater impact assessment criteria;
 - (c) a program to monitor ground water levels and quality;
 - (d) a program to monitor ground water level effects on vegetation, and on ground water supply to adjoining properties; and
 - (e) a protocol for the investigation, notification and mitigation of identified exceedances of the groundwater impact assessment criteria.

REHABILITATION AND LANDSCAPING

Rehabilitation and Revegetation

25. The Proponent shall rehabilitate the site to the satisfaction of the Director-General.
26. The Proponent shall:
- (a) rehabilitate and revegetate the 15 ha hectares of land identified in the EA (see the revegetation plan in Appendix 2); and
 - (b) within 12 months of the commencement of quarrying operations, make suitable arrangements to provide appropriate long term security for the revegetation area to ensure it is managed for conservation purposes,
- to the satisfaction of the Director-General.

Landscape Management Plan

27. The Proponent shall prepare and implement a Landscape Management Plan for the project to the satisfaction of the Director-General. This plan must:
- (a) be prepared:
 - by suitably qualified consultants, including a specialist hydrologist, coastal engineer, wetlands ecologist and landscape architect;

- in consultation with Council, DWE, DECC, DPI-Fisheries and the CCC; and
 - in accordance with extant guidelines including the DWE's *Constructed Wetlands Manual, Volumes 1 and 2* and the DPI's *Policy and Guidelines: Aquatic Habitat Management, 1999*;
- (b) be submitted to the Director-General prior to starting quarrying operations on the site; and
- (c) include a:
- Rehabilitation and Revegetation Management Plan; and
 - Long Term Management Strategy.

Note: The Department accepts that the initial Landscape Management Plan may not include the detailed Long Term Management Strategy. However, a conceptual strategy must be included in the initial plan, along with a timetable for augmentation of the strategy with each subsequent review of the plan.

28. The Rehabilitation and Revegetation Management Plan must include:
- (a) the rehabilitation objectives for the site and revegetation areas;
 - (b) a description of the short, medium, and long term measures that would be implemented to:
 - rehabilitate and stabilise the site;
 - implement the revegetation strategy; and
 - manage the remnant vegetation and habitat on the site and in the revegetation areas;
 - (c) detailed performance and completion criteria for the rehabilitation and stabilisation of the site and implementation of the revegetation strategy;
 - (d) a detailed description of how the performance of the rehabilitation of the quarry and the revegetation areas would be monitored over time to achieve the stated objectives;
 - (e) a detailed description of what measures would be implemented over the next 5 years to rehabilitate and manage the landscape of the site and revegetation areas including the procedures to be implemented for:
 - progressively rehabilitating and stabilising areas disturbed by quarrying;
 - implementing revegetation and regeneration within the disturbance areas and revegetation areas;
 - protecting areas outside the disturbance areas, including SEPP 14 wetlands and SEPP 26 littoral rainforests;
 - vegetation clearing protocols;
 - managing impacts on fauna;
 - controlling terrestrial and aquatic weeds and pests;
 - controlling access;
 - bushfire management; and
 - reducing the visual impacts of the project;
 - (f) a description of the potential risks to successful rehabilitation and/or revegetation, and a description of the contingency measures that would be implemented to mitigate these risks; and
 - (g) details of who is responsible for monitoring, reviewing, and implementing the plan.
29. The Long Term Management Strategy must:
- (a) define the objectives and criteria for quarry closure and post-extraction management;
 - (b) investigate options for the future use of the site;
 - (c) describe the measures that would be implemented to minimise or manage the ongoing environmental effects of the project; and
 - (d) describe how the performance of these measures would be monitored over time.

Rehabilitation Bond

30. Prior to starting quarrying operations on the site, the Proponent shall lodge a rehabilitation bond for the project with the Director-General. The sum of the bond shall be calculated at:
- (a) \$2.50/m² for the total area to be disturbed and/or revegetated in each 5 year review period (see condition 31 below); and
 - (b) \$1.50/m² for the total area of land previously disturbed and/or rehabilitated by the project, to the satisfaction of the Director-General.

Notes:

- *If the rehabilitation and revegetation works are completed to the satisfaction of the Director-General, the Director-General will release the rehabilitation bond.*

- *If the rehabilitation and revegetation works are not completed to the satisfaction of the Director-General, the Director-General will call in all or part of the rehabilitation bond, and arrange for the satisfactory completion of the relevant works.*
31. Within 6 months of each Independent Environmental Audit (see condition 6 of schedule 5) excluding the inaugural audit, unless the Director-General directs otherwise, the Proponent shall review, and if necessary revise, the sum of the rehabilitation bond to the satisfaction of the Director-General. This review must consider:
- (a) the effects of inflation;
 - (b) any changes to the total area of disturbance; and
 - (c) the performance of the rehabilitation and revegetation to date.

ABORIGINAL CULTURAL HERITAGE

Aboriginal Cultural Heritage Management Plan

32. The Proponent shall prepare and implement an Aboriginal Cultural Heritage Management Plan to the satisfaction of the Director-General. This plan must:
- (a) be prepared in consultation with DECC and all relevant Aboriginal communities;
 - (b) be submitted to the Director-General for approval prior to commencement of construction; and
 - (c) include a:
 - program for additional archaeological survey/s of the disturbance area;
 - description of the measures that would be implemented to salvage any identified Aboriginal sites within the disturbance area;
 - description of the measures that would be implemented to protect any Aboriginal sites outside the disturbance area; and
 - description of the measures that would be implemented if any new Aboriginal objects or skeletal remains are discovered during the project.

TRAFFIC AND TRANSPORTATION

Road Haulage

33. Prior to commencement of operations the Proponent shall:
- (a) design and construct the haul road and its intersection with Pottsville-Mooball Road; and
 - (b) install advanced truck turning warning signage along Pottsville-Mooball Road, to the satisfaction of Council.
34. The Proponent shall ensure that all loaded vehicles entering or leaving the site have their loads covered.
35. The Proponent shall ensure all loaded vehicles leaving the site are cleaned of materials that may fall on the road before they are allowed to leave the site.

Parking

36. The Proponent shall provide sufficient parking on-site for all project-related traffic and visitors, in accordance with Council's parking codes and to the satisfaction of the Director-General. No on street parking shall be undertaken.

VISUAL IMPACT

Visual Amenity

37. The Proponent shall minimise the visual impacts of the project to the satisfaction of the Director-General.
38. The Proponent shall establish and subsequently maintain the vegetated buffer around the extraction area within 12 months of the date of this approval.

Note: The vegetation buffer shall be detailed in the Landscape Management Plan.

Lighting Emissions

39. The Proponent shall:
- (a) take all practicable measures to mitigate off-site lighting impacts from the project; and
 - (b) ensure that all external lighting associated with the project complies with *Australian Standard AS4282 (INT) 1995 – Control of Obtrusive Effects of Outdoor Lighting*, to the satisfaction of the Director-General.

Advertising

40. The Proponent shall not erect or display any advertising structure(s) or signs on the site without the written approval of the Director-General.

Note: This does not include business identification, traffic management and safety or environmental signs.

WASTE MANAGEMENT

41. The Proponent shall minimise the amount of waste generated by the project to the satisfaction of the Director-General.

EMERGENCY AND HAZARDS MANAGEMENT

Dangerous Goods

42. The Proponent shall ensure that the storage, handling, and transport of dangerous goods are conducted in accordance with the relevant *Australian Standards*, particularly AS1940 and AS1596, and the *Dangerous Goods Code*.

Safety

43. The Proponent shall secure the project to ensure public safety to the satisfaction of the Director-General.

Bushfire Management

44. The Proponent shall:
- (a) ensure that the project is suitably equipped to respond to any fires on-site; and
 - (b) assist the rural fire service and emergency services as much as possible if there is a fire on-site.

PRODUCTION DATA

45. The Proponent shall:
- (a) provide annual production data to the DPI using the standard form for that purpose; and
 - (b) include a copy of this data in the AEMR.

SCHEDULE 4 ADDITIONAL PROCEDURES

NOTIFICATION OF LANDOWNERS

1. If the results of monitoring required in schedule 3 identify that impacts generated by the project are greater than the relevant impact assessment criteria, then the Proponent shall notify the Director-General, affected landowners, and/or existing or future tenants accordingly, and provide quarterly monitoring results to each of these parties until the results show that the project is complying with the relevant criteria.

INDEPENDENT REVIEW

2. If a landowner considers that the project is exceeding the impact assessment criteria in schedule 3, then he/she may ask the Director-General in writing for an independent review of the impacts of the project on his/her land.

If the Director-General is satisfied that an independent review is warranted, the Proponent shall within 3 months of the Director-General advising that an independent review is warranted:

- (a) consult with the landowner to determine his/her concerns;
 - (b) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Director-General, to conduct monitoring on the land, to determine whether the project is complying with the relevant criteria in schedule 3, and identify the source(s) and scale of any impact on the land, and the project's contribution to this impact; and
 - (c) give the Director-General and landowner a copy of the independent review.
3. If the independent review determines that the project is complying with the relevant criteria in schedule 3, then the Proponent may discontinue the independent review with the approval of the Director-General.
 4. If the independent review determines that the project is not complying with the relevant criteria in schedule 3, and that the project is primarily responsible for this non-compliance, then the Proponent shall:
 - (a) implement all reasonable and feasible measures, in consultation with the landowner, to ensure that the project complies with the relevant criteria; and
 - (b) conduct further monitoring to determine whether these measures ensure compliance; or
 - (c) secure a written agreement with the landowner to allow exceedances of the relevant criteria in schedule 3,to the satisfaction of the Director-General.

If the additional monitoring referred to above subsequently determines that the project is complying with the relevant criteria in schedule 3, or the Proponent and landowner enter into a negotiated agreement to allow these exceedances, then the Proponent may discontinue the independent review with the approval of the Director-General.

5. If the landowner disputes the results of the independent review, either the Proponent or the landowner may refer the matter to the Director-General for resolution.

If the matter cannot be resolved within 21 days, the Director-General shall refer the matter to an Independent Dispute Resolution Process (see Appendix 4).

SCHEDULE 5
ENVIRONMENTAL MANAGEMENT AND MONITORING CONDITIONS

ENVIRONMENTAL MANAGEMENT STRATEGY

1. The Proponent shall prepare and implement an Environmental Management Strategy for the project to the satisfaction of the Director-General. This strategy must:
 - (a) be submitted to the Director-General prior to starting quarrying operations on the site;
 - (b) be prepared in consultation with the relevant agencies;
 - (c) provide the strategic context for environmental management of the project;
 - (d) identify the statutory requirements that apply to the project;
 - (e) describe in general how the environmental performance of the project would be monitored and managed;
 - (f) describe the procedures that would be implemented to:
 - keep the local community and relevant agencies informed about the construction, operation and environmental performance of the project;
 - receive, handle, respond to, and record complaints;
 - resolve any disputes that may arise during the life of the project;
 - respond to any non-compliance;
 - manage cumulative impacts; and
 - respond to emergencies; and
 - (g) describe the role, responsibility, authority, and accountability of the key personnel involved in the environmental management of the project.

ENVIRONMENTAL MONITORING PROGRAM

2. The Proponent shall prepare an Environmental Monitoring Program for the project to the satisfaction of the Director-General. This program must be submitted to the Director-General prior to starting quarrying operations on the site, and consolidate the various monitoring requirements in schedule 3 of this approval into a single document.

INCIDENT REPORTING

3. Within 24 hours of detecting an exceedance of the limits/performance criteria in this approval or the occurrence of an incident that causes (or may cause) material harm to the environment, the Proponent shall notify the Department and other relevant agencies of the exceedance/incident.
4. Within 6 days of notifying the Department and other relevant agencies of an exceedance/incident, the Proponent shall provide the Department and these agencies with a written report that:
 - (a) describes the date, time, and nature of the exceedance/incident;
 - (b) identifies the cause (or likely cause) of the exceedance/incident;
 - (c) describes what action has been taken to date; and
 - (d) describes the proposed measures to address the exceedance/incident.

ANNUAL REPORTING

5. Within 12 months of the date of this approval, and annually thereafter, the Proponent shall submit an AEMR to the Director-General and relevant agencies. This report must:
 - (a) identify the standards and performance measures that apply to the project;
 - (b) describe the works carried out in the last 12 months;
 - (c) describe the works that will be carried out in the next 12 months;
 - (d) include a summary of the complaints received during the past year, and compare this to the complaints received in previous years;
 - (e) include a summary of the monitoring results for the project during the past year;
 - (f) include an analysis of these monitoring results against the relevant:
 - impact assessment criteria/limits;
 - monitoring results from previous years; and
 - predictions in the EA;
 - (g) identify any trends in the monitoring results over the life of the project;
 - (h) identify any non-compliance during the previous year; and
 - (i) describe what actions were, or are being, taken to ensure compliance.

INDEPENDENT ENVIRONMENTAL AUDIT

6. Within 2 years of the start of quarrying operations on site, and every 5 years thereafter, unless the Director-General directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the project. This audit must:
 - (a) be conducted by a suitably qualified, experienced, and independent person(s) whose appointment has been approved by the Director-General;
 - (b) include consultation with the relevant agencies;
 - (c) assess the environmental performance of the project, and its effects on the surrounding environment;
 - (d) assess whether the project is complying with the relevant standards, performance measures and statutory requirements;
 - (e) review the adequacy of any strategy/plan/program required under this approval; and, if necessary,
 - (f) recommend measures or actions to improve the environmental performance of the project, and/or any strategy/plan/program required under this approval.
7. Within 1 month of completion of each Independent Environmental Audit, the Proponent shall submit a copy of the audit report to the Director-General and relevant agencies, with a response to any of the recommendations in the audit report.
8. Following each Independent Environmental Audit, the Proponent shall review and if necessary revise each of the environmental management and monitoring strategies/plans/programs in schedules 3 and 5, to the satisfaction of the Director-General. The revised strategies/plans/programs shall be submitted to the Director-General within 6 months of completing the audit.

COMMUNITY CONSULTATIVE COMMITTEE

9. Prior to starting quarrying operations on the site, the Proponent shall establish a CCC for the project. This CCC must be established and operated in accordance with the *Guideline for Establishing and Operating Community Consultative Committees for Mining Developments*, and to the satisfaction of the Director-General.

ACCESS TO INFORMATION

10. Within 1 month of the approval of any plan/strategy/program required under this approval (or any subsequent revision of these plans/strategies/programs), or the completion of any independent environmental audit or AEMR, the Proponent shall:
 - (a) provide a copy of the relevant document/s to Tweed Shire Council and relevant agencies; and
 - (b) ensure that a copy of the relevant document/s is made publicly available on site and/or at the Proponent's regional office,to the satisfaction of the Director-General.
11. During the project, the Proponent shall:
 - (a) make a summary of monitoring results required under this approval publicly available at the Proponent's regional office; and
 - (b) update these results regularly (at least every 3 months),to the satisfaction of the Director-General.

APPENDIX 1 PROJECT SITE



[illegible]

APPENDIX 3 STATEMENT OF COMMITMENTS

Amended Statement of Commitments

The following sections summarises the commitments by Ramtech Pty Ltd regarding mitigations and control measures to be implemented for the proposal:

Sand Extraction

- Additional resource assessment works are to be undertaken in respect of two (2) key elements, being the extent of resource available for brickies loam and the extent of resource available with respect of mineral sands. Such assessments are to be undertaken in accord with the matters raised by the Department of Primary Industries in correspondence dated 21st December 2007.
- Annual production data will be made available in accord with DPI requirements.
- Extraction of marine clay will not be undertaken
- Sand extraction below the watertable will be by suction dredge only. No dry extraction of sand will occur on site, with the exception of the initial overburden and brickies loam.
- Prior to commencement of extraction, the extent of the approved extraction areas shall be clearly and permanently marked by a licensed surveyor with survey posts.
- Fines will be re-interred approximately below the watertable at approximately 10m below NSL.

Sediment and Erosion Control

- A perimeter bund and catch drain shall be constructed around each dredge pond and processing areas. The bund is to be vegetated.
- Installation of sediment control fences at the downslope perimeter of cleared or disturbed land. These are to be functional before clearing commences.
- A negative grade will be maintained around the dredge ponds within the bund perimeter.
- Additional Erosion and sediment control devices shall be installed on an 'as required' basis. Such measures will be installed in accordance with the "Soils and Construction Guidelines - Managing Urban Stormwater".
- Where practical, surface waters from undisturbed areas shall be diverted away from extraction/works areas.
- All processing areas will drain towards the onsite water bodies. No discharge of processing waters from the site shall occur under normal conditions (ie. Not flooded).
- Topsoil stripping will be undertaken in sub-stages of 1 hectare or less
- All existing ground cover around the site is to remain and be maintained to limit sediment and erosion.
- Any on-site stockpiles of commercial sand shall remain damp and will have appropriate sediment and erosion control devices installed at all times.
- Stockpiled topsoil shall be seeded so as to achieve adequate vegetation cover and sediment and erosion devices will be installed around all stockpiles at all times.
- No discharge of processing water from the site shall occur under normal conditions (ie. not flooded)

Surface Water Control & Quality

- Installation of surface and ground water monitoring devices as located on figure GJ0400.9.2 (Appendix Q)
- Surface water monitoring shall be undertaken in accordance with requirements as outlined with the draft EMP under Appendix G.

- All processing areas will drain towards the onsite water bodies. No discharge of processing waters from the site shall occur under normal conditions (ie. not flooded).
- Provision of reliable in situ monitoring equipment at all times for use by Quarry staff. This equipment will be calibrated at least monthly.
- All effluent generated will be pumped off site for treatment at Council facility.

Groundwater Movement and Quality

- Installation of ground water monitoring devices as located on figure GJ0400.8.1 (Appendix Q)
- Ground water monitoring shall be undertaken in accordance with the requirements as outlined within the draft EMP under Appendix G.
- Provision of reliable in situ monitoring equipment at all times for use by Quarry staff. This equipment will be calibrated at least monthly.
- All groundwater bores will be licensed by DIPNR.
- Dewatering from on site water bodies will not be undertaken
- Contour profiling of groundwater head data will be undertaken as part of site monitoring and reporting procedures.

Fuel Management and Land Contamination

- Fuel storage is to be contained within a bund area, and protected from the elements. Bunding will be sufficient to contain 110% of the volume of fuel storage.
- Operating procedures for containing and cleaning up oil spills on water to be established and implemented on site, with all staff to be trained in these procedures. Such measures are to form part of the site EMP.
- Products designed to contain and absorb oil spills on water will be available on site. Quantity and type of product will be monitored and will be available in sufficient quantities to deal with any potential spill on site.
- Materials stored on site will be limited to
 - One (1) month supply of diesel
 - Machine and equipment oils and grease
 - limited quantities of petrol

Air Quality

- The full length of internal haulage roadways will be sealed.
- A vegetation barrier for dust control along the southern boundary adjoining Warwick Park Road will be established (species and planting in accordance with rehabilitation plan, Appendix H).
- Topsoil stripping will be undertaken in sub-stages of 1 hectare or less.
- Topsoil stripping will not be undertaken on day with excess winds.
- All trucks entering/leaving the site shall be covered.
- Stockpiled topsoil shall be seeded so as to achieve adequate vegetation cover and sediment and erosion devices will be installed around all stockpiles.
- Any disturbed or unsealed movement areas will be watered by an onsite cart to ensure that such areas remain damp. Watering rates shall not be less than 2.5l/m²/hour.

Noise

- Construction of a 4m high earth mound shielding the operational areas. This mound shall form part of the stockpile and be lightly top soiled, seeded and maintained with native grasses.

- The earth mound is to be constructed between 7.30am and 5pm. The occupants of the nearest dwellings to the site be notified as to the hours of operation for the mound construction, and be provided with a contact telephone number should they have concerns regarding noise from this stage of the operation;
- The bulldozer used to construct the earth barriers should be well maintained, and fitted with residential mufflers;
- Upon plant dredge pump selection, noise levels should be less than or equal to 88dB(A) at 1m from the plant. If this level is not achievable, further acoustic treatment in the form of a semi enclosure will be required to reduce source noise levels to within the acceptable range;
- Upon sand screening plant selection, noise levels should be less than or equal to 80dB(A) at 1m from the plant. If this level is not achievable, further acoustic treatment in the form of a semi enclosure will be required to reduce source noise levels to within the acceptable range;
- Haulage trucks and the wheeled loader should be well maintained, and fitted with residential mufflers;
- Internal haulage route and the crossover to Pottsville Road be as smooth as possible, and well maintained;
- Prior to commencement of operations, an acoustic test be conducted to ensure compliance with the noise limit criteria;
- All operations to be limited to 7am to 6pm, Monday to Friday, and 7am to midday, Saturdays.

Flora & Fauna

- A detailed regeneration and rehabilitation plan is to be prepared and approved by the DECC prior to the issue of a construction certificate.
- Removal of existing weed species (particularly infestations of Bitou Bush and Lantana).
- Revegetation of disturbed areas within existing native vegetation communities with plants endemic to the locality. Revegetation areas will total approximately 15ha in area. No clearing of vegetation is required with the exception of approximately 20 Casuarina trees lining minor drainage channels in the extraction areas.
- Revegetation of nominated areas within the rehabilitation plan as attached under Appendix H to strengthen potential habitat corridors, extend the distribution of Swamp Sclerophyll and Littoral Rainforest environments and to extend the perimeter of the narrowest portions of the eastern forest to provide long-term mitigation against potential edge effects.
- A monitoring program will be implemented in respect of the rehabilitation areas external to the extraction areas. Such program will be subject to final approval by the DECC and will contain consideration of additional rehabilitation / regeneration areas at the expense of implementation of the nest boxes. Consideration will also be given to strengthening corridor linkages where possible.
- Incorporation of potential foraging resources for threatened fauna species within landscaping/revegetation areas including:
 - *Allocasuarina littoralis*, *A. torulosa* for Glossy Black Cockatoos
 - Flowering species (Eucalypts, Corymbians, Melaleuca, Banksia) for flying fox/bat species
 - Littoral Rainforest fruiting species for Fruit-doves/Rainforest Pigeons
 - Favoured Eucalypts for Koalas
- Installation of nest boxes within the existing vegetation communities.

Waste

- All soil waste will be disposed of by licensed contractor in accordance with the Protection of Environmental Operations Act 1997 (PEEO Act 1997) & Waste Minimisation Act 1995.
- All solid wastes are to be managed in accord with the attached HMC Solid Waste Management Plan.
- Effluent will be treated on site in accord with the attached HMC report.

Flooding

- Adoption of a maximum 300mm bund height to all levels below 2m AHD.

Cultural Heritage

- The proponent will undertake additional archaeological surveys of the proposed extraction areas prior to works commencing to provide assurance that no aboriginal sites exist within the extraction areas
- If aboriginal sites are found within the extraction areas the proponent must undertake surveys / assessment to determine the cultural heritage values of the site and report how those values might be impacted upon and provide appropriate avoidance, mitigation or compensatory measures. Such additional assessments must be in accord with guidelines and requirements of the DECC.

Views and Landscapes

- 5m to 10m vegetated buffers will be established around the extraction areas in accordance with the rehabilitation plan attached under Appendix H. The objectives of these areas are for visual protection primarily.
- A detailed rehabilitation plan will be prepared for those areas external to the extraction areas.

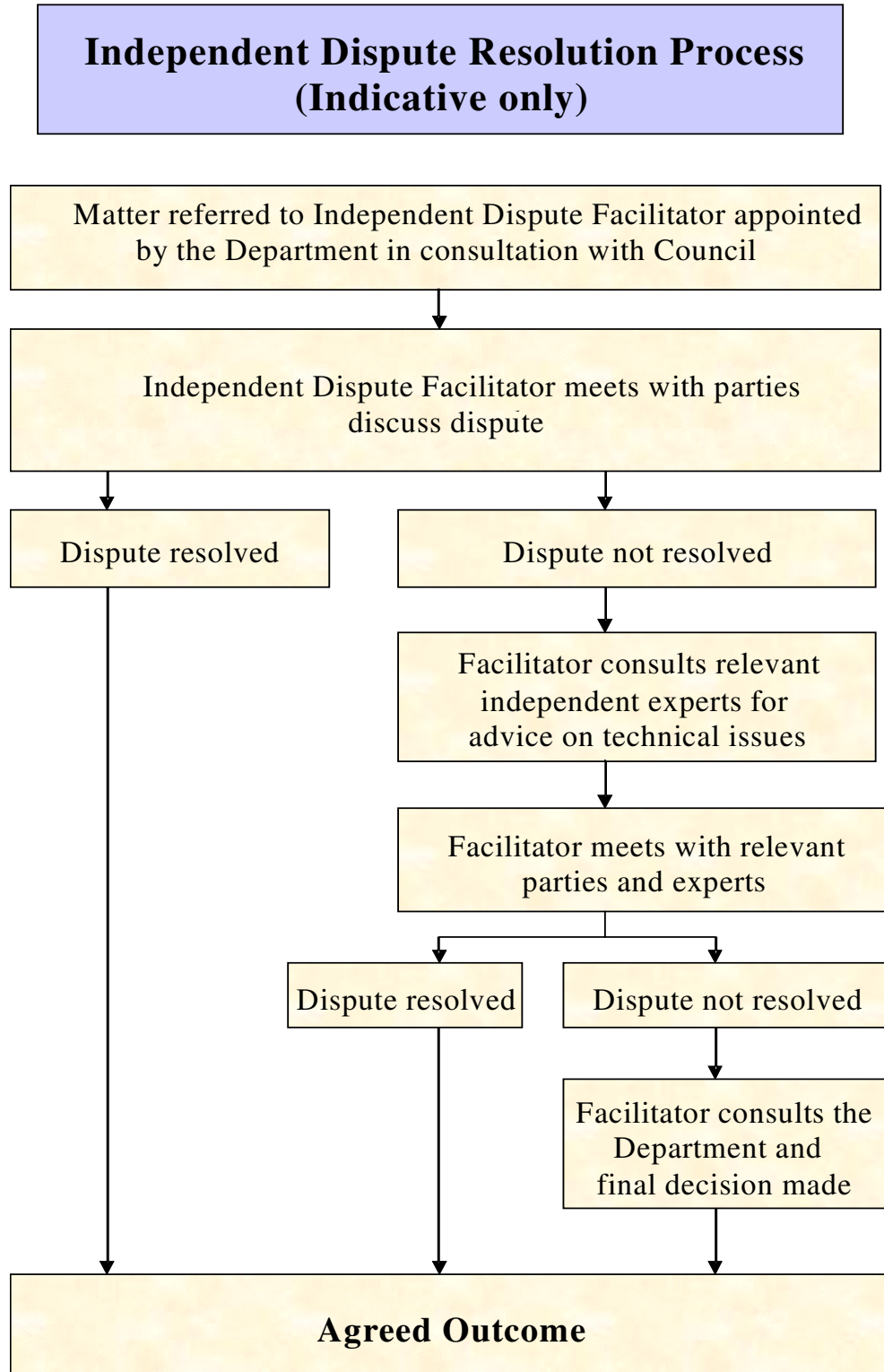
Monitoring, Reporting and Consultation

- Reporting and consultation measures will be implemented as outlined with the draft EMP under Appendix G.

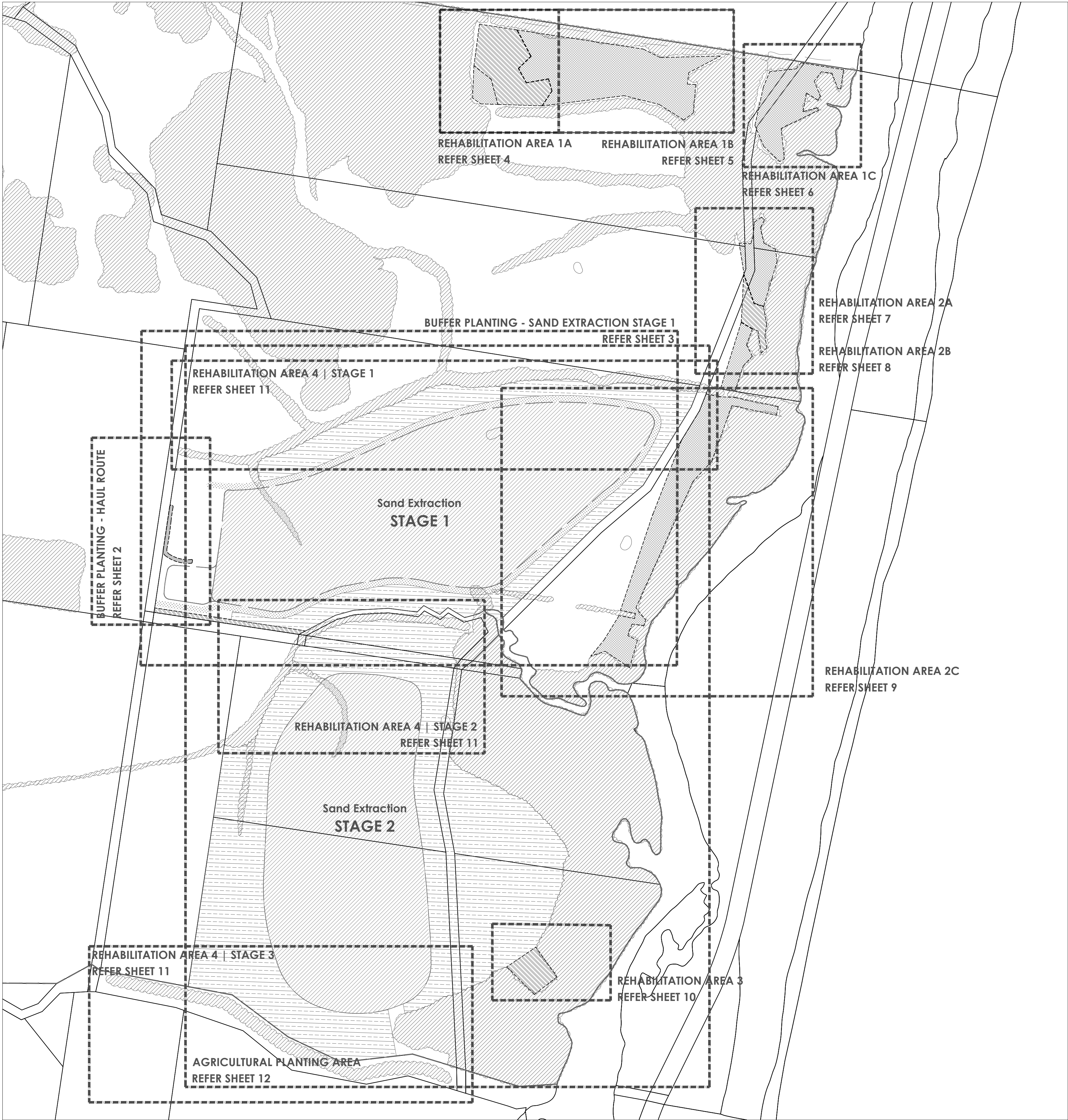
Licensing

- The proponent will commit to gaining an Environmental Protection Licence from DECC.

**APPENDIX 4
INDEPENDENT DISPUTE RESOLUTION PROCESS**



ATTACHMENT 3 – LANDSCAPING PLANS



Key Plan Dunloe Park Sand Extraction
Scale: 1:5000 at full size A1

Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



Key Plan Dunloe Park Sand Extraction
Scale: 1:5000 at full size A1

Drawing Schedule

Sheet 1	Drawing Schedule + Key Plan	845-01
Sheet 2	Buffer Planting - Stage 1 Haul Route	845-02
Sheet 3	Buffer Planting - Stage 1 Sand Extraction	845-03
Sheet 4	Rehabilitation Area 1A	845-04
Sheet 5	Rehabilitation Area 1B	845-05
Sheet 6	Rehabilitation Area 1C	845-06
Sheet 7	Rehabilitation Area 2A	845-07
Sheet 8	Rehabilitation Area 2B	845-08
Sheet 9	Rehabilitation Area 2C	845-09
Sheet 10	Rehabilitation Area 3	845-10
Sheet 11	Rehabilitation Area 4 - Stage 1-3	845-11
Sheet 12	Agricultural Area	845-12
Sheet 13	Specifications	845-13

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - KEY PLAN
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

SCALE:	AS SHOWN	DATE:	JUNE 2016
DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO:	DS_OPW_845_01

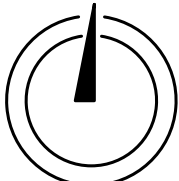
CLIENT	RAMTECH PTY LTD
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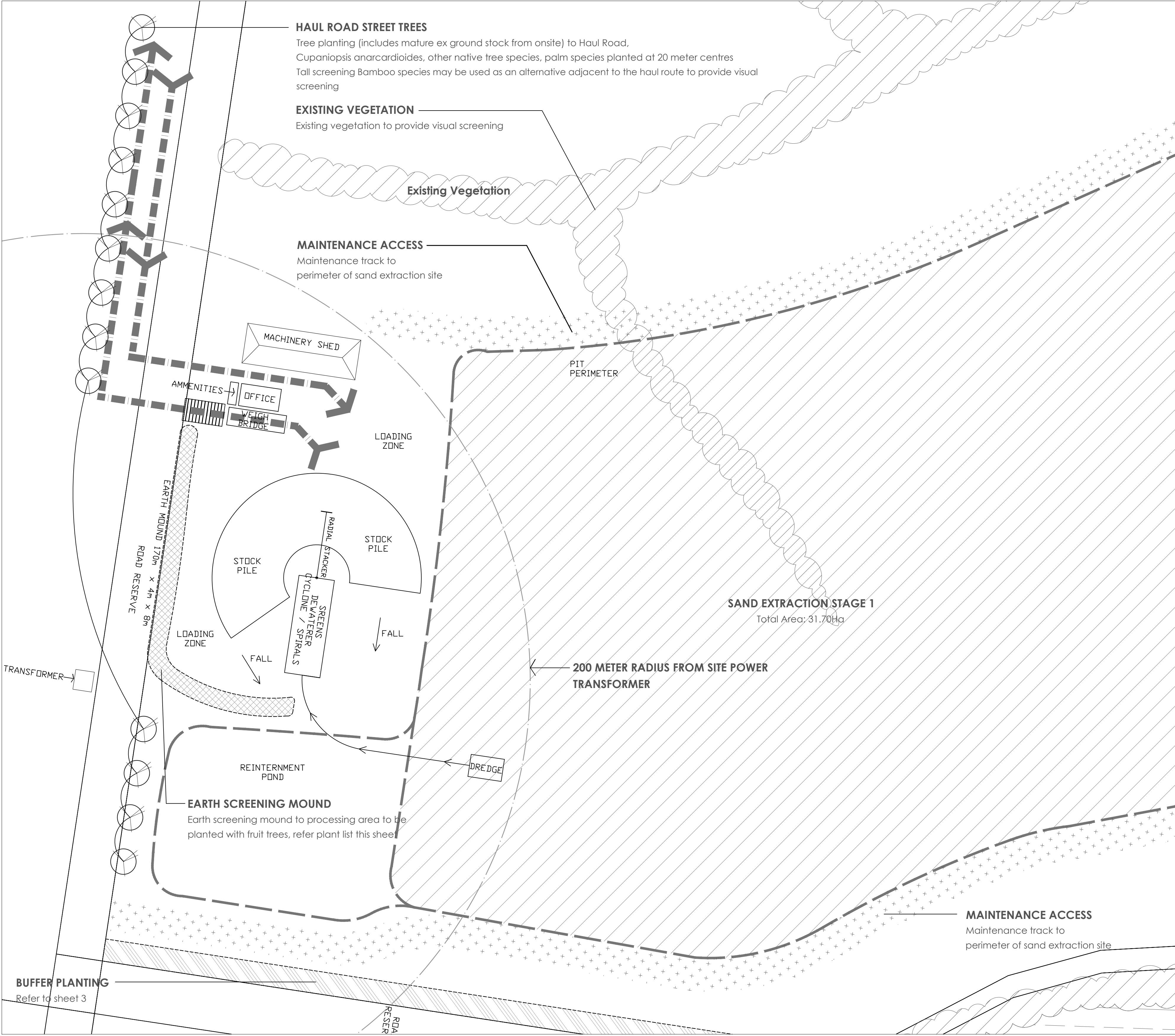
Level 1 2247 Gold Coast Hwy
Nobby Beach
PO Box 206 Nobby Beach QLD 4218

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PLANIT
CONSULTING




NORTH



Buffer Planting Area 1 - Earth Screening Mound
Total Area: 0.14Ha

Dunloe Park Sand Extraction
Scale: 1:1000 at full size A1

Dunloe Park - Rehabilitation Plan

OPW Landscape Plans

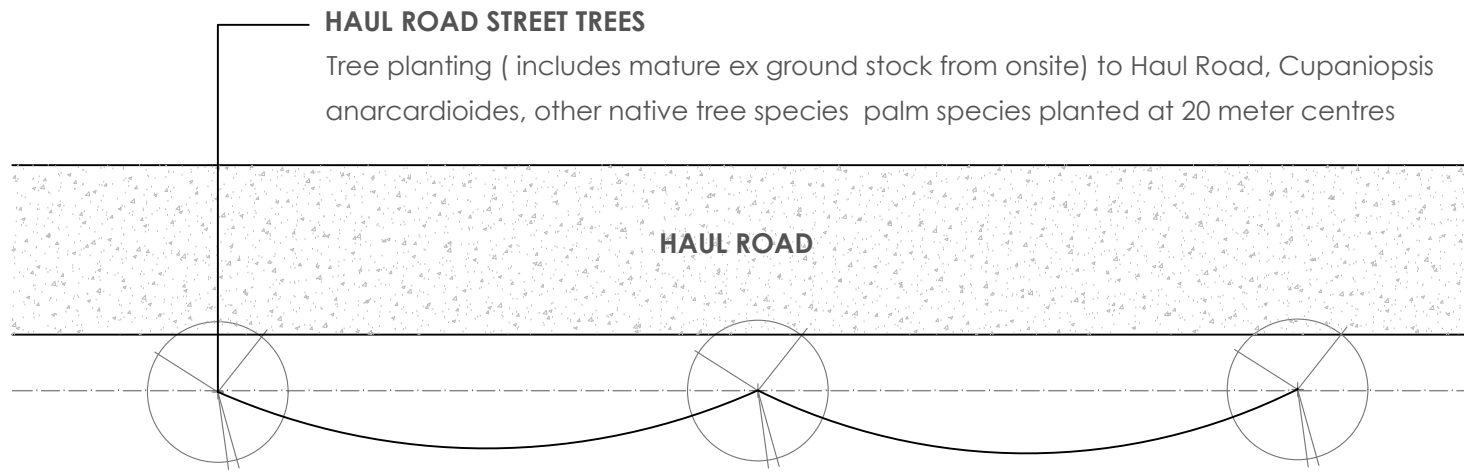


Buffer Planting - location plan

NTS

EARTH SCREENING MOUND
Total Area: 0.14Ha
CANOPY TREES

CODE	PLANT SPECIES	COMMON NAME	SPACING	SIZE	QTY
ban int	Citrus sinensis	Orange Tree	3 METER CENTRES	45LTR	210
cas gla	Davidsonia jerseyana	Davidson Plum			
cor int	Magnifera indicica	Mango Tree			
euc ler	Persea americano	Avocado Tree			



Planting to Haul Road - trees at 20 meter centres

NTS

Bamboo Screen Planting

Tall screening Bamboo species may be used as an alternative adjacent to the haul route to provide visual screening

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - BUFFER HAUL ROUTE
BASE PROVIDED BY	

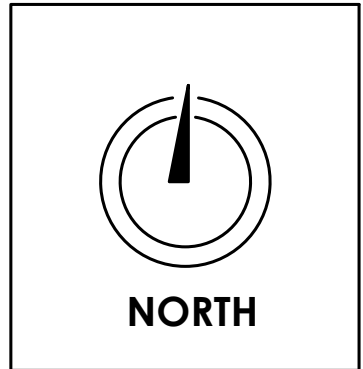
NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

SCALE:	AS SHOWN	DATE:	JUNE 2016
DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO:	DS_OPW_845_02

CLIENT	RAMTECH PTY LTD
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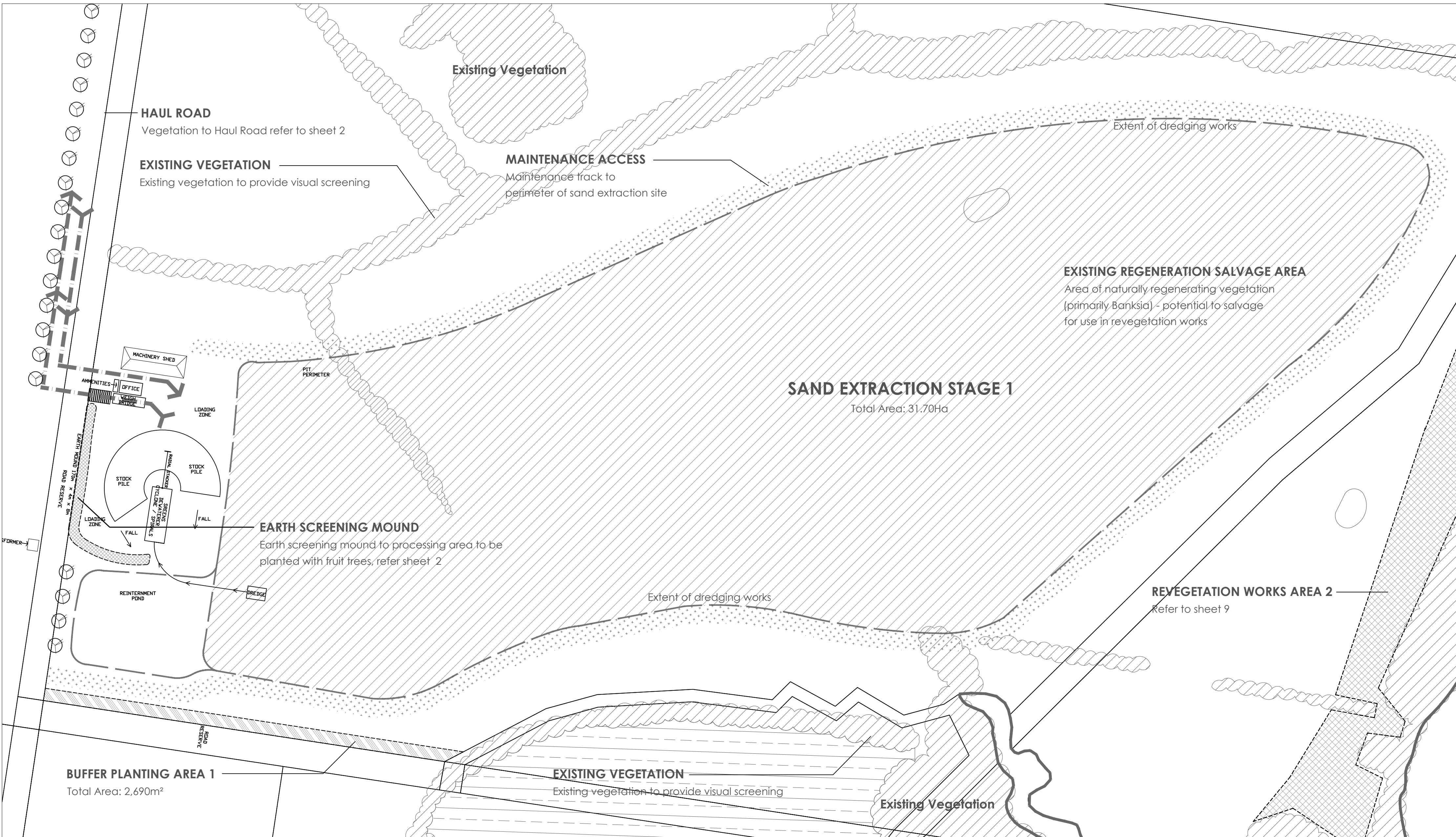


Dunloe Park - Rehabilitation Plan

OPW Landscape Plans

BUFFER PLANTING AREA 1
Total Area: 0.34Ha (34 MODULES)
CANOPY TREES

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coast Banksia	10 min 3 species per mod	45LTR	340
cas gla	Casuarina glauca	Swamp Oak			
cor int	Corymbia intermedia	Pink Bloodwood			
euc gra	Eucalyptus grandis	Flooded Gum			
euc ter	Eucalyptus tereticornis	Forest Red Gum			
euc mic	Eucalyptus microcorys	Tallow Wood			
euc sid	Eucalyptus siderophloia	Ironbark			
lap sau	Lophostemon saueolens	Swampbox			
lap con	Lophostemon confertus	Brush Box			
mel qui	Melaleuca quinquevneria	Paperbark			
syn glo	Syzygium moorei	Watermelon Tree			

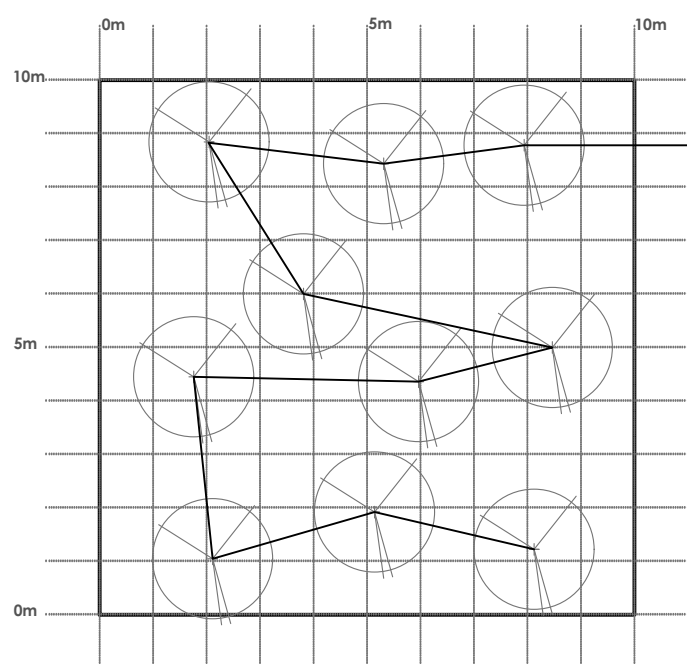


Buffer Planting Area 1
Total Area: 0.34Ha

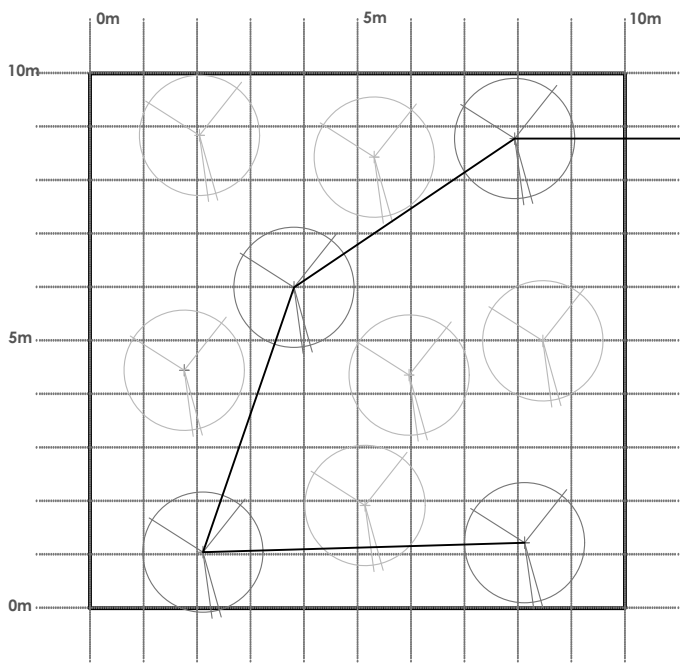
Dunloe Park Sand Extraction
Scale: 1:2000 at full size A1

EXTENT OF SAND EXTRACTION WORKS
Proposed extent of sand extraction works

EXTENT OF BUFFER PLANTING WORKS
Rehabilitation Works - 10 meter buffer
Total area: 0.34 Ha
Boundary of Buffer Planting Area to be pegged out by surveyor prior to commencement of works.
Pegs to be star pickets / galv pipe to minimum 1 meter above ground painted yellow



Planting Module 1 - Buffer Planting
10 x 10 meter module shown - refer also typical section

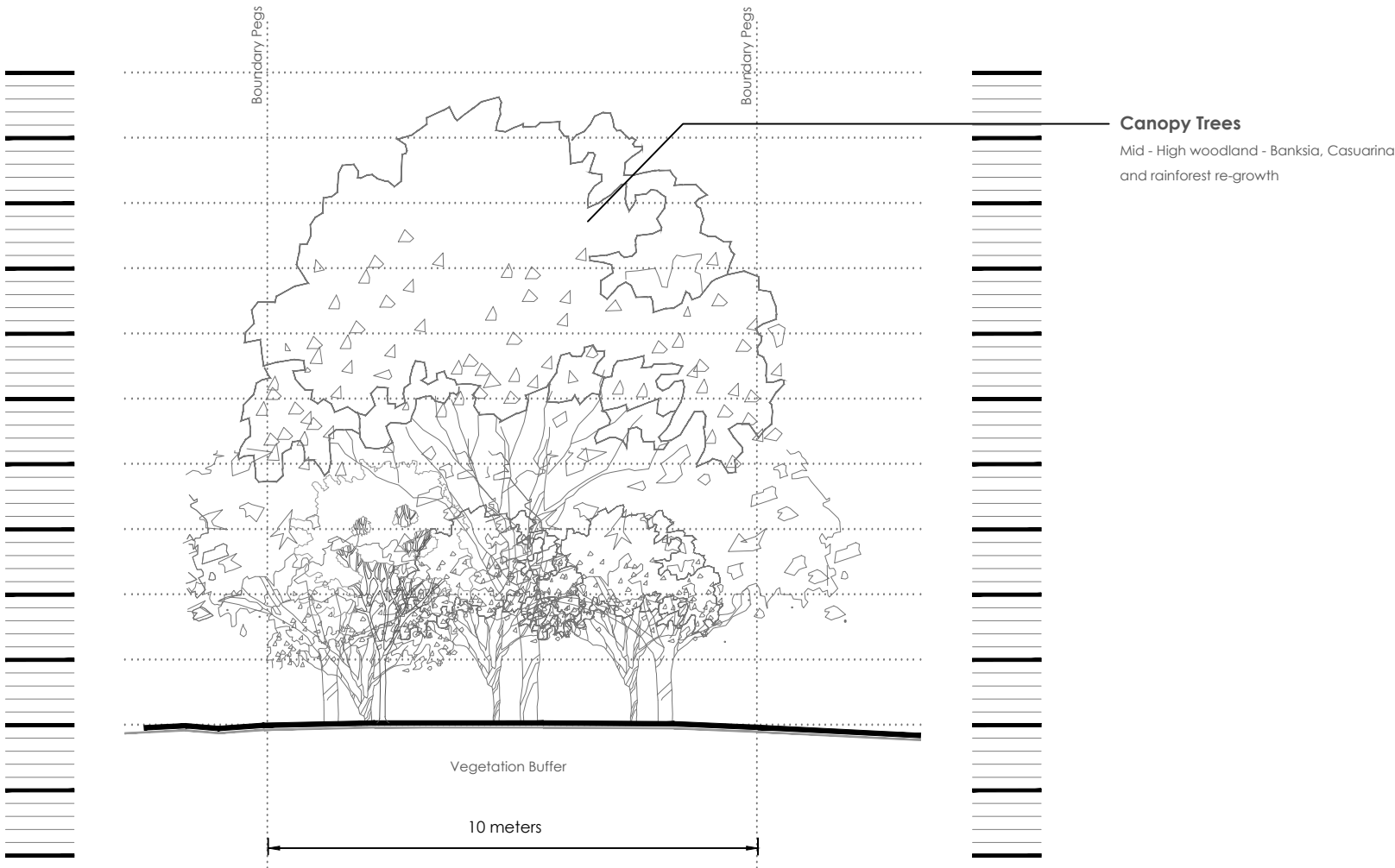


Planting Module 2 - Buffer Planting
SUPPLEMENTARY 10 x 10 meter module shown

Works Schedule Buffer Planting

Stage	0 - 6 months	6 - 12 months	Year 1+
Buffer Planting Total Area: 3.10Ha	PLANTING MODULE 1 Canopy/Subcanopy Trees 10 Canopy trees per module 20 Subcanopy trees per module refer to planting list this sheet Potential for salvaged plant stock (refer above plan) to be translocated to achieve planting densities	PLANTING MODULE 2 Supplementary planting to increase diversity and maintain densities. (exact numbers to be determined onsite by bush regeneration expert)	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09
	On-going monitoring and maintenance as per Rehabilitation Plan		

Notes:
Site subject to periods of frost
All existing tracks and trails onsite to remain



Typical Buffer Profile
Refer to Plant Modules and Species Listings this sheet for details
1:100 at full size A1

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - BUFFER PLANTING STAGE 1
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

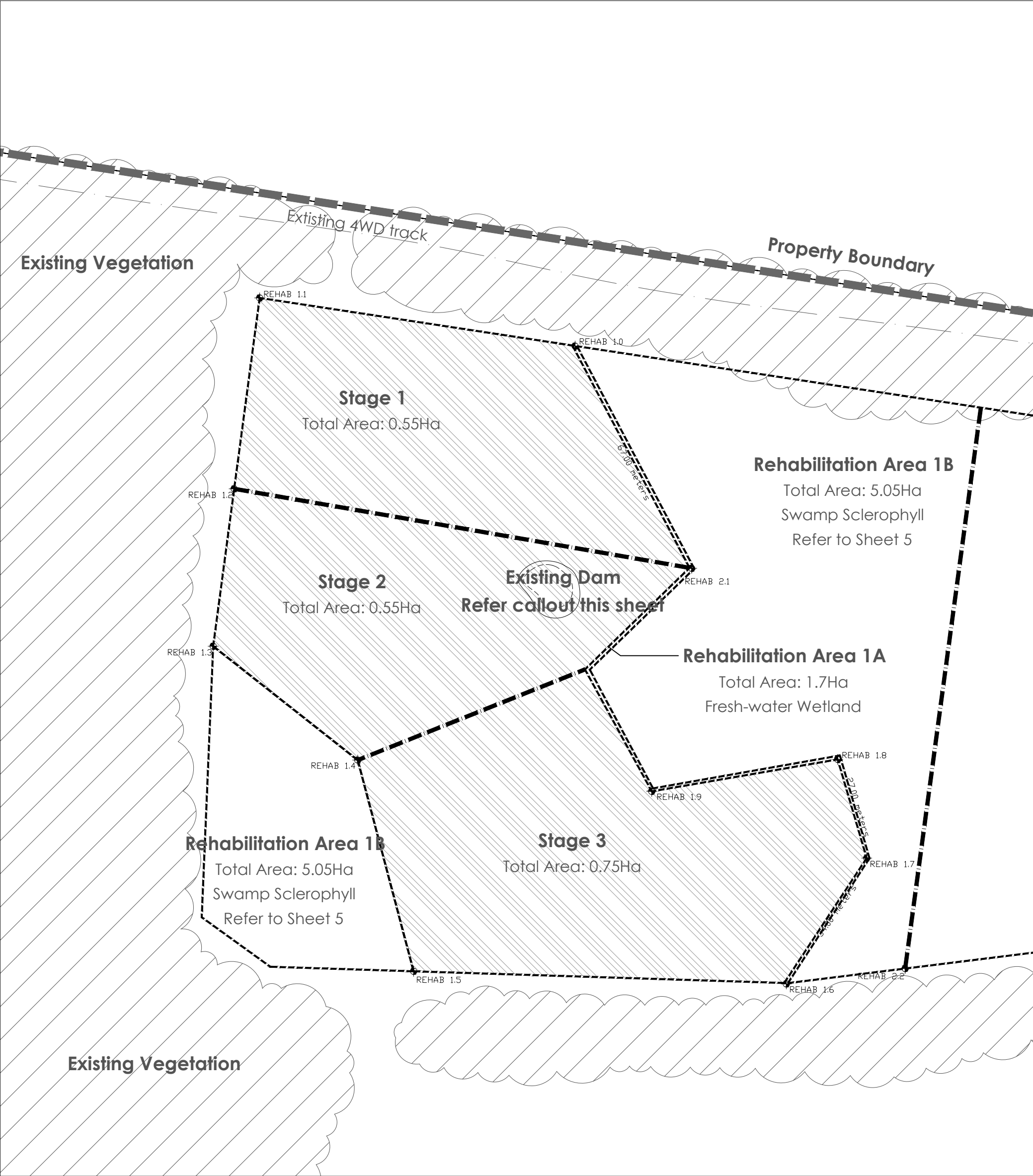
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DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO:	DS_OPW_845_03

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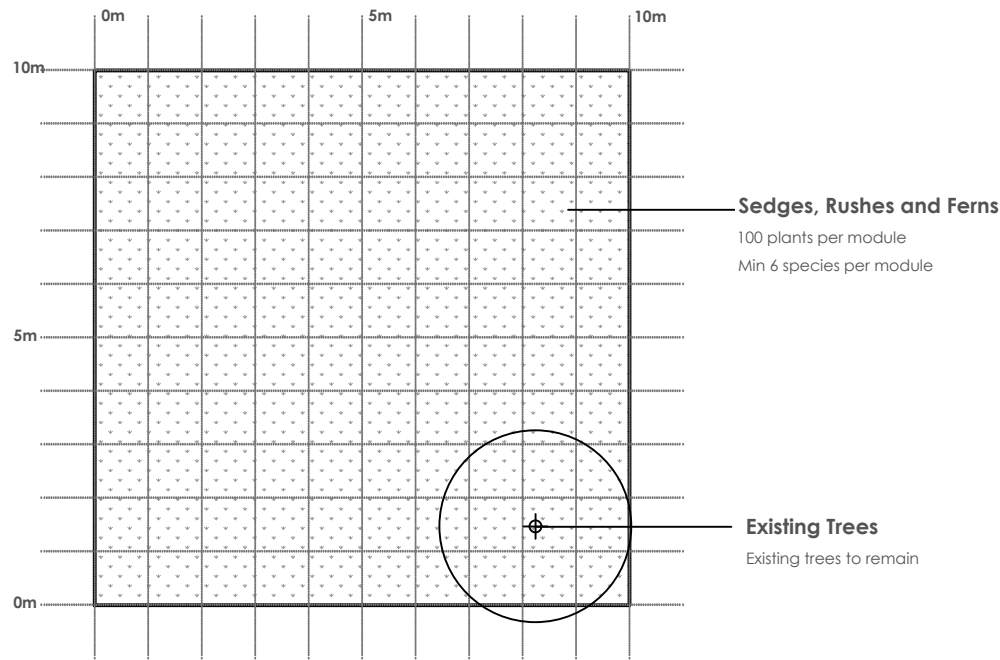
NORTH



Rehabilitation Area 1A
Total Area: 1.85Ha
Vegetation Type: Fresh-water Wetland

TREES - TO DAM					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
cas gla	Casuarina glauca	Swamp Oak	9	140MM	21
cal sal	Callistemon salignus	Willow Bottlebrush			
lop sau	Lophoslemon saueolens	Swampbox			
mel qui	Melaleuca quinquenervia	Paperbark			

REHABILITATION AREA 1A (185 MODULES) SEDGES, RUSHES + FERNS					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
bau jun	Baumea juncea	Bare Twigrush	100 min 4 species per mod	75MM TUBE	Stage 1 5500
bau ter	Baumea teretifolia	Twigrush			
ble ind	Blechnum indicum	Bungwall Fern			
cen asi	Centella asiatica	Pennywort			
cyp pol	Cyperus polystachyos	Bunchy Sedge			
flm fer	Fimbristylis ferruginea	Rusty Fringesedge			Stage 2 5500
flm pol	Fimbristylis polytrichoides	Fuzzy Rush			
gah asp	Gahnia aspera	Saw Sedge			
jun kra	Juncus kraussii	Searush			
jun val	Juncus vallatus	Common Rush			
pht lan	Philydrium lanuginosum	Fragmough			Stage 3 7500
pht aus	Phragmites australis	Common Reed			
sch val	Schoenoplectus vallatus	Clubrush			
sch ill	Schoenoplectus illaralis	Clubrush			
spo vir	Sporobolus virginicus	Salt Couch			
tri str	Triglochin striatum	Steaked Arrow Grass			
xyr com	Xyris complanata	Hatpins			

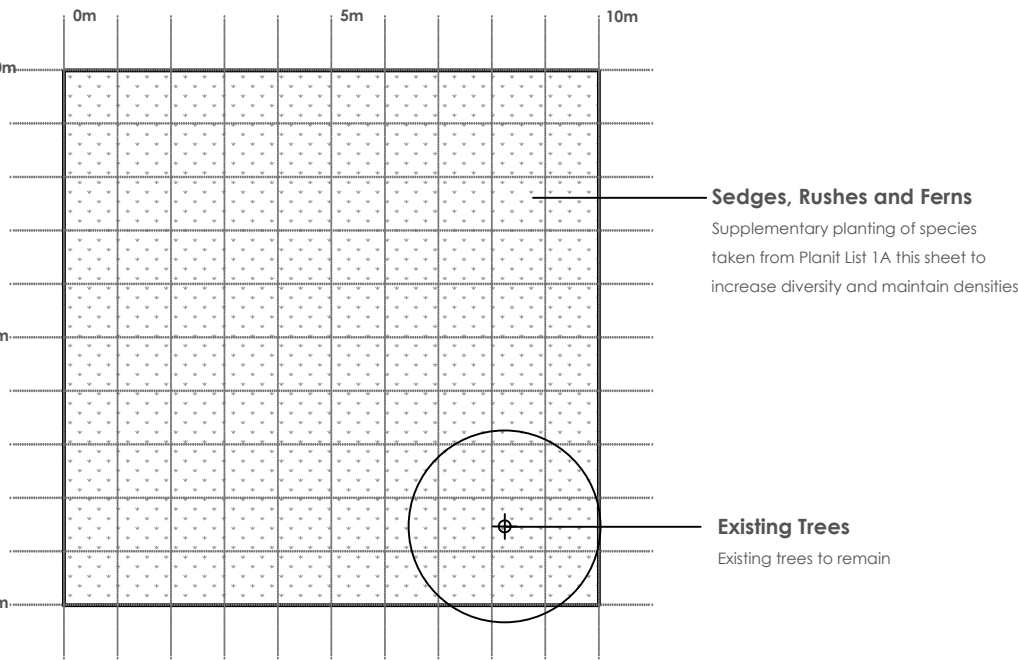


Planting Module 1 - Freshwater Wetland
PIONEER SPECIES PLANTING 10 x 10 meter module



Rehabilitation Area 1A - location plan
Dunloe Park Sand Extraction
NTS

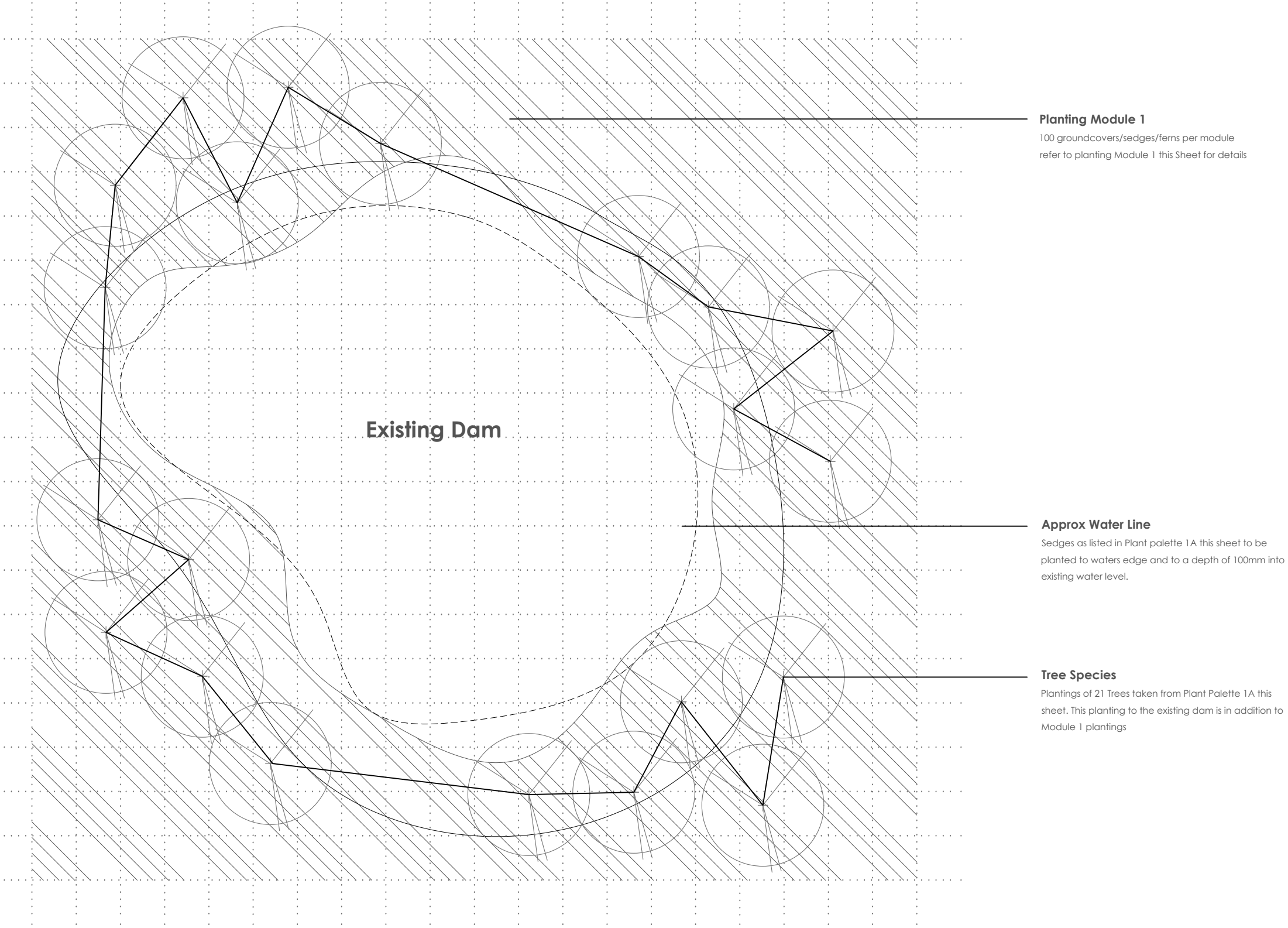
- REHAB 1.0 BOUNDARY PEGS**
Boundary of rehabilitation areas to be pegged out by surveyor prior to commencement of works. Pegs to be star pickets / galv pipe to minimum 1 meter above ground painted yellow with notation to match as noted on these plans. Existing vegetation line to form all other boundaries as indicated this sheet.
- FENCES**
Boundary of rehabilitation areas to be fenced if cattle are to be introduced to adjacent grazing areas.



Planting Module 2 - Freshwater Wetland
SUPPLEMENTARY SPECIES PLANTING 10 x 10 meter module

Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



Callout 1 - Existing Dam
To be planted as part of Stage 1 works
Vegetation Type: Fresh-water Wetland

Dunloe Park Sand Extraction
Scale: 1:100 at full size A1

Rehabilitation Schedule

Stage	Year 1	Year 2	Year 3	Year 4	Year 5+
Stage 1 Total Area: 0.55Ha	PLANTING MODULE 1 Species selected from Rehabilitation Area 1A species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined onsite by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
	▶ ▶ ▶ ▶ On-going monitoring and maintenance as per Rehabilitation Plan	▶ ▶ ▶ ▶			
Stage 2 Total Area: 0.55Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09 Existing Dam to be planted as per Callout this sheet	PLANTING MODULE 1 PIONEER SPECIES PLANTING 'Trees' and 'Small Trees' selected from Rehabilitation Area 1A species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined onsite by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
		▶ ▶ ▶ ▶ On-going monitoring and maintenance as per Rehabilitation Plan	▶ ▶ ▶ ▶		
Stage 3 Total Area: 0.75Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	PLANTING MODULE 1 PIONEER SPECIES PLANTING 'Trees' and 'Small Trees' selected from Rehabilitation Area 1A species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined onsite by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
			▶ ▶ ▶ ▶ On-going monitoring and maintenance as per Rehabilitation Plan	▶ ▶ ▶ ▶	

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - AREA 1A
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

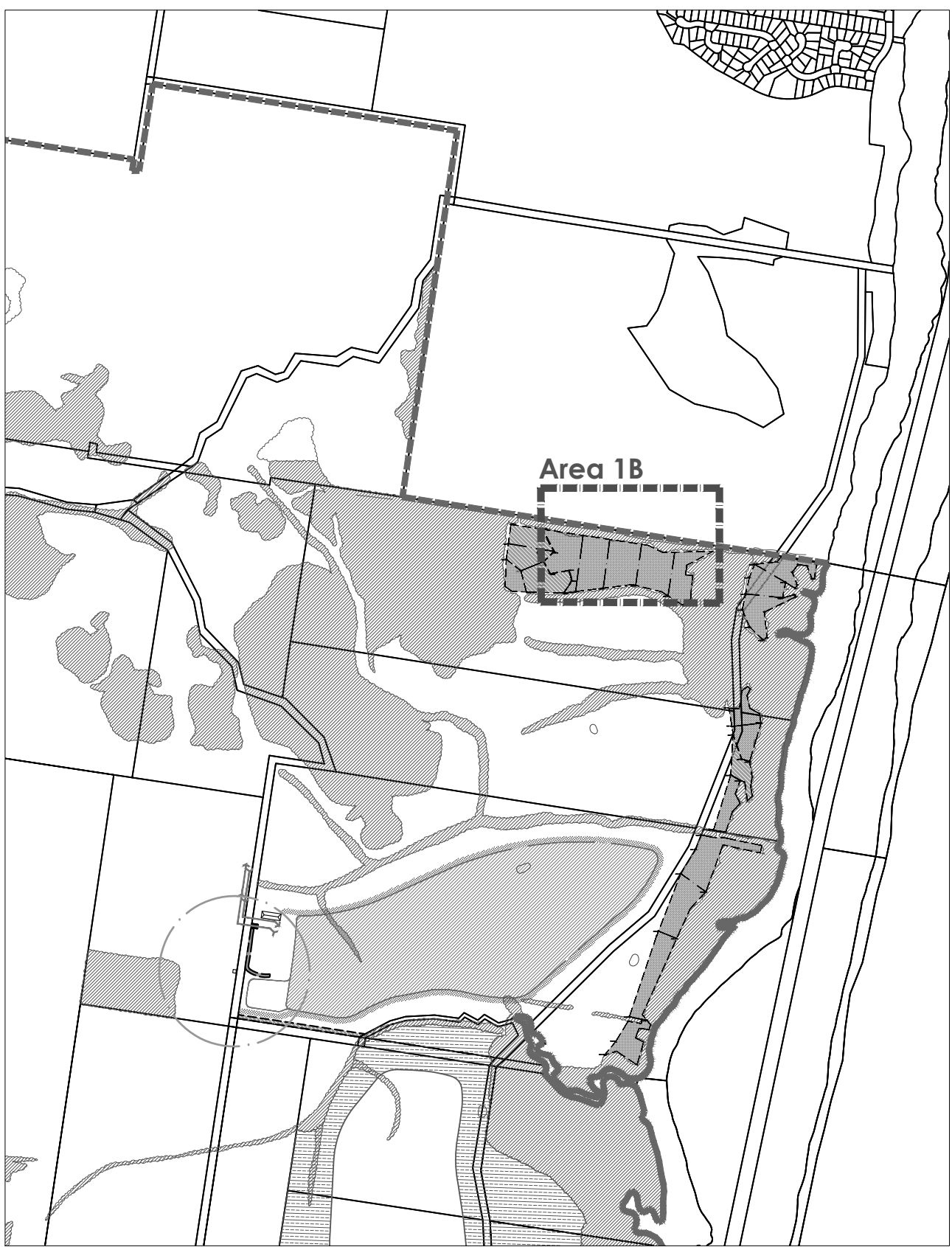
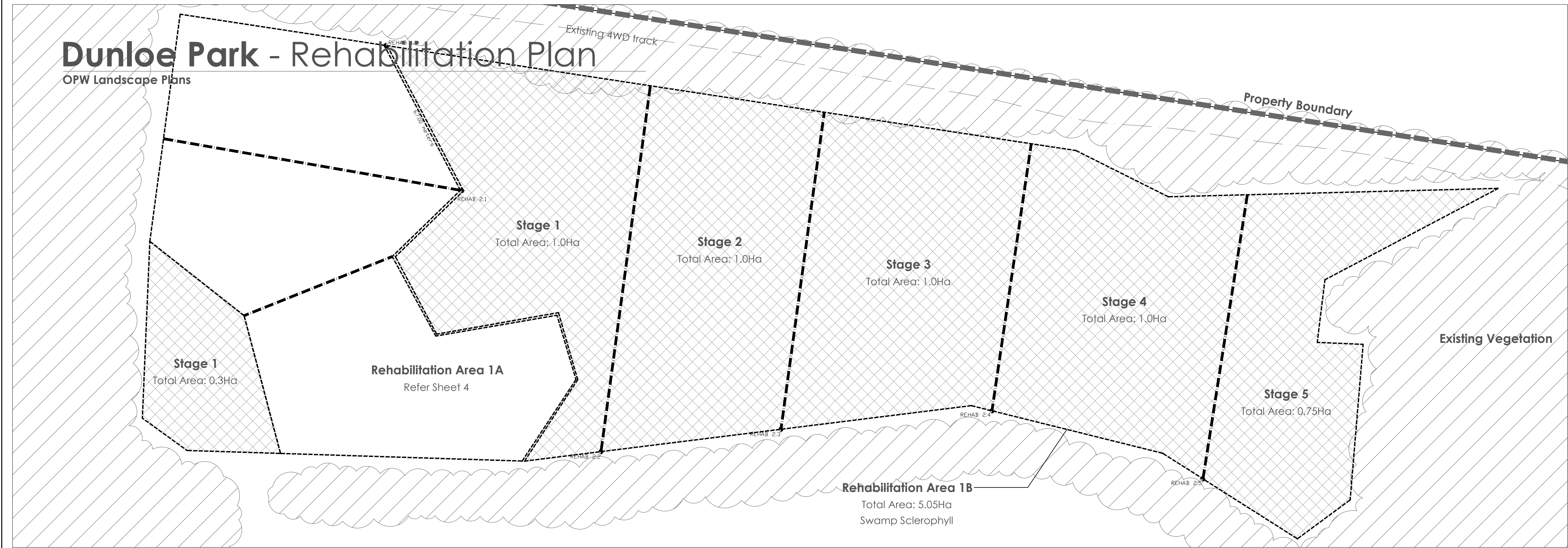
SCALE:	AS SHOWN	DATE:	JUNE 2016
DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO:	DS_OPW_845_04

CLIENT	RAMTECH PTY LTD
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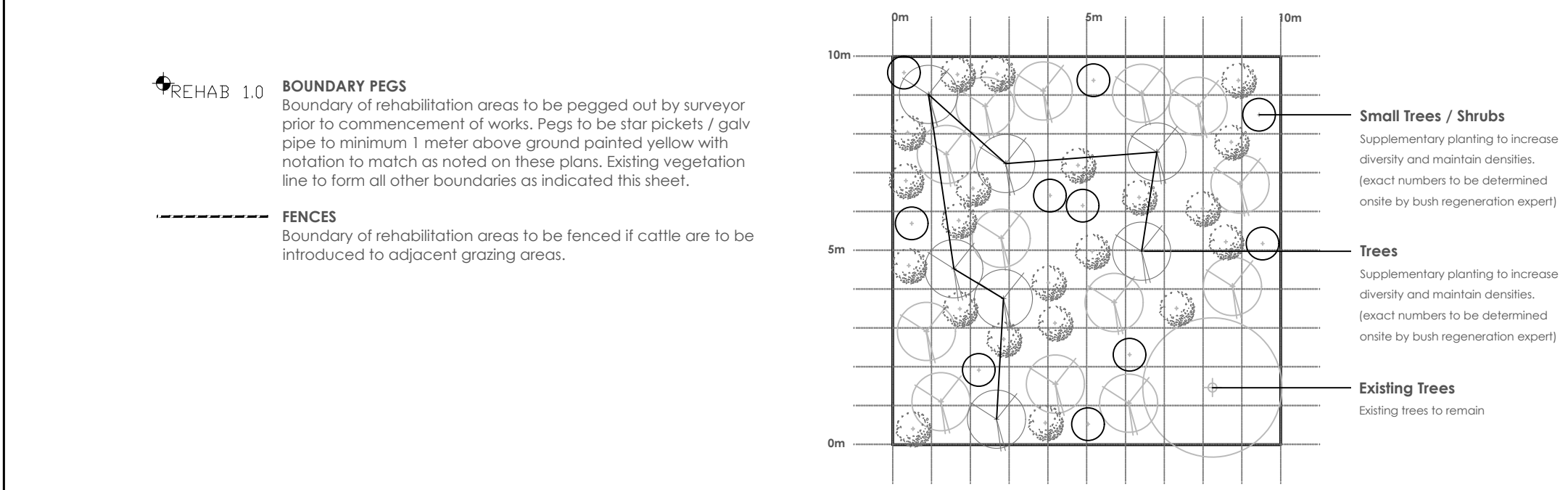
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admin@planitconsulting.com.au

NORTH



Rehabilitation Area 1B - location plan Dunloe Park Sand Extraction
NTS

Rehabilitation Area 1B
Total Area: 5.05Ha
Vegetation Type: Swamp Sclerophyll + Littoral Rainforest Understorey



REHABILITATION AREA 1B
TOTAL AREA: 5.05Ha (505 MODULES)
TREES - module 1, 2 and 3

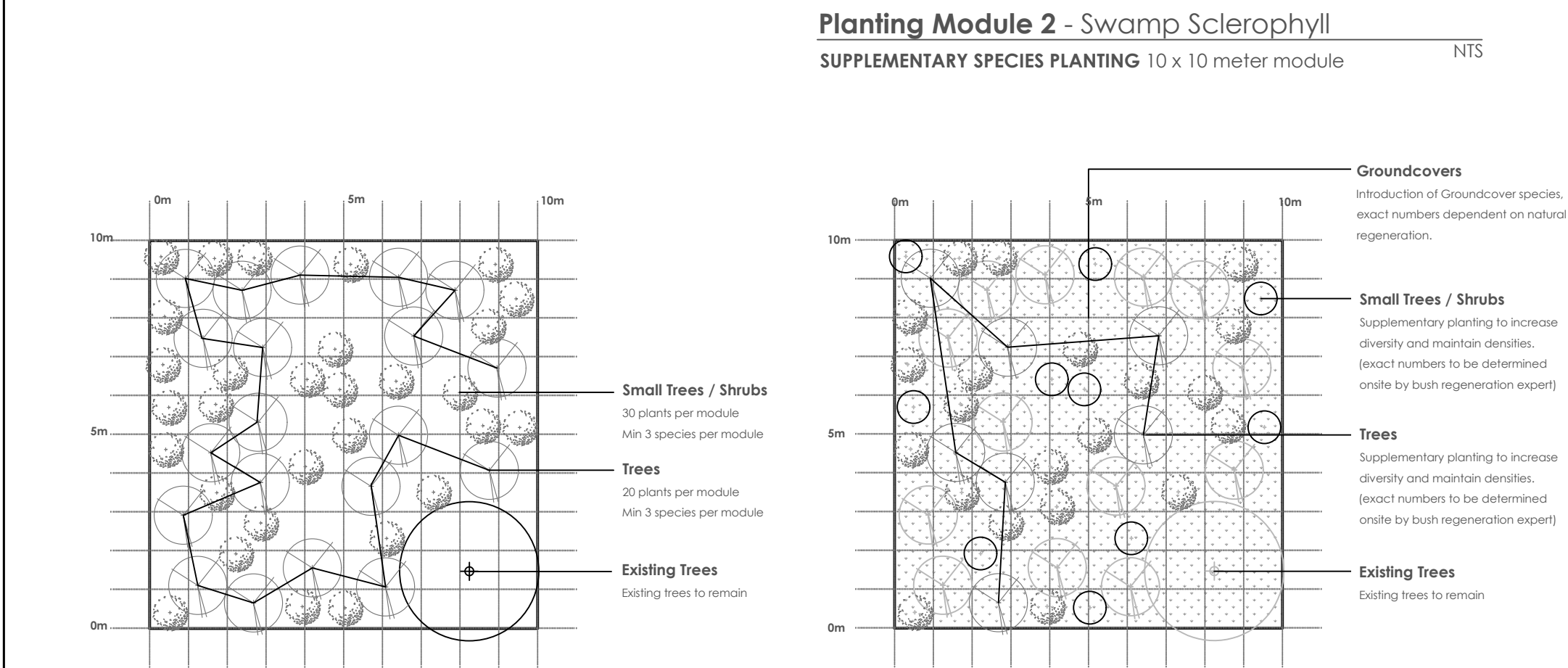
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
cal sal	Callistemon salignus	White Bottlebrush	20	75MM TUBE	Stage 1 2600
cor int	Corymbia intermedia	Pink Bloodwood			Stage 2 2600
euc ter	Eucalyptus tereticornis	Blue Gum			Stage 3 2600
euc rob	Eucalyptus robusta	Swamp Mahogany			Stage 4 2600
mel qui	Melaleuca quinquenervia	Paperbark			Stage 5 1500
lap sau	Laphoslemon saundersii	Swamp Box	Minimum 3 species selected per module		

SMALL TREES / SHRUBS - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
all for	Allocasuarina torulosa	Forest Oak	30	75MM TUBE	Stage 1 3900
acr imp	Acronychia imperforata	Beach Acronychia			Stage 2 3000
ban int	Banksia integrifolia	Coastal Banksia			
cup ana	Cupanopsis anacardioides	Tuckeroo			Stage 3 3000
carl mya	Dalbergia myzopoides	Corkwood			
hav acu	Hovea acutifolia	Wavea			Stage 4 3000
nat lon	Natalaea longifolia	Long-leaved Mock-olive			
pil rev	Pittosporum revolutum	Forest Pittosporum			Stage 5 2250
sys ole	Syzygium oleosum	Blue Lillypill			
tra lau	Trocaropa laurina	Tree Heath			

GROUNDCOVERS - module 3 only

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
aus dul	Austromyrtus dulcis	Midyim	50	75MM TUBE	To be determined on site by both regeneration expert
ble ind	Blechnum indicum	Swamp Water Fern			
cen asi	Centella asiatica	Pennywort			
cyp pol	Cyperus polystachyos	Flat Sedge			
dia coe	Dianella caerulea	Blue Flax Lilly			
gsh asp	Gahnia aspera	Saw Sedge			
hib sca	Hibbertia scandens	SNAKE VINE			
har vio	Hardenbergia violacea	Native sarsaparilla			
lom lon	Lomandra longifolia	Matrush			
ple esc	Pholidium esculentum	Broken Fern			
sch val	Schoenoplectus validus	Clubrush			
xyr com	Xyris complanata	Yelloweyed Grass			



Planting Module 1 - Swamp Sclerophyll
PIONEER SPECIES PLANTING 10 x 10 meter module
NTS

Planting Module 3 - Swamp Sclerophyll
SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS 10 x 10 meter module
NTS

Rehabilitation Schedule

Stage	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Stage 1 Total Area: 1.3Ha	PLANTING MODULE 1 PIONEER SPECIES PLANTING Tree and Small trees selected from Rehabilitation Area 1B species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined on-site by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet.	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet.	PLANTING MODULE 3 SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
	On-going monitoring and maintenance as per Rehabilitation Plan								
Stage 2 Total Area: 1.0Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	PLANTING MODULE 1 PIONEER SPECIES PLANTING Tree and Small trees selected from Rehabilitation Area 1B species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined on-site by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet.	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet.	PLANTING MODULE 3 SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
	On-going monitoring and maintenance as per Rehabilitation Plan								
Stage 3 Total Area: 1.0Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	PLANTING MODULE 1 PIONEER SPECIES PLANTING Tree and Small trees selected from Rehabilitation Area 1B species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined on-site by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet.	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
	On-going monitoring and maintenance as per Rehabilitation Plan								
Stage 4 Total Area: 1.0Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	PLANTING MODULE 1 PIONEER SPECIES PLANTING Tree and Small trees selected from Rehabilitation Area 1B species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined on-site by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
	On-going monitoring and maintenance as per Rehabilitation Plan								
Stage 5 Total Area: 0.75Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	PLANTING MODULE 1 PIONEER SPECIES PLANTING Tree and Small trees selected from Rehabilitation Area 1B species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined on-site by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet.	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet.	PLANTING MODULE 3 SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. Pioneer species - 'Tree' and 'Small Tree' selected from Rehabilitation Area 1B species list this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
	On-going monitoring and maintenance as per Rehabilitation Plan								

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - AREA 1B
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

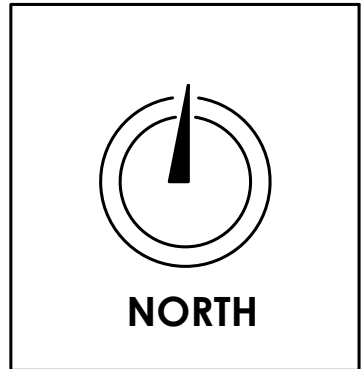
SCALE:	AS SHOWN	DATE:	JUNE 2016
DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO:	DS_OPW_845_05

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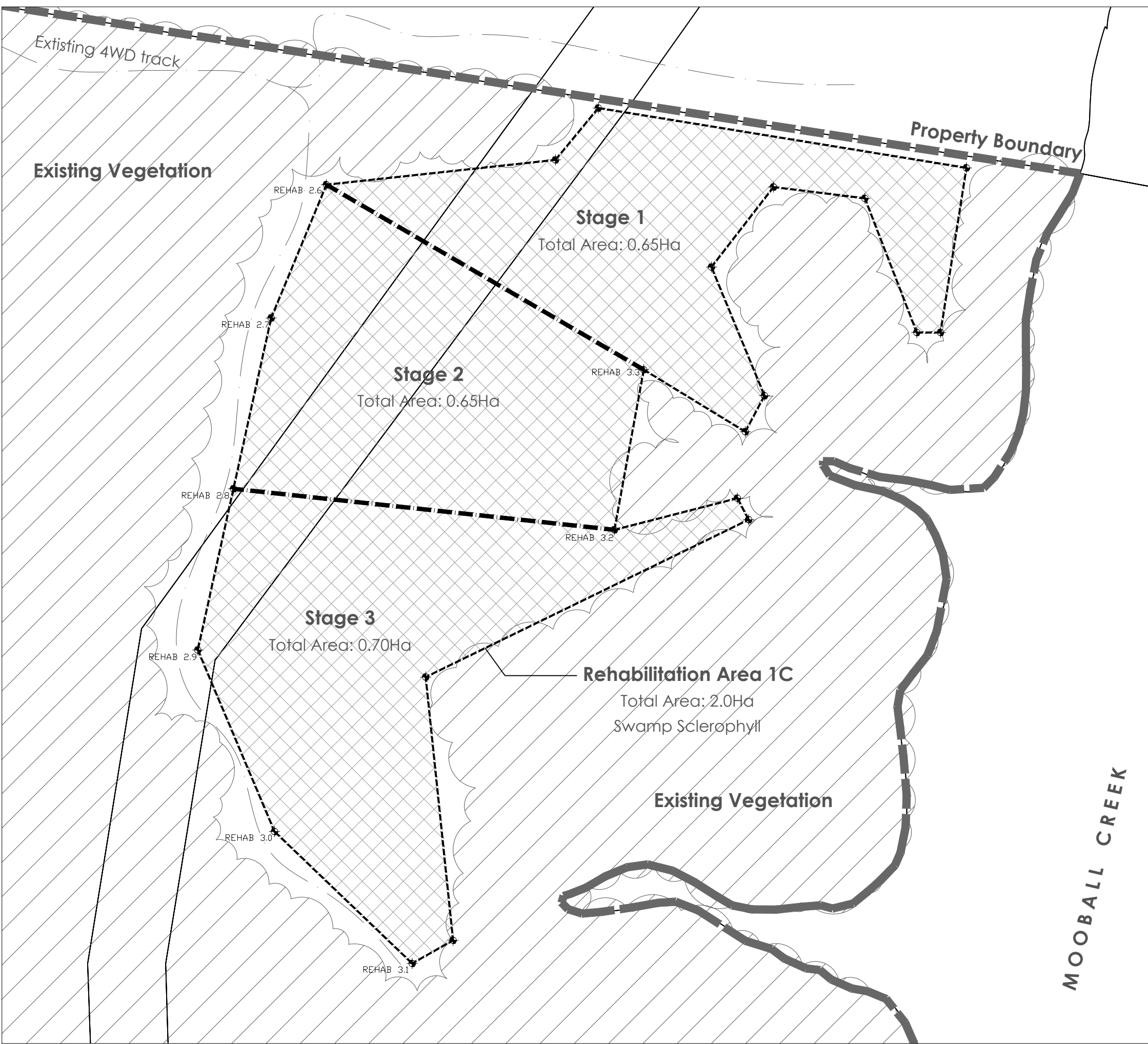
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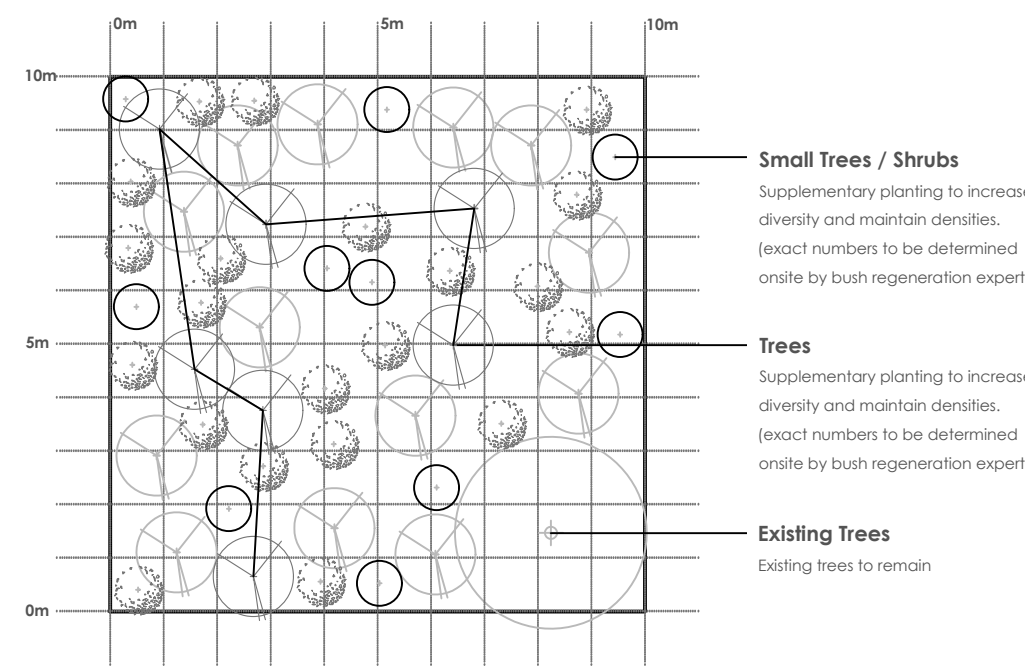
Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



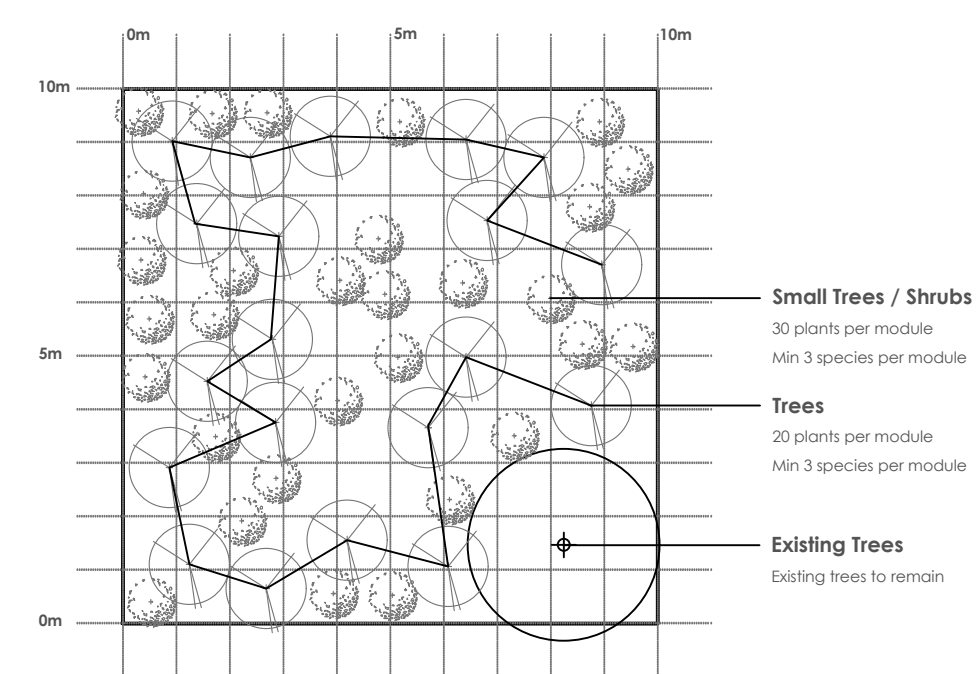
REHAB 1.0 **BOUNDARY PEGS**
Boundary of rehabilitation areas to be pegged out by surveyor prior to commencement of works. Pegs to be star pickets / galv pipe to minimum 1 meter above ground painted yellow with notation to match as noted on these plans. Existing vegetation line to form all other boundaries as indicated this sheet.

FENCES
Boundary of rehabilitation areas to be fenced if cattle are to be introduced to adjacent grazing areas.



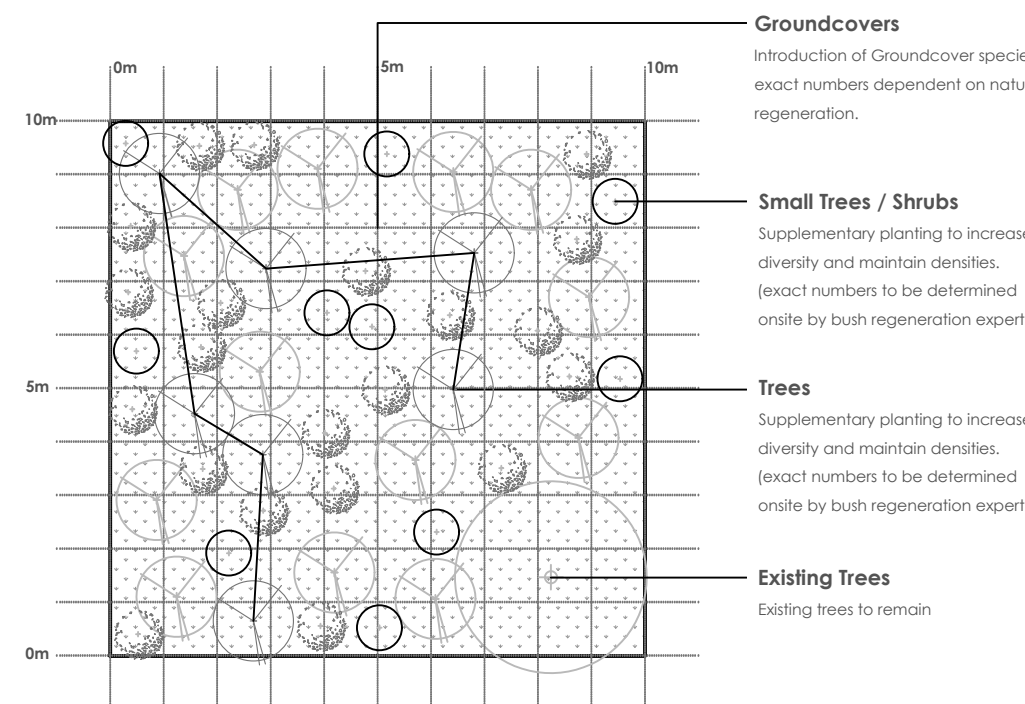
Planting Module 2 - Swamp Sclerophyll

SUPPLEMENTARY SPECIES PLANTING 10 x 10 meter module



Planting Module 1 - Swamp Sclerophyll

PIONEER SPECIES PLANTING 10 x 10 meter module



Planting Module 3 - Swamp Sclerophyll NTS

SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS 10 x 10 meter module

Rehabilitation Area 1C

Total Area: 2.0Ha

Vegetation Type: Swamp Sclerophyll + Littoral Rainforest Understorey

Dunloe Park Sand Extraction
Scale: 1:1000 at full size A1

Rehabilitation Area 1C - location plan

Dunloe Park Sand Extraction
NTS

REHABILITATION AREA 1C
TOTAL AREA: 2.0Ha (200 MODULES)
TREES - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
c-al sal	Callistemon salignus	White Bottlebrush	20 Minimum 3 species selected per module	75MM TUBE	Stage 1 1'x3'
cr int	Corymbia intermedia	Pink Bloodwood			Stage 2 1'x3'
euc fer	Eucalyptus tereticornis	Blue Gum			Stage 3 1'x3'
euc rob	Eucalyptus robusta	Swamp Mahogany			
mel qui	Melaleuca quinquenervia	Paperbark			
lop sau	Lophostemon suaveolens	Swamp Box			

SMALL TREES / SHRUBS - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
all for	<i>Allocasuarina torulosa</i>	Forest Oak	30 Minimum 3 garden selected per module	75MM TUBE	Stage 1 1950
acp imp	<i>Acronychia imperforata</i>	Beach Acronychia			
ban int	<i>Banksia integrifolia</i>	Coastal Banksia			Stage 2 1950
cup and	<i>Cupanilepis andracoedites</i>	Tuckeroo			
dub myo	<i>Dubautia myoporoides</i>	Corkwood			Stage 3 2100
hav acu	<i>Hevea acutifolia</i>	Hevea			
nat lon	<i>Nolotelea longifolia</i>	Long-leaved Mock-olive			
pil rev	<i>Pittosporum revolutum</i>	Forest Pittosporum			
syz ole	<i>Syzygium oleosum</i>	Blue Lillipilli			
tro lau	<i>Tracocarpa laurina</i>	Tree Heath			

GROUNDCOVERS - module 3 only

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
aus dul	<i>Austromyrtus dulcis</i>	Midyim	50	75MM TUBE	To be determined on-site by both regeneration expert
ble ind	<i>Blechnum indicum</i>	Bungwall Fern			
cen asi	<i>Centella asiatica</i>	Pennywort			
cyp pol	<i>Cyperus polystachyos</i>	Flat Sedge			
dia cae	<i>Dianella caerulea</i>	Blue Flax Lilly			
gah asp	<i>Gahnia aspera</i>	Saw Sedge			
hib sca	<i>Hibbertia scandens</i>	Snake Vine			
har vio	<i>Hardenbergia violacea</i>	Native soursopilla			
lom lon	<i>Lomandra longifolia</i>	Matrush			
ple esc	<i>Pteridium esculentum</i>	Braken Fern			
sch val	<i>Schoenoplectus validus</i>	Clabrush	Minimum 5 species selected per module		
xyr com	<i>Xyris complanata</i>	Yelloweyed Grass			

Rehabilitation Area 1C - species list

Stage	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7+
Stage 1 Total Area: 0.65Ha	PLANTING MODULE 1 PIONEER SPECIES PLANTING 'Trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined onsite by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLATING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet.	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet.	PLANTING MODULE 3 SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. 'Trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
	▶ ▶ ▶ On-going monitoring and maintenance as per Rehabilitation Plan		▶ ▶ ▶ ▶ ▶				
Stage 2 Total Area: 0.65Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	PLANTING MODULE 1 PIONEER SPECIES PLANTING 'trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined onsite by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLATING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet.	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet.	PLANTING MODULE 3 SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. 'Trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
	▶ ▶ ▶ ▶ ▶ On-going monitoring and maintenance as per Rehabilitation Plan		▶ ▶ ▶ ▶ ▶				
Stage 3 Total Area: 0.7Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	PLANTING MODULE 1 PIONEER SPECIES PLANTING 'Trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined onsite by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet.	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet.	PLANTING MODULE 3 SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. 'Trees' and 'Small Trees' selected from Rehabilitation Area 1C species list this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
			▶ ▶ ▶ ▶ ▶ On-going monitoring and maintenance as per Rehabilitation Plan		▶ ▶ ▶ ▶ ▶		

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - AREA 1C
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

SCALE: AS SHOWN	DATE: JUNE 2016
DESIGN: JB/GD	CHECKED: AS
DRAWN: JB	DRAWING NO: DS_OPW_B45_06

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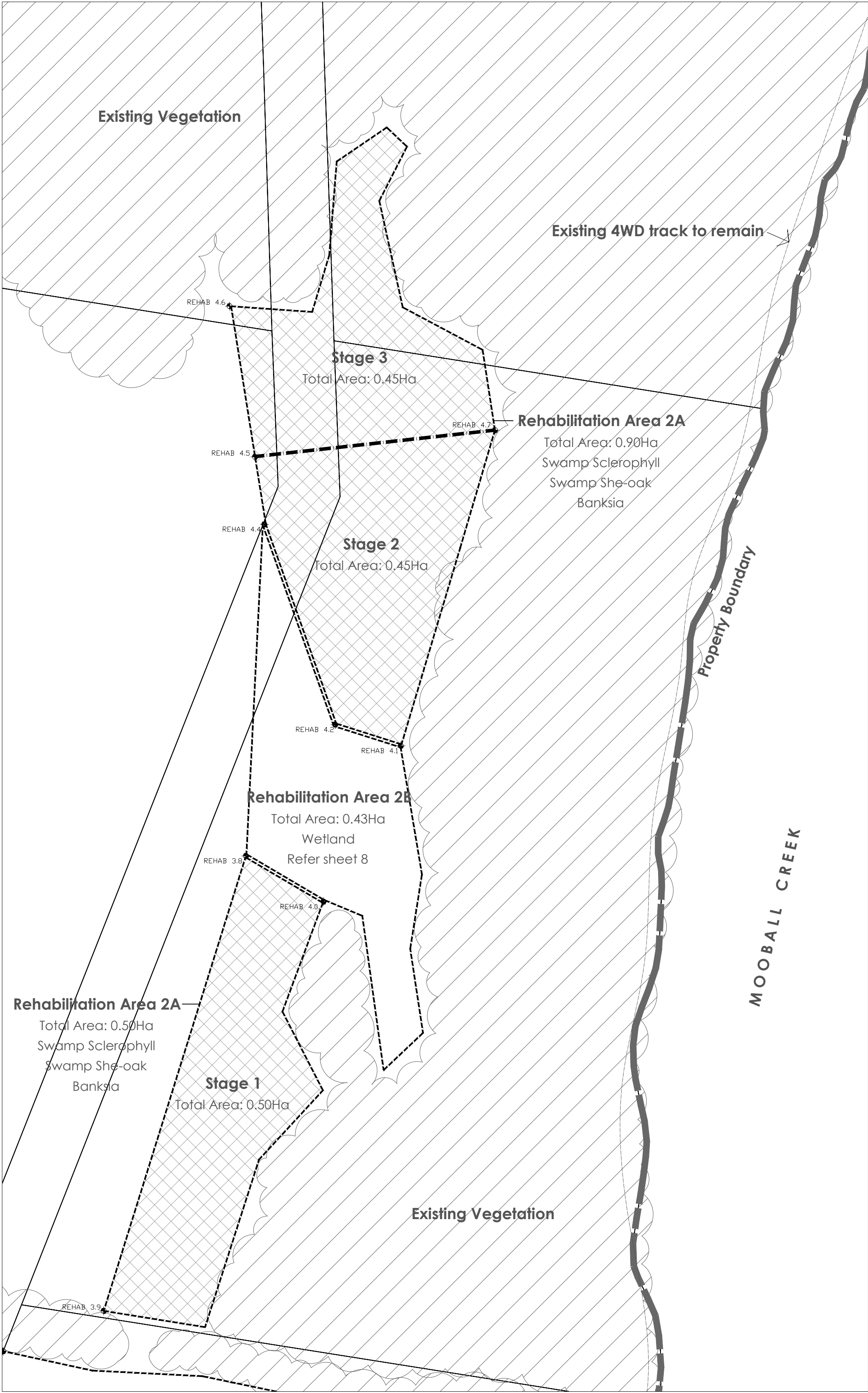
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NORTH

Dunloe Park - Rehabilitation Plan

OPW Landscape Plans



Rehabilitation Area 2A
Total Area: 1.40Ha
Vegetation Type: Swamp Sclerophyll, She-oak + Banksia with Littoral Rainforest Understorey

Dunloe Park Sand Extraction
Scale: 1:1000 at full size A1



Rehabilitation Area 2A - location plan
Dunloe Park Sand Extraction
NTS

Rehabilitation Area 2A - species list

REHABILITATION AREA 2A
TOTAL AREA: 1.40ha (140 MODULES)
TREES - module 1, 2 and 3

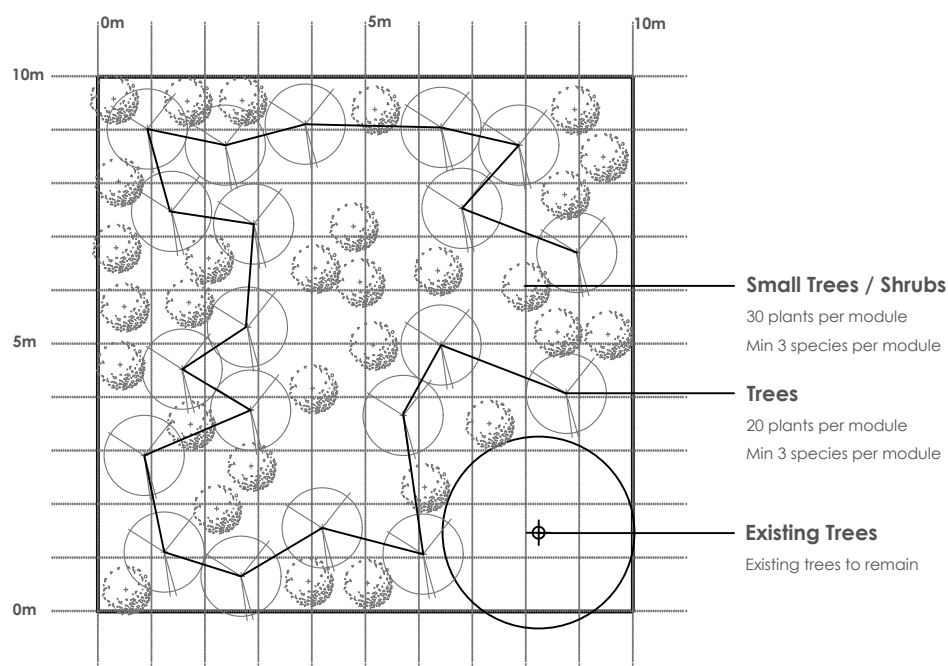
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coastal Banksia	20	75MM TUBE	Stage 1 1000
cal sal	Callistemon salignus	White Bottlebrush	Minimum 3 species selected per module		Stage 2 900
lop sau	Lophoslemon suaveolens	Swamp Box			Stage 3 900
mel qui	Melaleuca quinquenervia	Paperbark			

REHAB 1.0 BOUNDARY PEGS

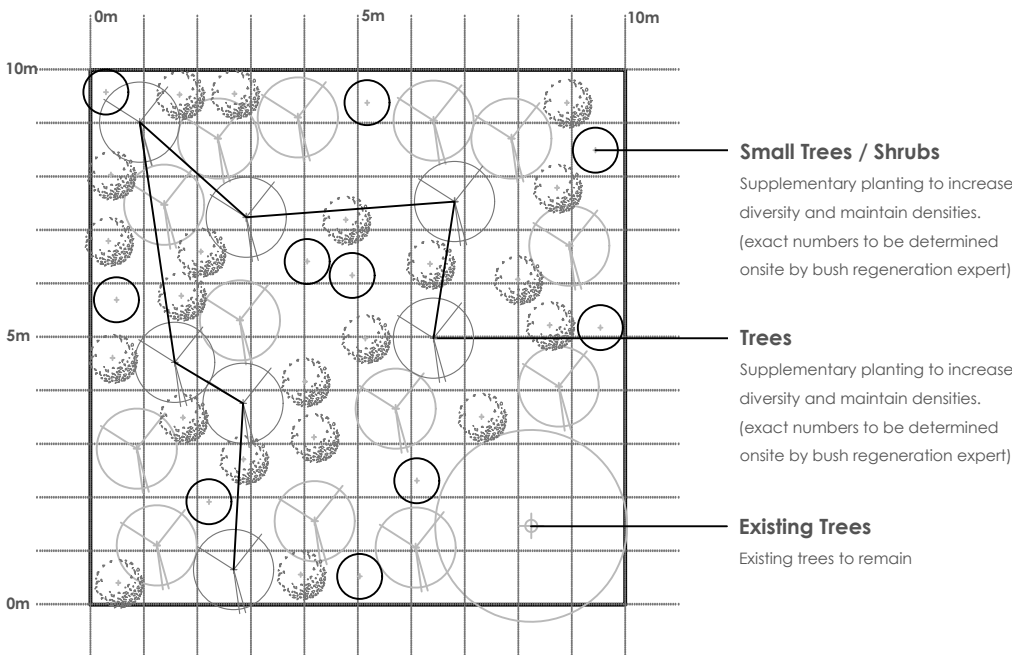
Boundary of rehabilitation areas to be pegged out by surveyor prior to commencement of works. Pegs to be star pickets / galv pipe to minimum 1 meter above ground painted yellow with notation to match as noted on these plans. Existing vegetation line to form all other boundaries as indicated this sheet.

FENCES

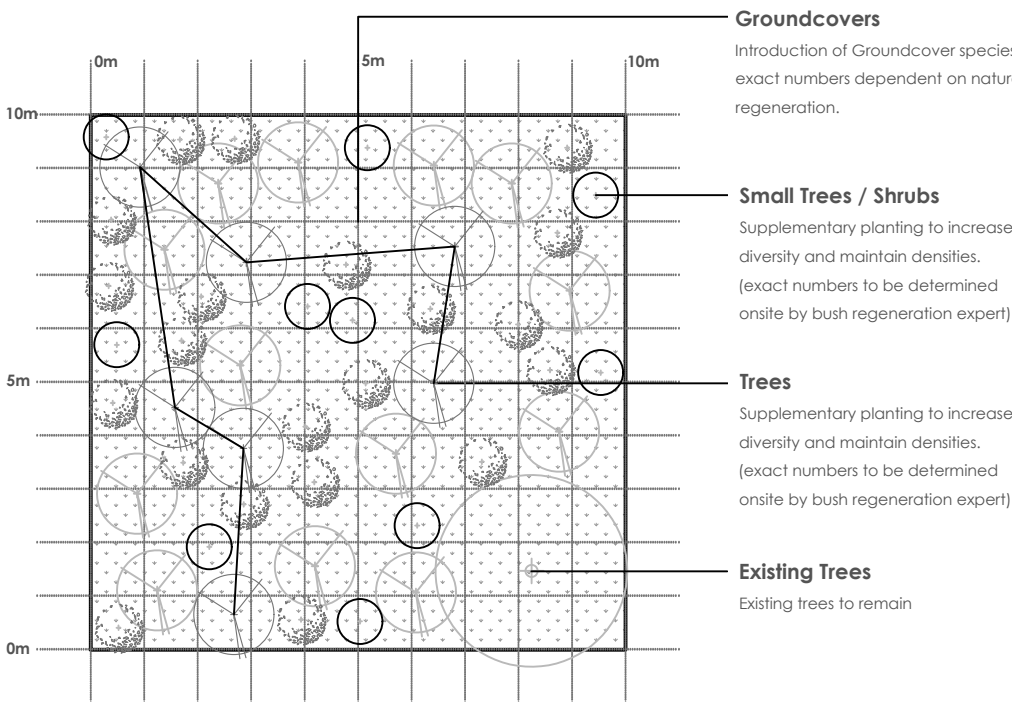
Boundary of rehabilitation areas to be fenced if cattle are to be introduced to adjacent grazing areas.



Planting Module 1 - Swamp Sclerophyll, She-oak + Banksia
PIONEER SPECIES PLANTING 10 x 10 meter module
NTS



Planting Module 2 - Swamp Sclerophyll, She-oak + Banksia
SUPPLEMENTARY SPECIES PLANTING 10 x 10 meter module
NTS



Planting Module 3 - Swamp Sclerophyll, She-oak + Banksia
SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS 10 x 10 meter module

SMALL TREES / SHRUBS - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
acm hem	Acmena hemilampra	Broad-leaved Lillypilli	30	75MM TUBE	Stage 1 1500
aca sop	Acacia sophorae	Coast Wattle			
ale cor	Alectryon coriaceus	Beach Alectryon			
can bar	Commersonia bartramia	Brown Kurodjing			Stage 2 1500
cup ana	Cupaniopsis anacardioides	Tuckeroo			
dub mya	Dubalia myrsinoides	Carlwood			Stage 3 1350
ela ref	Elaeocarpus reticulatus	Blueberry Ash			
exo lat	Exocarpus latifolius	Broad-leaved Cherry	Minimum 3 species selected per module		
per str	Persoonia strabrokanensis	Coast Geebung			

GROUNDCOVERS - module 3 only

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
adi his	Adiantum hispidulum	Rough Maidenhair	50	75MM TUBE	To be determined on-site by bush regeneration expert
aus dul	Austromyrtus dulcis	Midyim			
ble car	Blechnum carolinense	Gistie Fern			
ble ind	Blechnum indicum	Bungwall Fern			
cri pen	Citrus pendunculatum	Swamp Lilly			
gah asp	Gahnia aspera	Saw Sedge	Minimum 5 species selected per module		
lom lon	Lomandra longifolia	Maltush			

Rehabilitation Schedule Area 2A

Stage	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7+
Stage 1 Total Area: 0.5Ha	PLANTING MODULE 1 PIONEER SPECIES PLANTING 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined onsite by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLATING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet.	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet.	PLANTING MODULE 3 SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet. Introduction of Groundcover species. dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09
	On-going monitoring and maintenance as per Rehabilitation Plan						
Stage 2 Total Area: 0.45Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09	PLANTING MODULE 1 PIONEER SPECIES PLANTING 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined onsite by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLATING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet.	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet.	PLANTING MODULE 3 SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet. Introduction of Groundcover species. dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09
	On-going monitoring and maintenance as per Rehabilitation Plan						
Stage 3 Total Area: 0.45Ha	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09	PLANTING MODULE 1 PIONEER SPECIES PLANTING 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined onsite by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLATING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet.	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet.	PLANTING MODULE 3 SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. 'Trees' and 'Small Trees' selected from Rehabilitation Area 2A species list this sheet. Introduction of Groundcover species. dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09
	On-going monitoring and maintenance as per Rehabilitation Plan						

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - AREA 2A
BASE PROVIDED BY	

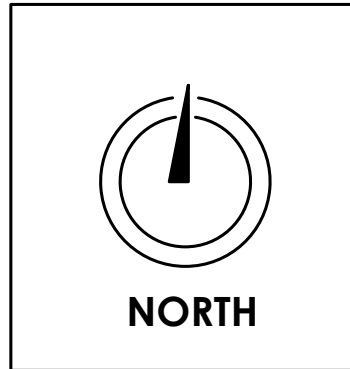
NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

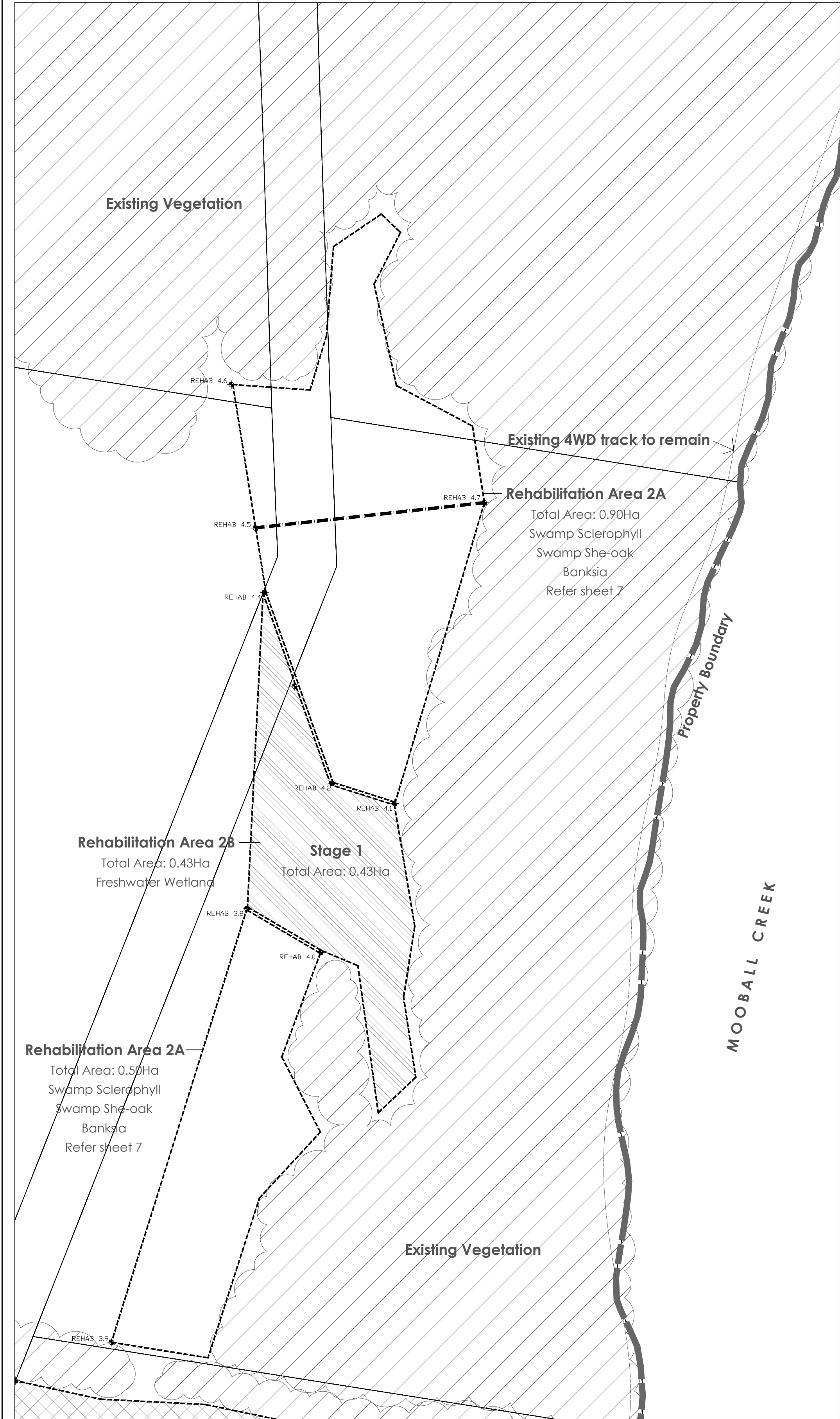
SCALE:	AS SHOWN	DATE:	JUNE 2016
DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO:	DS_OPW_845_07

CLIENT	RAMTECH PTY LTD
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Rehabilitation Area 2B
Total Area: 0.43Ha
Vegetation Type: Coastal Wetland

Dunloe Park Sand Extraction
Scale: 1:1000 at full size A1

- BOUNDARY PEGS**
Boundary of rehabilitation areas to be pegged out by surveyor prior to commencement of works. Pegs to be star pickets / galv pipe to minimum 1 meter above ground painted yellow with notation to match as noted on these plans. Existing vegetation line to form all other boundaries as indicated this sheet.
- FENCES**
Boundary of rehabilitation areas to be fenced if cattle are to be introduced to adjacent grazing areas.

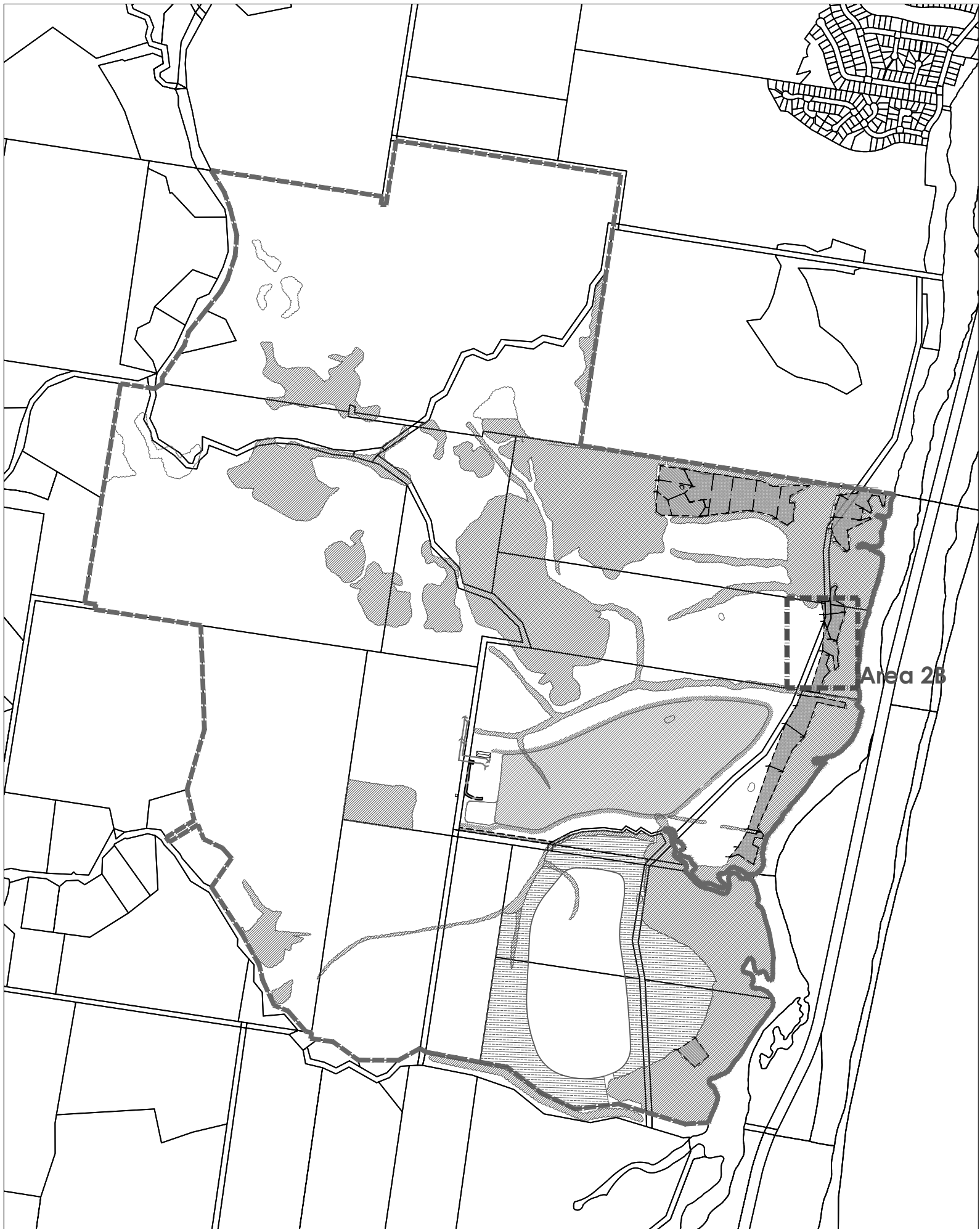
Rehabilitation Area 2B - species list

REHABILITATION AREA 2B
TOTAL AREA:0.43Ha (43 MODULES)

SEDGES, RUSHES + FERNS					
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
bau jun	Baumea juncea	Bare Twigrush	100	75MM TUBE	Stage 1 4300
bau ter	Baumea heretfolia	Twigrush			
ble ind	Blechnum indicum	Bungwall Fern			
cen asi	Centella asiatica	Pennywort			
cyp pol	Cyperus polystachyos	Bunchy Sedge			
fim fer	Fimbristylis ferruginea	Rusty Fringesedge			
fim pol	Fimbristylis polytrichoides	Fuzzy Rush			
gah asp	Gahnia aspera	Saw Sedge			
jun kra	Juncus kraussii	Searush			
jun usl	Juncus ustulatus	Common Rush			
phi lan	Philydrium lanuginosum	Frogsmouth			
phr aus	Phragmites australis	Common Reed			
sch val	Schoenoplectus validus	Clubrush			
sch ill	Schoenoplectus littoralis	Clubrush			
spo vir	Sporobolus virginicus	Salt Couch			
tri str	Triglochin striatum	Steaked Arrow Grass			
xyl com	Xyris complanata	Halpins			

Rehabilitation Schedule Area 2A

Stage	Year 1	Year 2	Year 3	Year 4
Stage 1 Total Area: 0.43Ha	PLANTING PHASE 1 PIONEER SPECIES PLANTING 100 Groundcovers/sedges/rushes from species list this sheet to be planted per module - exact numbers dependent on natural regeneration to be determined onsite by regeneration expert.	PLANTING PHASE 2 SUPPLEMENTARY SPECIES PLATING Supplementary planting to increase diversity and maintain stated densities.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09
	▶ ▶ ▶ ▶ On-going monitoring and maintenance as per Rehabilitation Plan	▶ ▶ ▶ ▶		



Rehabilitation Area 2B - location plan
Dunloe Park Sand Extraction
NTS

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - AREA 2B
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

SCALE:	AS SHOWN	DATE:	JUNE 2016
DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO:	DS_OPW_845_08

CLIENT	RAMTECH PTY LTD
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Total Area: 3.67Ha

Vegetation Type: Swamp Sclerophyll with Littoral Rainforest Understorey



NTS

REFHAB 1.0 BOUNDARY PEGS

BOUNDARY PEGS
Boundary of rehabilitation areas to be pegged out by surveyor prior to commencement of works. Pegs to be star pickets / galv pipe to minimum 1 meter above ground painted yellow with notation to match as noted on these plans. Existing vegetation line to form all other boundaries as indicated this sheet.

===== FENCES

===== FENCES

FENCES
Boundary of rehabilitation areas to be fenced if cattle are to be introduced to adjacent grazing areas.
† grazing areas.



ies per module

cies per module

ies to remain

Planting Module 1 - Swamp Sclerophyll, She-oak + Banksia

PIONEER SPECIES PLANTING 10 x 10 meter module

NTS

Rehabilitation Area 2C - species list

REHABILITATION AREA 2C

TOTAL AREA:3.67Ha (367 MODULES)

TREES - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	<i>Banksia integrifolia</i>	Coastal Banksia	20 Minimum 3 species selected (per module)	75MM TUBE	Stage 1 2000
cal sal	<i>Callistemon salignus</i>	White Bottlebrush			
lap sav	<i>Lophostemon succulentus</i>	Swamp Box			Stage 2 2000
mel qui	<i>Melaleuca quinquevnia</i>	Paperbark			Stage 3 2000
					Stage 4 1340

SMALL TREES / SHRUBS - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
acm hem	Acmena hemilampra	Broad-leaved Lillypill	30	75MM TUBE	Stage 1 300
aco sep	Acacia sophore	Coast Wattle			
alc cor	Aleclytron corceus	Beach Aleclytron			
acn bar	Commersonia bartramia	Brown Kuringlong			Stage 2 300
cyp are	Caupolipha areacardifolia	Turkeycreeper			
dis myl	Dubautia myrsinoides	Corkwood			
ela rel	Elaeocarpus reticulatus	Blighwey Ash			Stage 4 200
exo lat	Excoecarpus latifolius	Broad-leaved Cherry			
per str	Persea strodonchroites	Coast Geebung			

GROUNDCOVERS - module 3 only

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
adi.hi	<i>Adiantum hidpidulum</i>	Bayong Maitohat			
asa.dul	<i>Acaesmyrtus dulcis</i>	Malay Maltin			
ble.cor	<i>Blechnum corallinum</i>	Garang fern			
ble.ind	<i>Blechnum indicum</i>	Bungwig fern	50	75MM TUBE	To be determined on site for representative aspect
cli.pan	<i>Clinium pendulicolum</i>	Sungay Lily			
gah.asp	<i>Gahnia aspera</i>	Saw Sedge	Minimum 3 (species selected) per module		
lom.lan	<i>Lomandra longifolia</i>	Matahau			

Rehabilitation Schedule Area 2C

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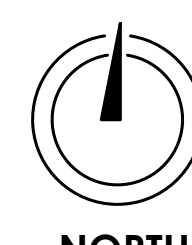
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DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - AREA 2C
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

SCALE: AS SHOWN	DATE: JUNE 2016
DESIGN: JB/GD	CHECKED: AS
DRAWN: JB	DRAWING NO: DS_OPW_845_09

CLIENT

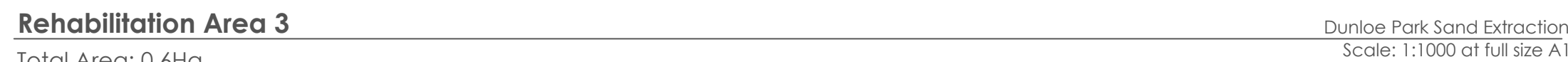
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NORTH

rehabilitation area 2c opw landscape plans Dunloe Sand Extraction sheet 9 of 13

OPW Landscape Plans



Rehabilitation Area 3

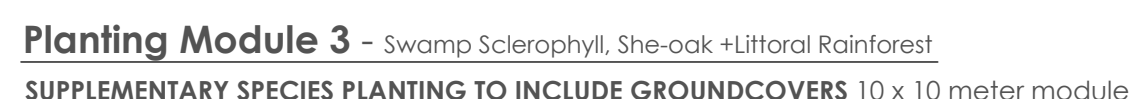
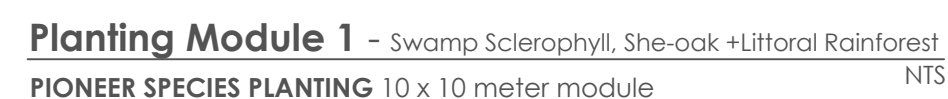
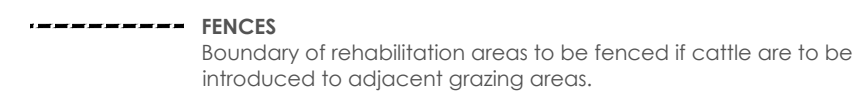
Total Area: 0.6Ha

Vegetation Type: Swamp Sclerophyll, She-oak + Littoral Rainforest Understorey



REHABILITATION AREA 3
TOTAL AREA:0.60ha (60 MODULES)
TREES - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
cas gla	Casuarina glauca	Swamp Oak	20	75MM TUBE	Stage 1 1200
cal sal	Calistemon salignus	White Bottlebrush	Minimum 3 species selected per module		
lop sau	Lophostemon suaveolens	Swamp Box			
mel qui	Melaleuca quinquenervia	Paperbark			



SMALL TREES / SHRUBS - module 1, 2 and 3

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
acr imp	Acronychia imperforata	Beach Acronychia	30 Minimum 3 species selected per module	75MM TUBE	Stage 1 1800
all fl	Allocasuria illoralis	Black She-oak			
ban int	Banksia integrifolia	Coast Banksia			
com bar	Commersonia bartramia	Brown Kunajong			
dub my	Duboisia myoporoides	Corkwood			
gau sem	Gaulth semiglossa	Wild Quince			
mis pyr	Mischocarpus pyramidalis	Yellow Pearfruit			
per str	Persea laevis strathbrenensis	Coast Geebung			
pil gla	Pholidostigma glabrum	Flum Myrtle			
pol ele	Polyscias elegans	Celesteywood			

GROUNDCOVERS - module 3 only

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY.
adi his	<i>Adiantum hispidulum</i>	Rough Maidenhair	50 Minimum 5 species selected per module	75MM TUBE	To be determined on-site by third regeneration expert
aus dud	<i>Austromyrica dulcis</i>	Mydin			
ble lnd	<i>Blechnum indicum</i>	Bungwall Fern			
chr api	<i>Chryscephalum apiculatum</i>	Yellow Buttons			
crt pen	<i>Crinum pendunculatum</i>	Swamp Lily			
gah asp	<i>Gahnia aspera</i>	Saw Sedge			
gao rat	<i>Goedenia rotundifolia</i>	Star Goedenia			
lom lon	<i>Lomandra longifolia</i>	Maitrush			

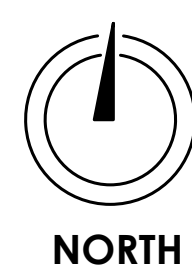
Stage	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6+
Stage 1 Total Area: 0.60Ha	PLANTING MODULE 1 PIONEER SPECIES PLANTING 'Trees' and 'Small Trees' selected from Rehabilitation Area 3 species list this sheet. Exact numbers to achieve densities as stated dependent on natural regeneration (determined onsite by Regeneration expert)	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 3 species list this sheet.	PLANTING MODULE 2 SUPPLEMENTARY SPECIES PLANTING Supplementary planting to increase diversity. Pioneer species - 'Trees' and 'Small Trees' selected from Rehabilitation Area 3 species list this sheet.	PLANTING MODULE 3 SUPPLEMENTARY SPECIES PLANTING TO INCLUDE GROUNDCOVERS Supplementary planting to increase diversity. 'Trees' and 'Small Trees' selected from Rehabilitation Area 3 species list this sheet. Introduction of Groundcover species, dependent on natural regeneration.	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Plant January 09
	▶ ▶ ▶ ▶ ▶ On-going monitoring and maintenance as per Rehabilitation Plan ▶ ▶ ▶ ▶ ▶					

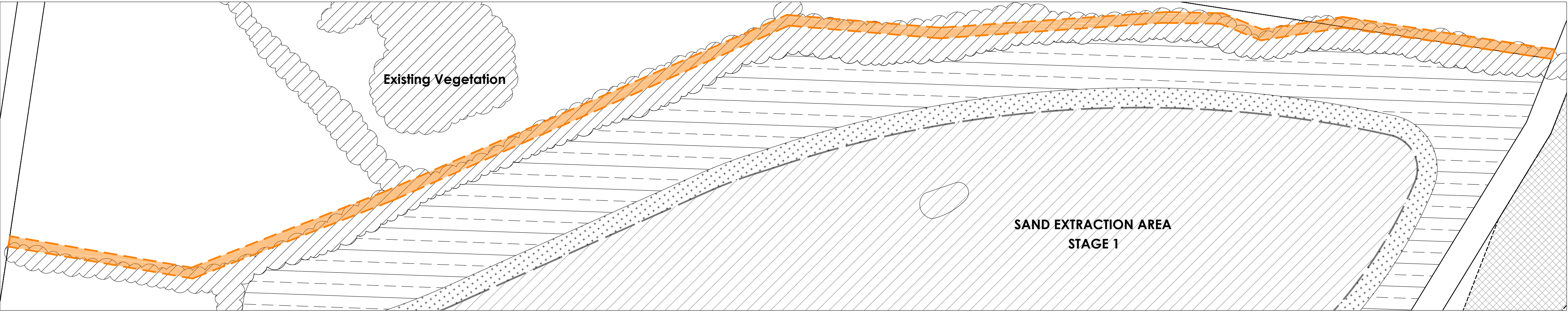
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DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - AREA 3
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

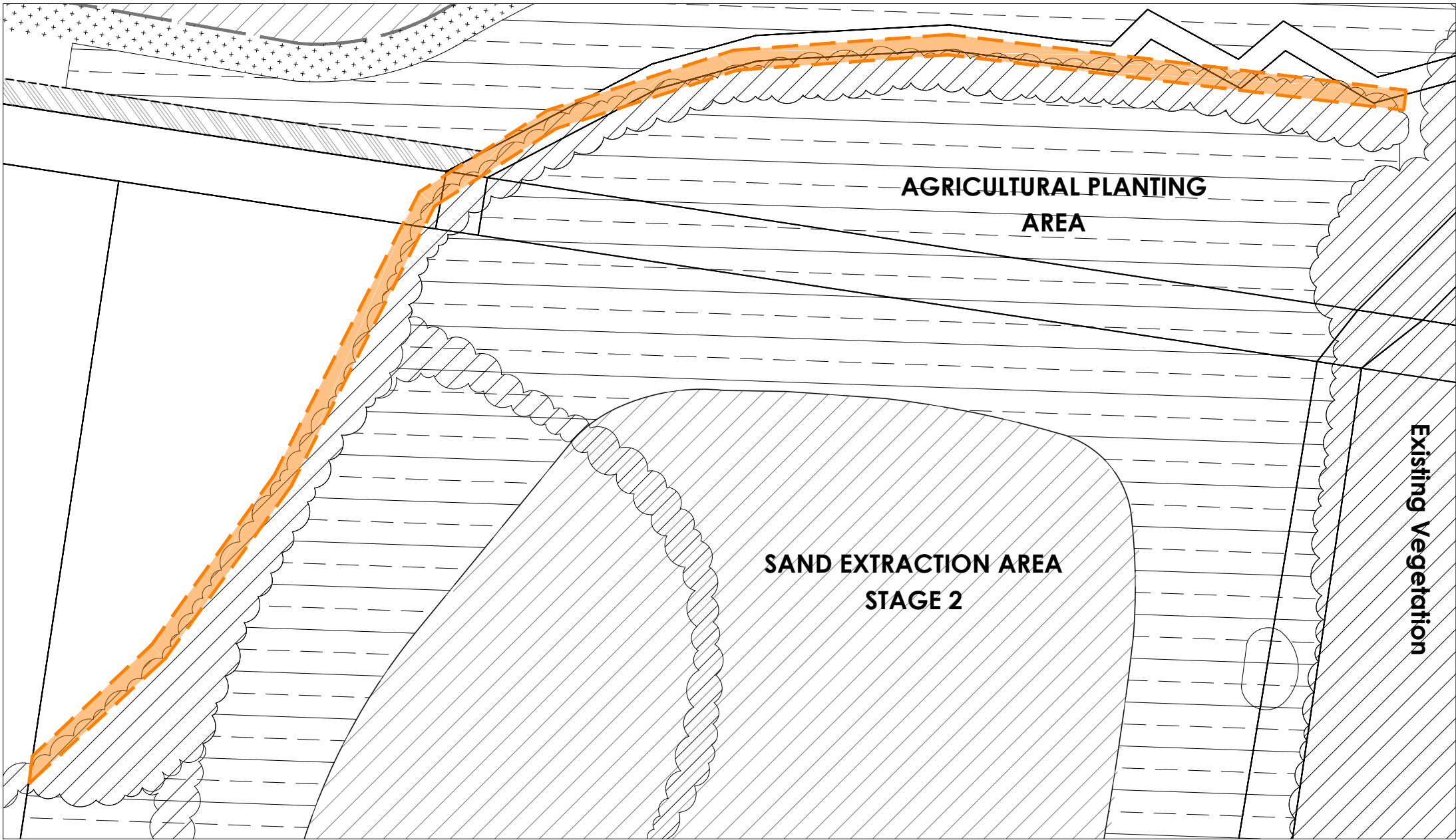
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DRAWN: JB	DRAWING NO: DS_OPW_845_10

CLIENT	RAMTECH PTY LTD
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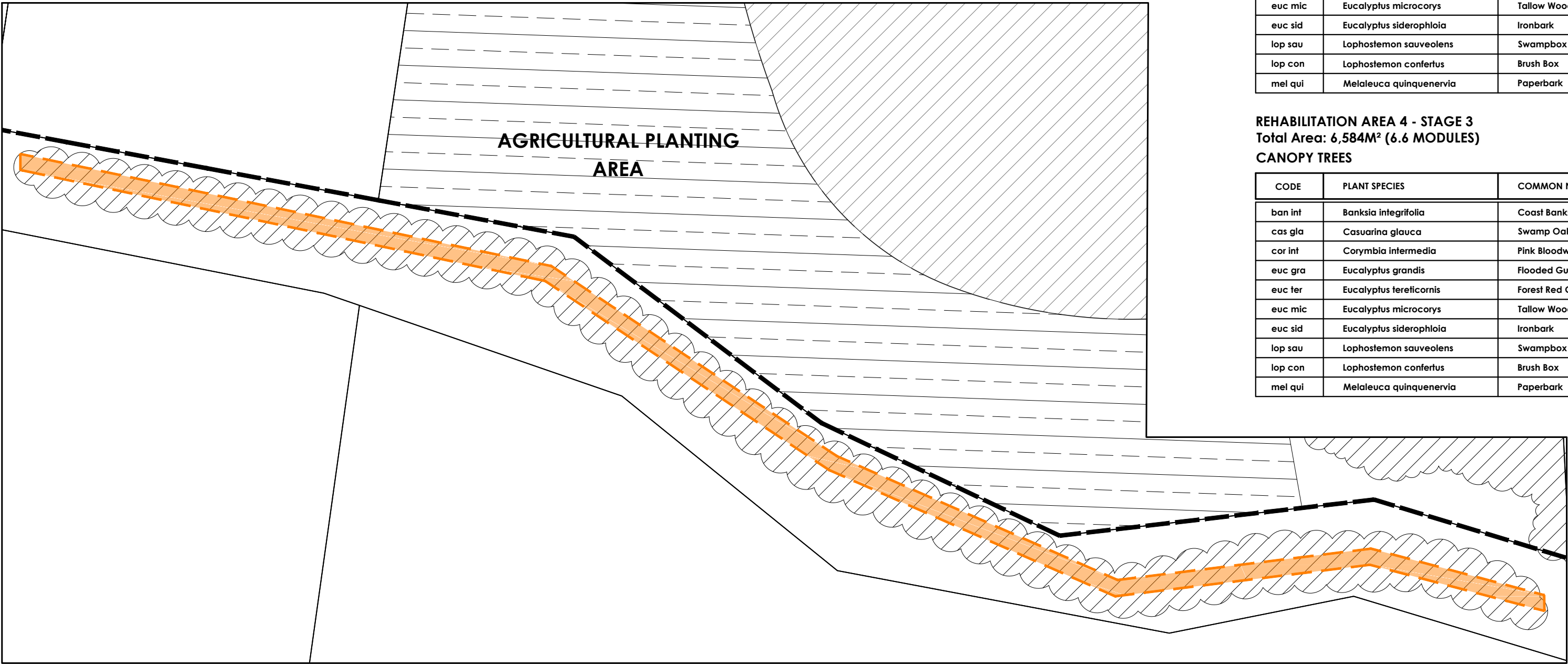




Rehabilitation Planting Area 4 | STAGE 1
Total Area: 9,688M²



Rehabilitation Planting Area 4 | STAGE 2
Total Area: 5,432M²



Rehabilitation Planting Area 4 | STAGE 3
Total Area: 6,585M²

Dunloe Park - Rehabilitation Plan

OPW Landscape Plans

REHABILITATION AREA 4 - STAGE 1
Total Area: 9,688M² (9.7 MODULES)
CANOPY TREES

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coast Banksia	10 min 3 species per mod	45LTR	970
cas gla	Casuarina glauca	Swamp Oak			
cor int	Corymbia intermedia	Pink Bloodwood			
euc gra	Eucalyptus grandis	Flooded Gum			
euc ter	Eucalyptus tereticornis	Forest Red Gum			
euc mic	Eucalyptus microcorys	Tallow Wood			
euc sid	Eucalyptus siderophloia	Ironbark			
lap sau	Lophoslemon sauealeans	Swampbox			
lap con	Lophoslemon confertus	Brush Box			
mel qui	Melaleuca quinquenervia	Paperbark			

REHABILITATION AREA 4 - STAGE 2
Total Area: 5,432M² (5.5 MODULES)
CANOPY TREES

CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coast Banksia	10 min 3 species per mod	45LTR	550
cas gla	Casuarina glauca	Swamp Oak			
cor int	Corymbia intermedia	Pink Bloodwood			
euc gra	Eucalyptus grandis	Flooded Gum			
euc ter	Eucalyptus tereticornis	Forest Red Gum			
euc mic	Eucalyptus microcorys	Tallow Wood			
euc sid	Eucalyptus siderophloia	Ironbark			
lap sau	Lophoslemon sauealeans	Swampbox			
lap con	Lophoslemon confertus	Brush Box			
mel qui	Melaleuca quinquenervia	Paperbark			

REHABILITATION AREA 4 - STAGE 3
Total Area: 6,584M² (6.6 MODULES)
CANOPY TREES

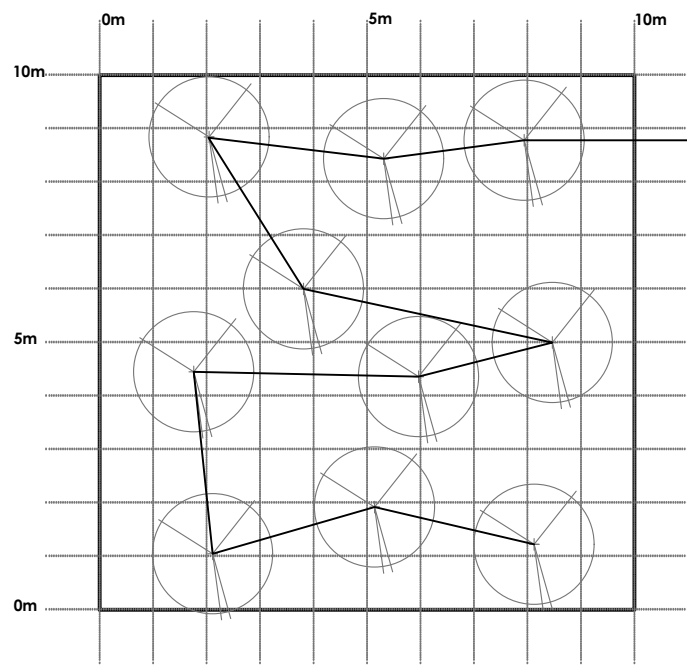
CODE	PLANT SPECIES	COMMON NAME	NO PER MODULE	SIZE	QTY
ban int	Banksia integrifolia	Coast Banksia	10 min 3 species per mod	45LTR	660
cas gla	Casuarina glauca	Swamp Oak			
cor int	Corymbia intermedia	Pink Bloodwood			
euc gra	Eucalyptus grandis	Flooded Gum			
euc ter	Eucalyptus tereticornis	Forest Red Gum			
euc mic	Eucalyptus microcorys	Tallow Wood			
euc sid	Eucalyptus siderophloia	Ironbark			
lap sau	Lophoslemon sauealeans	Swampbox			
lap con	Lophoslemon confertus	Brush Box			
mel qui	Melaleuca quinquenervia	Paperbark			

Rehabilitation Planting Area 4

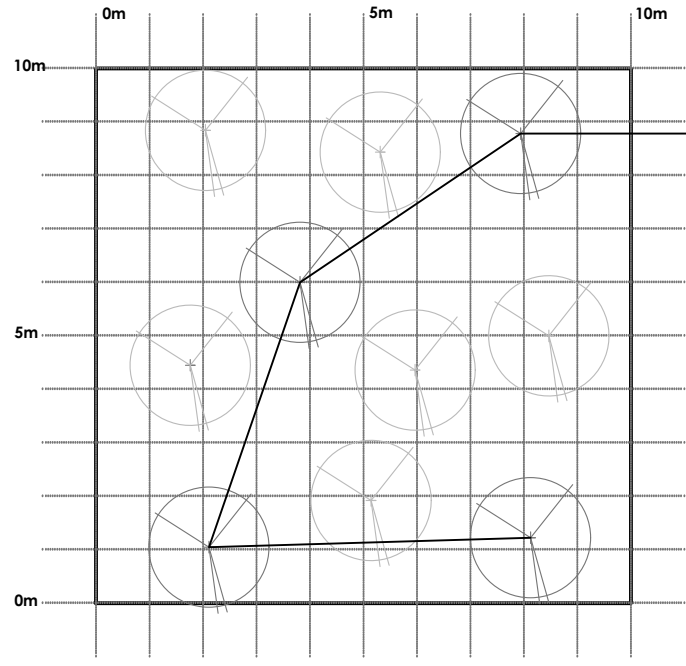
Total Area: 21,705M²

EXTENT OF REHABILITATION PLANTING WORKS
Rehabilitation Works | 8 meter wide buffer to northern sides of creek
Stage 1: 9,688M²
Stage 2: 5,432M²
Stage 3: 6,585M²

Boundary of Buffer Planting Area to be pegged out by surveyor prior to commencement of works.
Pegs to be star pickets / galv pipe to minimum 1 meter above ground painted yellow



Canopy Trees
10 Canopy trees per module, refer to planting list this sheet



Canopy Trees
Supplementary planting to increase diversity and maintain densities. (exact numbers to be determined onsite by bush regeneration expert)

Planting Module 1

10 x 10 meter module shown - refer also typical section

Planting Module 2

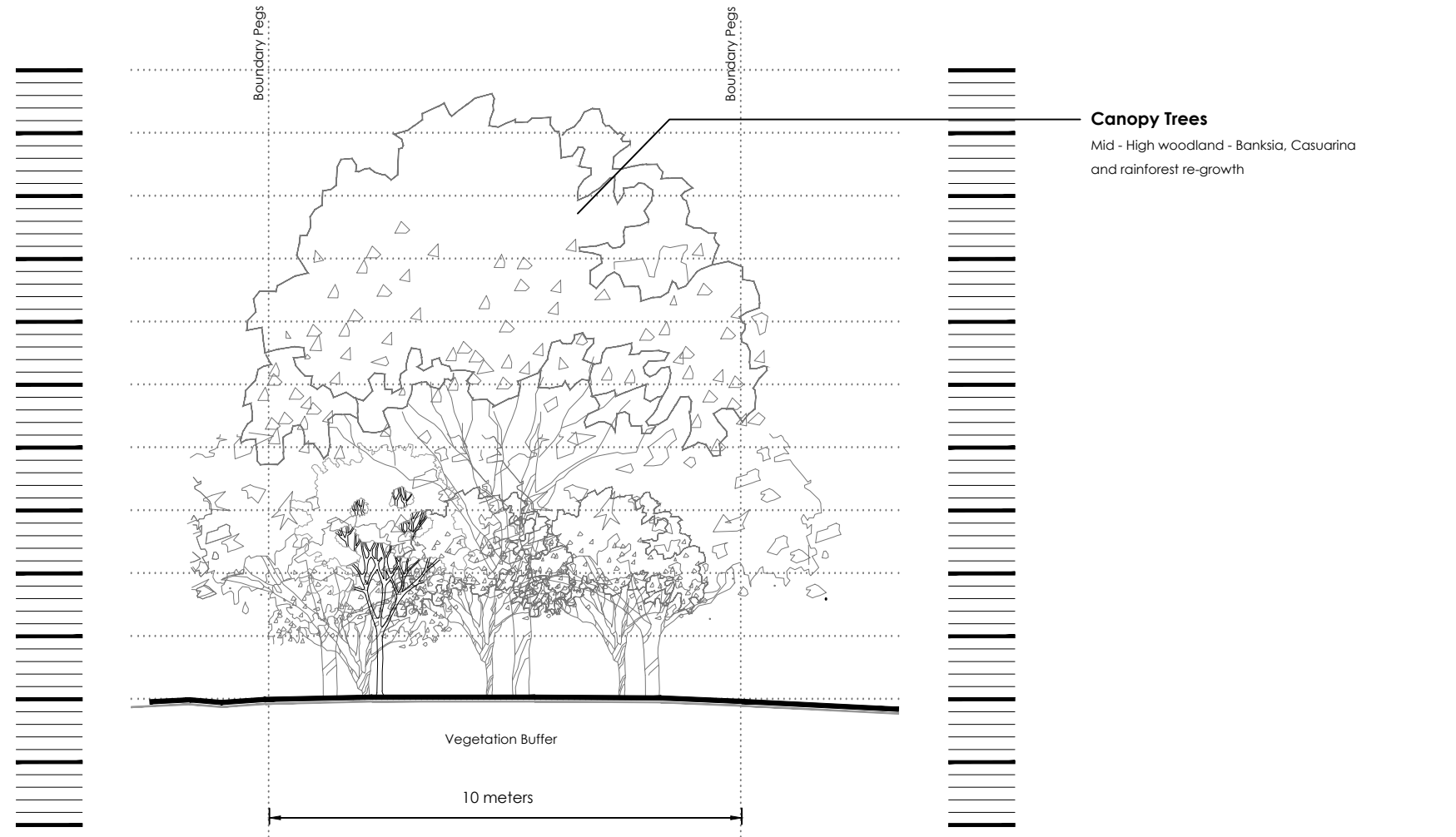
SUPPLEMENTARY 10 x 10 meter module shown

Works Schedule Rehabilitation Planting

Stage	0 - 6 months	6 - 12 months	Year 1+
Rehabilitation Planting Total Area: 21,705M²	PLANTING MODULE 1 Canopy/Subcanopy Trees 10 Canopy trees per module 20 Subcanopy trees per module refer to planting list this sheet Potential for salvaged plant stock (refer above plan) to be translocated to achieve planting densities	PLANTING MODULE 2 Supplementary planting to increase diversity and maintain densities. (exact numbers to be determined onsite by bush regeneration expert)	Natural Regeneration Weed Management Monitoring and maintenance as per Rehabilitation Plan - prepared by Planit January 09
	▶ ▶ ▶ ▶ On-going monitoring and maintenance as per Rehabilitation Plan ▶ ▶ ▶ ▶		

Notes:
Site subject to periods of frost
All existing tracks and trails onsite to remain

Dunloe Park Sand Extraction
Scale: 1:2000 at full size A1



Typical Buffer Profile

Refer to Plant Modules and Species Listings this sheet for details

1:100 at full size A1

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - REHABILITATION PLANTING AREA 4 STAGE 1-3
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

SCALE:	AS SHOWN	DATE:	JUNE 2016
DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO:	DS_OPW_845_11

CLIENT	RAMTECH PTY LTD
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Level 1 2247 Gold Coast Hwy
Nobby Beach
PO Box 206 Nobby Beach QLD 4218

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Fax: 07 5526 1502
admin@planitconsulting.com.au

NORTH

Dunloe Park - Agricultural Planting
OPW Landscape Plans

EXTENT OF REHABILITATION PLANTING WORKS
Rehabilitation Works | Fruiting trees (eg. Hass Avocado Trees)
Total Area: 396,975M²

Table 1. Row and Tree Spacing Options

DENSITY OPTION	ROW SPACING (M)	TREE SPACING (M)	NO. TREES PER HECARE
High	6 - 8	4 - 6	208 - 417
Medium	8 - 9	5 - 7	159 - 250
Low	10 - 12	10 - 12	69 - 100

Density information source: Australian Avocado Growers' Federation Section 6



Agricultural Planting Area
Total Area: 396,975M²

Dunloe Park Sand Extraction

0m 50m 100m 200m

PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - AGRICULTURAL PLANTING AREA
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

SCALE:	AS SHOWN	DATE:	JUNE 2016
DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO:	DS_OPW_845_12

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Dunloe Park - Rehabilitation Plan

OPW Landscape Plans

REVEGETATION SPECIFICATION

GENERAL NOTES:

ALL WORKS TO BE CARRIED OUT BY A QUALIFIED BUSH REGENERATION EXPERT WITH AS A MINIMUM, A DIPLOMA OF HORTICULTURE AND 5 YEARS DEMONSTRATED EXPERIENCE IN BUSH REGENERATION. EVIDENCE OF QUALIFICATIONS WILL BE REQUIRED TO BE SUBMITTED TO THE SUPERINTENDANT FOR APPROVAL PRIOR TO THE COMMENCEMENT OF THE CONTRACT PERIOD.

ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH:

- (1) NOXIOUS WEEDS ACT 1993
- (2) THREATENED SPECIES ACT 1995
- (3) PESTICIDES ACT 1999
- (4) NATIVE VEGETATION CONSERVATION ACT 1997
- (5) GOLD COAST CITY COUNCIL STANDARDS AND RELEVANT AUSTRALIAN STANDARDS

TO BE READ INCONJUNCTION WITH REHABILITATION AND REVEGETATION MANAGEMENT PLAN PREPARED BY PLANIT CONSULTING FEBRUARY 2009

SITE PREPARATION

1.1 VERIFY BOUNDARIES OF REVEGETATION AREAS

THE CONTRACTOR IS TO ASSESS THE SITE REVEGETATION AREAS IN ORDER TO ASCERTAIN A CLEAR CONSTRUCTION BOUNDARY. ALL BOUNDARIES WILL BE MARKED OUT BY QUALIFIED SURVEYOR PRIOR TO WORK COMMENCEMENT, MARKER PEGS TO HAVE NOTATION AS PER THESE PLANS.

1.2 WEED REMOVAL

REFER TO REHABILITATION MANAGEMENT PLAN PREPARED BY PLANIT CONSULTING SECTION 4.1

1.3 SOIL CULTIVATION

- AS REQUIRED WITHIN BUFFER PLANTING TO SAND EXTRACTION STAGE 1

CULTIVATE BY RIPPING TO THE DEPTHS SPECIFIED BELOW TO LOOSEN AND AERATE GROUND. DO NOT DISTURB EXISTING NATIVE TREE AND PLANT ROOTS. REMOVE UNWANTED MATTER INCLUDING STONES, RUBBISH AND RUBBLE EXCEEDING 20MM IN DIAMETER AND STICKS AND WEEDS BROUGHT TO THE SURFACE DURING CULTIVATION. FINELY CULTIVATE THE SURFACE AND RAKE FREE OF CLODS. *DO NOT REMOVE LARGE LOGS* UP TURNED STUMPS ETC AS THIS NATURAL DEBRI FORMS FAUNA HABITAT STRUCTURE

2.00 PLANTING

2. 1 THE WORKS

PLANTING WORK COMPRISES:

- SUPPLY AND INSTALLATION OF ALL GROUND COVER SHRUBS AND TREES AS SPECIFIED ON PLAN AS DETAILED IN 'REHABILITATION SCHEDULE'. EXACT NUMBERS OF PIONEER PLANTS AND SUPPLEMENTARY PLANTS TO BE DETERMINED ON SITE BY BUSH REGENERATION EXPERT - IN STRICT ACCORDANCE WITH SECTION 4 OF THE REHABILITATION/REVEGETATION MANMAGEMENT PLAN PREPARED BY PLANIT CONSULTING FEBRUARY 2009

2. 2 PLANTS

PLANTS SHALL BE VIGOROUS, WELL ESTABLISHED, OF GOOD FORM, NOT SOFT OR FORCED, HARDENED OFF, FREE FROM DISEASE AND PESTS WITH LARGE HEALTHY ROOT SYSTEMS AND NOT POT BOUND. THE ROOT SYSTEM SHALL BE WELL BALANCED IN RELATION TO THE SIZE OF THE PLANT.

PLANT CONTAINERS SHALL BE OF AN APPROPRIATE SIZE AND FREE FROM WEEDS. PLANTS SHALL NOT EXHIBIT SIGNS OF BEING STRESSED AT ANY STAGE DURING THEIR DEVELOPMENT DUE TO INADEQUATE WATERING, EXCESSIVE SUNLIGHT, PHYSICAL DAMAGE OR HAVE RESTRICTED GROWTH DUE TO NURSERY ROWS. NO SUBSTITUTIONS SHALL BE MADE UNLESS APPROVED BY THE LANDSCAPE DESIGNER.

KEEP PLANTS IN GOOD CONDITION DURING STORAGE. PREVENT DRYING OUT OR DAMAGE FROM ANY CAUSE INCLUDING FROST, WIND, SUN, THEFT, VERMIN ETC.

2. 3 PLANTING

ENSURE PLANTS CAN BE WATERED IN AT TIME OF PLANTING. DO NOT ALLOW PLANTS TO BE INSTALLED ON A DAY THEY CAN'T BE WATERED.

PLANTING TO BE EXECUTED IN ACCORDANCE WITH THE RELEVANT PLANTING DETAIL. DO NOT PLANT INTO DRY OR MUDDY SOIL OR IN EXTREME WEATHER CONDITIONS. ENSURE PLANT ROOT SYSTEMS ARE MOIST WHEN REMOVED FROM CONTAINER AND NOT ALLOWED TO DRY OUT AND PLANTING AREA HAS BEEN THOROUGHLY WATERED. PLANT OUT WITH A MINIMUM DISTURBANCE TO ROOT BALL ENSURING FINISHED COMPACTED SOIL LEVELS COINCIDE WITH THE NATURAL SOIL LEVEL OF THE PLANT. PLANT, STAKE, TIE AND MULCH ACCORDING TO DETAIL DRAWINGS AND THEN DEEP SOAK THE WHOLE OF THE PLANTING AREA.

2. 4 DEPTH OF PLANTING

WHEN THE PLANT IS IN ITS FINAL POSITION IN ITS HOLE THE TOP SOIL LEVEL OF THE PLANT ROOT BALL SHALL BE LEVEL WITH THE FINISHED SURFACE OF THE SOIL SURROUNDING THE HOLE.

2. 5 PLACING

WHEN THE HOLE APPEARS TO BE THE CORRECT SIZE, AND NOT BEFORE REMOVE THE PLANT FROM THE CONTAINER WITH MINIMUM DISTURBANCE TO THE ROOT BALL AND PLACE IN ITS FINAL POSITION, IN THE CENTRE OF THE HOLE AND PLUMB.

2. 6 BACKFILLING

BACKFILL WITH SITE TOPSOIL. LIGHTLY TAMP DOWN THE MIXTURE TO ENSURE NO AIR POCKETS ARE LEFT IN PLANTING HOLE.

2. 7 PLANTING FERTILIZER

'OSMOCOTE' SUSTAINED RELEASE FERTILISER IN GRANULE FORM OR APPROVED EQUIVALENT SUITABLE FOR NATIVE PLANTS SHALL BE ADDED TO THE SITE TOPSOIL AS PER MANUFACTURERS DIRECTION.

3.00 MAINTENANCE - 52 WEEKS

3. 1 GENERAL

THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR ESTABLISHMENT MAINTENANCE AND DEFECTS LIABILITY CLAUSES FOR **52 WEEKS** FOLLOWING COMPLETION OF THE LANDSCAPE CONSTRUCTION.

3. 2 MIN. MAINTENANCE REQUIREMENTS:

WATER

REGULARLY WATER THE PLANTS TO ENSURE ESTABLISHMENT WITH WATER TRUCK.

WEEDING

REFER TO SECTION 4 OF THE REHABILITATION PLAN PREPARED BY PLANIT CONSULTING FEBRUARY 2009

REPLACEMENTS

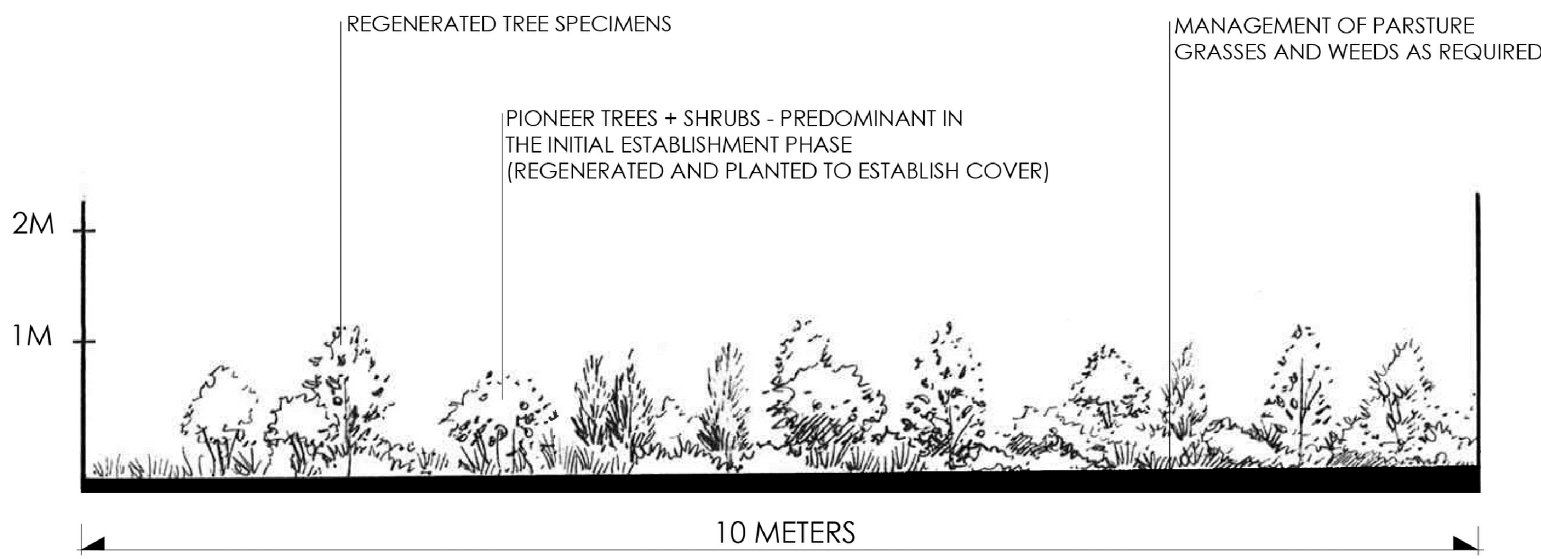
REPLACE ALL PLANTS THAT ARE UNHEALTHY OR DEAD. REPLACEMENTS SHALL BE IDENTICAL IN SIZE AND SPECIES. REFER CORRESPONDING PLANT LISTS FOR SUBSTITUTIONS WHERE REQUIRED.

SOIL SUBSIDENCE

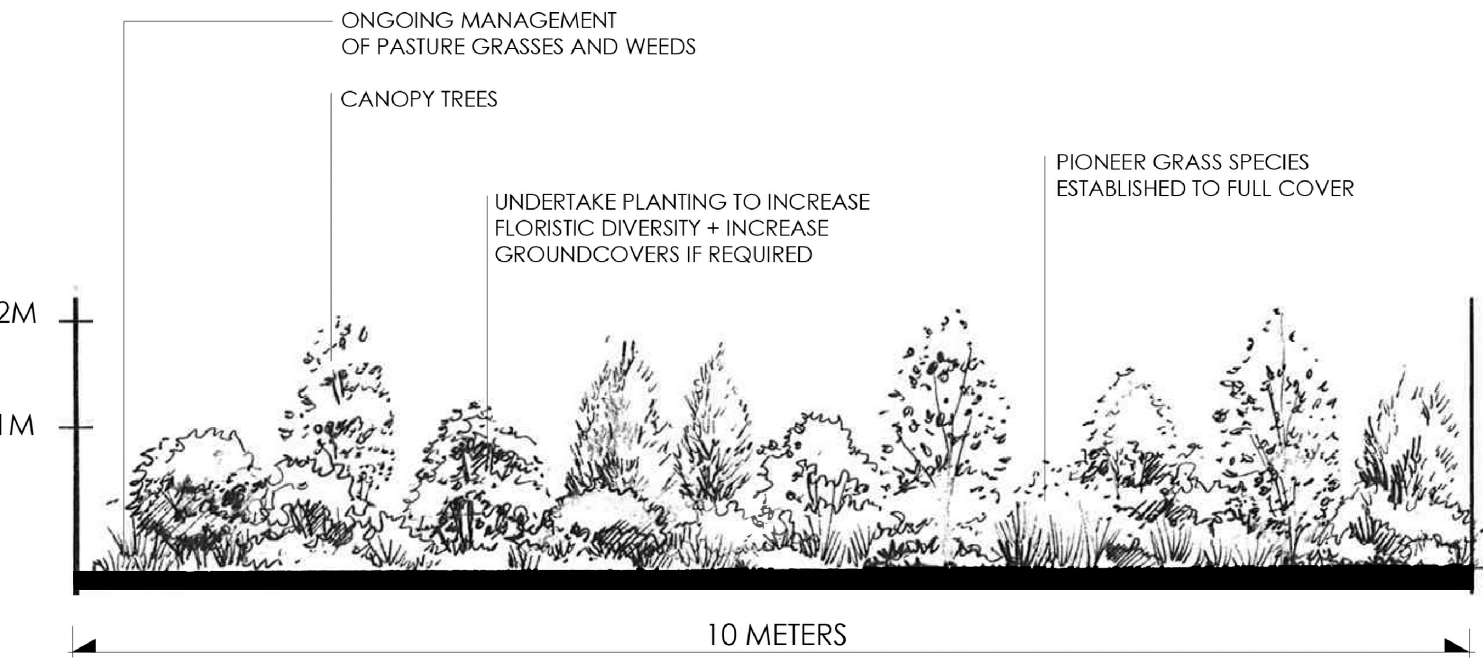
MAKE GOOD IF DUE TO WORKMANSHIP OF LANDSCAPE CONTRACTOR.

PROTECTION

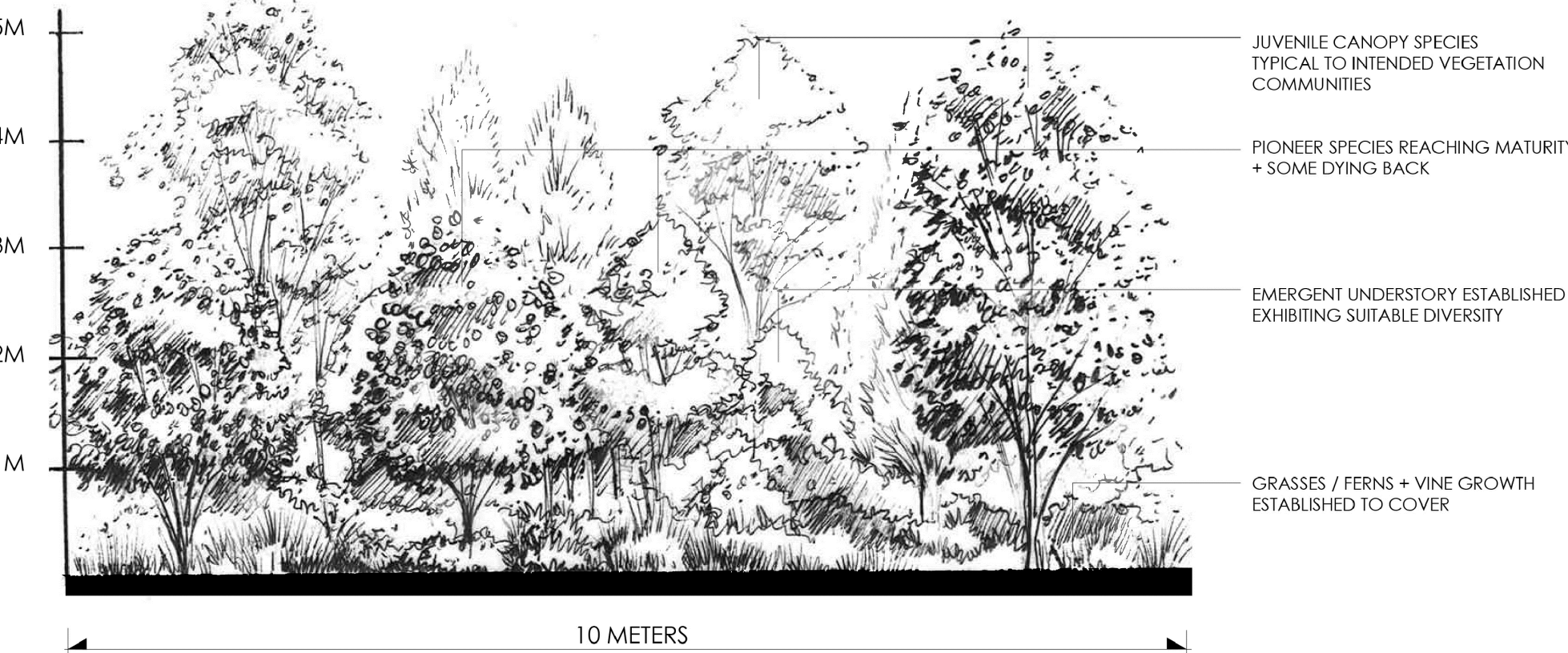
PROTECT PLANTED AREAS FROM DAMAGE, EITHER MALICIOUS, IRRESPONSIBLE OR ACCIDENTAL. AREAS OF REHABILITATION TO BE FENCED IF CATTLE ARE TO BE GRAZING ON ADJACENT PASTURE LANDS.



ASSISTED REGENERATION PROFILE: YEAR 1 - 2



ASSISTED REGENERATION PROFILE: 2 - 4 YEARS



PROJECT TITLE	DUNLOE PARK - REHABILITATION PLAN
DRAWING TITLE	OPERATIONAL WORKS LANDSCAPE PLAN - SPECIFICATIONS
BASE PROVIDED BY	

NO	DATE	REVISION	BY
01	06/16	OPW REVISED	MB

SCALE:	AS SHOWN	DATE:	JUNE 2016
DESIGN:	JB/GD	CHECKED:	AS
DRAWN:	JB	DRAWING NO:	DS_OPW_845_13

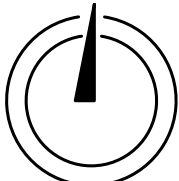
CLIENT	RAMTECH PTY LTD
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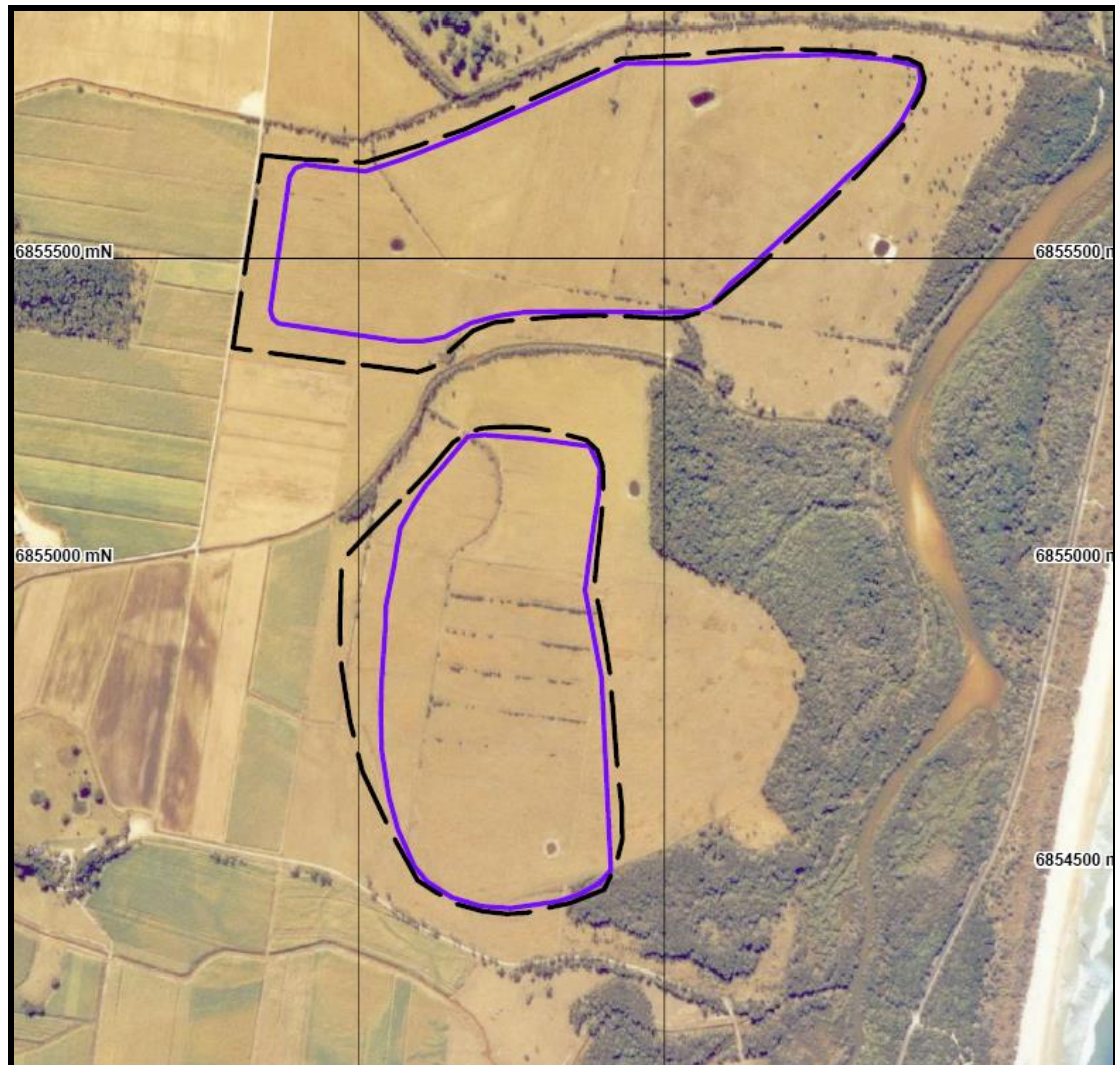

PLANIT
CONSULTING




NORTH

ATTACHMENT 4 – VEGETATION MANAGEMENT PLAN

This Vegetation Management Plan (VMP) has been prepared for both the clearing of all vegetation situated within approved sand quarrying areas and retention and protection of all other native vegetation on the Dunloe Park site.



APPROVED QUARRYING EXTRACTION AND COMPOUND AREAS

The VMP is to be used as a tool during the construction and operational phases of the development, identifying tasks to be undertaken, the timing of such works and responsible parties for supervision/implementation of vegetation removal/retention on the site.

This plan identifies appropriate vegetation protection methods and site rehabilitation strategies to retain and enhance wildlife habitat and also addresses the necessary removal of vegetation as described above. Strict implementation of the following methodologies will ensure that no retained vegetation will pose any detrimental impacts to future built components on the site.

Element	Vegetation Management
Objectives	• To remove native and exotic vegetation located within approved quarrying and compound areas • To retain and protect all other native vegetation communities and trees within the Dunloe Park site • To minimise tree-clearing impacts on native fauna. • To revegetate rehabilitation and buffer areas
Action	• Tree-clearing zones are to be clearly delineated on-site to ensure that all areas affected by this VMP are readily identifiable. • Vegetation to be retained within 20 metres of the approved clearing/works zones are to be tagged/marked/delineated for easy identification (do not use permanent paints or similar) i.e. trees and/or areas of vegetation to be retained are to be clearly fenced similar to below: • The contractor/developer must adequately protect from damage any vegetation on private and/or public property which is not designated for removal in association with this development. • Tree-clearing, fauna spotter-catcher and environmental consultants working in conjunction with Civil Works Contractors on this project are to be informed of all provisions specified under this VMP. • Cleared vegetation is to be disposed of in accordance with accepted measures. This includes mulching for future site-landscaping purposes and/or removal of millable timber where appropriate. • Remaining debris not disposed of in either of the above methods is to be removed off-site by the owner to an approved green-waste disposal facility. • The following activities are not permitted within the drip zones of vegetation to be retained on or offsite:

Action	- Storage and mixing of materials; - Vehicle parking; - Liquids disposal; - Machinery repairs or refuelling; - Site office and/or shed erection; - Lighting of fires; - Rubble, soil or debris stockpiling; and - Excavation. • No trees on Council property are to be removed, pruned or injured prior to obtaining necessary Council consent. • If root/crown damage (or other significant disturbance) to retained vegetation areas occurs/is required during approved earthworks/quarrying activity on the site, treatment by a suitably qualified Arborist (ie root truncations, crown thinning) is to be implemented. • A recognised fauna spotter-catcher is to ensure safe dispersal of fauna into areas of retained vegetation during clearing works in accordance with Section 5.1 of the attached report • Effective sediment and erosion control devices are to be identified and provided at earthworks boundaries in accordance with the prepared Environmental Management Plan. • Areas disturbed as a result of tree-clearing and/or earthworks are to be stabilised. Stabilisation is to occur within ten days of completion of works. • Revegetation and rehabilitation is to occur in accordance with the attached Rehabilitation and Revegetation Management Plan.															
Performance Indicators	• Tree-clearing activities are restricted to identified areas. • Native plants within the identified retention zones are protected. • Sediment and erosion control devices are installed and maintained in accordance with the EMP. • Retained vegetation on and/or offsite is to demonstrate healthy conditions: <table><tr><th>Grade</th><th>Condition</th><th>Descriptor</th></tr><tr><td>1</td><td>Healthy</td><td>Leaves green, no abnormal leaf loss</td></tr><tr><td>2</td><td>Fair</td><td>Leaves green, some yellowing of leaves, but <20% of canopy affected</td></tr><tr><td>3</td><td>Poor</td><td>Many leaves yellow or brown, substantial reduction in canopy extent since last measurement</td></tr><tr><td>4</td><td>Dead</td><td>Leaves brown or absent, little of the canopy remaining</td></tr></table> • Rehabilitation and buffer zones are managed in accordance with the attached Rehabilitation and Revegetation Management Plan. • No fauna injury or mortality occurs during the clearing/construction phase	Grade	Condition	Descriptor	1	Healthy	Leaves green, no abnormal leaf loss	2	Fair	Leaves green, some yellowing of leaves, but <20% of canopy affected	3	Poor	Many leaves yellow or brown, substantial reduction in canopy extent since last measurement	4	Dead	Leaves brown or absent, little of the canopy remaining
Grade	Condition	Descriptor														
1	Healthy	Leaves green, no abnormal leaf loss														
2	Fair	Leaves green, some yellowing of leaves, but <20% of canopy affected														
3	Poor	Many leaves yellow or brown, substantial reduction in canopy extent since last measurement														
4	Dead	Leaves brown or absent, little of the canopy remaining														

Frequency/ Deadline	• Identification of retained vegetation prior to commencement of clearing works. • Implement tree clearing works upon receipt of tree clearing approval - completion within 12 months. • Recognised fauna spotter-catcher to be present on-site prior to and during all vegetation-clearing works. • All revegetation, weed management and rehabilitation works occur at the timeframes stipulated in the attached Rehabilitation and Revegetation Management Plan.
Person Responsible	• The owner/developer/site manager is responsible for informing all contractors, sub-contractors, consultants and government authorities working on the site of the provisions of this VMP. • A suitably qualified consultant is responsible for the supervision and implementation of clearing works. • A recognised fauna spotter-catcher is to be contracted for fauna capture/relocation as necessary. • A suitably qualified consultant is responsible for the supervision and implementation of all rehabilitation works. • A suitably qualified Arborist is responsible for assessing and implementing any remediation works to damaged vegetation retained within protection zones areas if/where required. • A suitably qualified consultant is responsible for installing and monitoring erosion and sediment control devices.
Reporting and Reviewing	• A suitably qualified consultant is responsible for reporting to the developer where actions specified in this VMP are not undertaken and/or compromised. • The developer is responsible for reporting to Council where actions specified in this VMP are not implemented • Routine and specified monitoring of fauna, weeds, revegetation and rehabilitation zones is to occur as stipulated in the attached Rehabilitation and Revegetation Management Plan.
Corrective Action	• If vegetation not identified for removal is disturbed during the operational works phase, the need for supplementary rehabilitation works is to be negotiated between the developer and Council. • If retained trees show signs of ill health (i.e. poor or dead), likely causes are to be determined, methods of mitigating such effects are to be identified in consultation with a suitably qualified Arborist and Council officers, and mitigation measures to improve growth conditions are to be put in place. • Where a tree shows signs of any loss in structural integrity or a potentially unsafe condition, then in the opinion of a suitably qualified Arborist and Council officers the tree shall be either stabilised or removed to avoid any future risk. • Where sediment and erosion control structures fail, likely causes are to be identified and additional measures installed.

Appendix B – Agency consultation



Our Ref: DOC19/676169
Your Ref: 06_0030

GHD
230 Harbour Drive
Coffs Harbour NSW 2450

Attention: Mr Ben Luffman

Dear Mr Luffman

Subject: Dunloe Quarry MOD 2 - Landscape and Aboriginal Cultural Heritage Management Plans

Thank you for your letter dated 8 August 2019 about the amended management plans for the Dunloe Quarry MOD 2 seeking comments from the Biodiversity and Conservation Division (BCD) of the NSW Department of Planning, Industry and Environment. I appreciate the opportunity to provide input.

The Biodiversity and Conservation Division was formerly part of the Office of Environment and Heritage (OEH) but now forms part of the new Environment, Energy and Science Group in the Department of Planning, Industry and Environment (see <https://www.dpie.nsw.gov.au>).

We have reviewed the documents supplied and advise there are several issues apparent with the Landscape Management Plan (LMP), particularly the koala management plan, which lacks adequate detail. The main issues include:

- a) no description of the author qualifications in the Landscape Management Plan (LMP);
- b) insufficient or incorrect references to approval conditions and document sections;
- c) lack of supporting information in the Koala Management Plan (KMP);
- d) the need to refine koala management, monitoring and contingency measures.

These issues are discussed in detail in **Attachment 1** to this letter.

Prior to finalising the landscape and Aboriginal cultural heritage management plans we recommend that GHD:

1. Revises the Landscape Management Plan to:
 - a) include the relevant qualifications and experience of the contributors to demonstrate compliance with Project Approval 27(a); and
 - b) indicate in Table 2.1 that Project Approval Condition 28 clauses (h) and (i) are addressed in Appendix C.

2. Revises the Rehabilitation and Revegetation Management Plan to include Project Condition 28 in the list of conditions addressed.
3. Revises the Koala Management Plan to:
 - a) replace references to sections and tables of other management plans with the relevant content being referred to in order to minimise potential errors resulting from subsequent management plan revisions or amendments;
 - b) include mapping of koala habitat, koala records and potential koala movement corridors (i.e. habitat links) within and adjacent to the subject land and along the haul road between the quarry site and the Pottsville Road intersection;
 - c) acknowledge the possibility of infrequent koala movements during hours of quarry operation;
 - d) identify the most likely areas of interaction between koalas and quarry vehicles (e.g. koala habitat links);
 - e) include a proposed amendment to the quarry induction process to include an explanation of the legal consequences of unauthorised clearing of native vegetation on the quarry site;
 - f) include provision of compensatory koala food tree plantings as a contingency measure in the event of unauthorised clearing taking place;
 - g) ensure the proposed monitoring methodology focuses on identifying areas of koala activity susceptible to road strike rather than attempting to identify temporal changes in koala densities.
 - h) reduce the proposed koala road-strike threshold for management action from three koalas for the year to any koala at any time
4. Revise the Aboriginal Cultural Heritage Assessment Report to:
 - a) include a statement confirming the report was prepared in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW 2010*;
 - b) remove references to a requirement for an Aboriginal Heritage Impact Permit; and
 - c) ensure the recommendations are consistent with the requirement for a Care Agreement to remove Aboriginal objects from the approved project boundary for long-term management if required.
5. Revise the Aboriginal Cultural Heritage Management Plan to replace references to the Office of Environment and Heritage (OEH) with the Biodiversity and Conservation Division (BCD).

If you have any further questions about this issue, Mr Don Owner, Senior Conservation Planning Officer, Biodiversity and Conservation, can be contacted on 6659 8233 or at don.owner@environment.nsw.gov.au.

Yours sincerely

Dimitri Young 4 September 2019

DIMITRI YOUNG
Senior Team Leader Planning, North East Branch
Biodiversity and Conservation

Contact officer: DON OWNER
 6659 8233

Enclosure: Attachment 1: Detailed BCD Comments – Dunloe Quarry MOD 2 – Landscape and ACH Management Plans

Attachment 1: Detailed Biodiversity and Conservation Comments – Dunloe Quarry MOD 2 – Landscape and Aboriginal Cultural Heritage Management Plans

Landscape Management Plan

Author Qualifications

Project Approval 27(a) requires the plan to be prepared by suitably qualified consultants, including specialist hydrologist, coastal engineer, wetlands ecologist and landscape architect. The Landscape Management Plan (LMP) does not contain the qualifications of the contributing authors, which is necessary to demonstrate this condition has been met.

BCD Recommendation:

1. Revise the LMP to include the relevant qualifications and experience of the contributors to demonstrate compliance with Project Approval 27(a).

Project Approval Condition 28

The Rehabilitation and Revegetation Management Plan (RRMP) contained in Appendix A of the LMP claims to address the requirements of Conditions 26, 27a and 29 of the Project Approval. However, Project Approval Condition 28, which specifies what must be included in the RRMP, has not been referred to in the RRMP.

BCD Recommendation:

2. Revise the RRMP to include Project Condition 28 in the list of conditions addressed.

Koala Management Plan

Table 2.1 of the LMP indicates Project Approval Condition 28 clauses (h) and (i), which relate to koala management, are addressed in the RRMP provided in Appendix A. However, these conditions have not been addressed in the RRMP. Instead, they have been addressed in the Koala Management Plan (KMP) contained in Appendix C of the LMP.

BCD Recommendation:

3. Revise Table 2.1 of the LMP to indicate Project Approval Condition 28 clauses (h) and (i) are addressed in Appendix C.

Section 1.3 of the KMP refers to Section 5.4.1 of the LMP for details of the KMP reporting provisions. However, the LMP does not contain a Section 5.4.1. It is also indicated in this section that the presence of koalas will be noted during the monitoring program set out in Table 5.1 of the LMP. However, Table 5.1 provides a very brief summary of the monitoring program for the rehabilitation area, which would not include monitoring of the haul road.

BCD Recommendation:

4. Revise the KMP to replace references to sections and tables of other management plans with the relevant content being referred to in order to minimise potential errors resulting from subsequent management plan revisions or amendments.

The KMP does not provide any supporting information to inform or provide context to the proposed koala management or monitoring provisions.

BCD Recommendation:

5. Revise the KMP to include mapping of koala habitat, koala records and potential koala movement corridors (i.e. habitat links) within and adjacent to the subject land and along the haul road between the quarry site and the Pottsville Road intersection.

Section 1.2.1 of the KMP indicates the risk of koala mortalities due to quarry-related vehicle strike will be low due to the quarry operating hours not coinciding with the main periods of koala movement. This assumption is generally accurate. However, although infrequent, some koala movements may still occur during the quarry operating hours (e.g. movements resulting from territorial disputes or during dispersal of young from natal areas).

BCD Recommendations:

6. Revise the KMP to acknowledge the possibility of infrequent koala movements during hours of quarry operation.
7. Revise the KMP to identify the most likely areas of interaction between koalas and quarry vehicles (e.g. koala habitat links).

Section 1.2.2 of the KMP briefly discusses the potential impacts of unauthorised clearing of koala habitat. However, no preventative or contingency measures other than clearly demarcating the limit of authorised clearing have been proposed.

BCD Recommendation:

8. Revise the KMP to include a proposed amendment to the quarry induction process to include an explanation of the legal consequences of unauthorised clearing of native vegetation on the quarry site.
9. Revise the KMP to include provision of compensatory koala food tree plantings as a contingency measure in the event of unauthorised clearing taking place.

Proposed monitoring of the frequency of koala sightings would be based on incidental records rather than application of a systematic repeatable sampling method. The resulting dataset will not provide a reliable measure for determining temporal changes in koala occupancy levels or local population size, as intended in the KMP.

Nevertheless, such information may have some use in identifying areas of important koala occupancy, which could then be used to identify potential road strike '*black-spots*' and to formulate mitigation measures (e.g. speed limits, warning signage, traffic calming devices etc.).

BCD Recommendation:

10. Revise the KMP to ensure the proposed monitoring methodology focuses on identifying areas of koala activity susceptible to road strike rather than attempting to identify temporal changes in koala densities.

Table 1 of the KMP lists one of the proposed management triggers as being '*quarry-related vehicle koala strikes reach or exceed three for the year*'. This trigger threshold is too high given that three koalas are likely to represent a significant proportion of the koala population utilising the subject land and adjoining areas in any given year.

BCD Recommendation:

11. Revise the KMP to reduce the proposed koala road-strike threshold for management action from three koalas for the year to any koala at any time.

Aboriginal Cultural Heritage Management

RPS prepared an Aboriginal cultural heritage assessment report (ACHAR) to investigate the potential for harm to Aboriginal cultural heritage resulting from proposed expansion of the extraction boundaries into currently fenced off sand ridge areas. However, the ACHAR was not undertaken under the defence of being in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW 2010*.

References in the ACHAR to the need for an Aboriginal Heritage Impact Permit (AHIP) are incorrect given any proposed harm to Aboriginal objects from the approved project would be regulated by a management plan approved by the Secretary of the Department rather than an AHIP.

However, any Aboriginal objects identified whilst undertaking the approved project works could be lawfully removed from within the approved project boundary if the removal is consistent with the will of the Registered Aboriginal Parties and undertaken in accordance with a Care Agreement issued by the Department of Planning, Industry and Environment under section 85A(1)(c) of the *National Parks and Wildlife Act 1974*.

We note that one of the three recommendations provided in the ACHAR for inclusion in the updated Aboriginal Cultural Heritage Management Plan (ACHMP) appears inconsistent with the requirement for a Care Agreement to remove Aboriginal objects from the approved project boundary for long term management if required.

The relevant state government point of contact provided in the ACHMP for various aspects of Aboriginal cultural heritage recording and reporting (i.e. OEH) has recently changed and this should be amended to the Biodiversity and Conservation Division (BCD).

BCD Recommendations:

12. Revise the ACHAR to:
 - a) include a statement confirming the ACHAR was prepared in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW 2010*;
 - b) remove references to a requirement for an AHIP.
 - c) ensure the recommendations are consistent with the requirement for a Care Agreement to remove Aboriginal objects from the approved project boundary for long term management if required.
13. Revise the ACHMP to replace references to the Office of Environment and Heritage (OEH) with the Biodiversity and Conservation Division (BCD).

OUR REF: C19/467

13 September 2019

Mr Ben Luffman
Technical Director – Environment
GHD
230 Harbour Drive
COFFS HARBOUR NSW 2450

Dear Mr Luffman

Re: C19/467 Dunloe Sand Quarry (MP 06_0031) Landscape Management Plan consultation

I refer to your email dated 8 August 2019 requesting consultation with DPI Fisheries for the purpose of preparing a Landscape Management Plan for the Dunloe Sand Quarry Project (MP 06_0031). It is noted that consultation with DPI Fisheries for the development of the Landscape Management Plan is a specific requirement within Condition 27 of the Minister's Conditions of Approval (CoA).

DPI Fisheries is responsible for ensuring that fish stocks are conserved and that there is "no net loss" of key fish habitats upon which they depend. To achieve this, the Coastal Systems Unit assesses activities under Part 4 and Part 5 of the *Environmental Planning and Assessment Act 1979* in accordance with the objectives of the FM Act, the aquatic habitat protection and threatened species conservation provisions in Parts 7 and 7A of the FM Act, and the associated *Policy and Guidelines for Fish Habitat Conservation and Management (2013 Update)* (DPI Fisheries P&G). This document is available online at:

<https://www.dpi.nsw.gov.au/fishing/habitat/protecting-habitats/toolkit>. In addition, DPI Fisheries is responsible for ensuring the sustainable management of viable commercial fishing and aquaculture; quality recreational fishing; and to promote the continuation of Aboriginal cultural fishing within NSW.

It is noted that the submitted draft Landscape Management Plan, titled *Holcim Australia Dunloe Sand Quarry Landscape Management Plan* and dated August 2019, contains the relevant requirements as stipulated by Condition 27 of the CoA and, if implemented in full, would contribute to the protection of adjacent key fish habitats from potential impacts of the sand quarry. In summary, DPI Fisheries has no objection to the draft Landscape Management Plan.



Department of Primary Industries

If you have any queries, please contact me on 02 6626 1375 or jonathan.yantsch@dpi.nsw.gov.au.

Yours sincerely

Jonathan Yantsch
Senior Fisheries Manager, Coastal Systems (North Coast)
Authorised delegate of the Minister for Primary Industries

Ben Luffman

From: Ben Luffman
Sent: Thursday, 8 August 2019 12:50 PM
To: 'landuse.enquiries@dpi.nsw.gov.au'
Cc: 'Victoria Musgrove'
Subject: Dunloe Quarry Management Plan consultation

CompleteRepository: 2220056
Description: Dunloe EMP
JobNo: 20056
OperatingCentre: 22
RepoEmail: 2220056@ghd.com
RepoType: Job

Hi,

We have updated the management plans for Dunloe Quarry following the recent approval of MOD2. The conditions of the Project Approval – SSD 06_0030 require a number of the plans to be prepared in consultation with the DoI. We have therefore provided a link below to the relevant plans for review.

<https://ghd.sendthisfile.com/M3RFj9HigPcjj1ATu8LUMpEj>

The updates have mainly been a reformatting to remove duplication and inclusion of additional information to address the new requirements of the conditions.

We would appreciate your comments by 23 August 2019.

Please contact me if you have any questions.

Regards

Ben Luffman | A GHD Associate

B.App.Sc. (Hons) | Grad.Dip. Urban and Regional Planning | Environmental Auditor
Technical Director - Environment

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Ben Luffman

From: cassandra.mcnamara@dpi.nsw.gov.au on behalf of DPI Cabinet
<dpi.cabinet@dpi.nsw.gov.au>
Sent: Friday, 23 August 2019 10:34 AM
To: Ben Luffman
Cc: Brendan Stone
Subject: DPI Advice - Local Project - Dunloe Quarry Management Plan Consultation

CompleteRepository: 2220056
Description: Dunloe EMP
JobNo: 20056
OperatingCentre: 22
RepoEmail: 2220056@ghd.com
RepoType: Job

Hi Ben

Subject: Request for input Dunloe Quarry Management Plan Consultation

I refer to your email of 8 August 2019 to the Department of Planning, Industry and Environment (DPIE) - Department of Primary Industries (DPI) regarding the above matter.

The Department of Primary Industries has reviewed the various management plans and has no objection or comment.

Any further referrals to DPIE - DPI can be sent by email to dpi.cabinet@dpi.nsw.gov.au

Kind regards,
Cass

DPI Coordination Team:

Cass McNamara, Manager - 0404 087 481
Jane Bak, A/Manager - 0438 458 914 (27 Aug - 20 Sept)
Sophia Stanley, Policy & Project Officer - 0427 326 931

eCabinet: <https://ecab.nsw.gov.au/ecabinet-prod/login?0>

NSW Department of Primary Industries

Lvl 49 MLC Centre | 19 Martin Place | Sydney NSW 2000

E: dpi.cabinet@dpi.nsw.gov.au

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----- Forwarded message -----

From: **Ben Luffman** <Ben.Luffman@ghd.com>

Date: Thu, 8 Aug 2019 at 12:50

Subject: Dunloe Quarry Management Plan consultation

To: landuse.enquiries@dpi.nsw.gov.au <landuse.enquiries@dpi.nsw.gov.au>

Cc: Victoria Musgrove <victoria.musgrove@lafargeholcim.com>

Hi,

We have updated the management plans for Dunloe Quarry following the recent approval of MOD2. The conditions of the Project Approval – SSD 06_0030 require a number of the plans to be prepared in consultation with the DoI. We have therefore provided a link below to the relevant plans for review.

<https://ghd.sendthisfile.com/M3RFj9HigPcjj1ATu8LUMpEj>

The updates have mainly been a reformatting to remove duplication and inclusion of additional information to address the new requirements of the conditions.

We would appreciate your comments by 23 August 2019.

Please contact me if you have any questions.

Regards

Ben Luffman | A GHD Associate

[B.App.Sc.](mailto:Ben.Luffman@ghd.com) (Hons) | Grad.Dip. Urban and Regional Planning | Environmental Auditor

Technical Director - Environment

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Ben Luffman

From: Colleen Forbes <CForbes@tweed.nsw.gov.au>
Sent: Wednesday, 21 August 2019 4:08 PM
To: Ben Luffman
Cc: Victoria Musgrove; Scott Hetherington; Vince Connell (InTouch); Tracey Stinson
Subject: RE: Dunloe Quarry - Landscape Management Plan consultation

CompleteRepository: 2220056
Description: Dunloe EMP
JobNo: 20056
OperatingCentre: 22
RepoEmail: 2220056@ghd.com
RepoType: Job

Dear Ben,

As requested and as part of your consultation process, Council has reviewed the *Dunloe Sand Quarry Landscape Management Plan* August 2019, primarily in relation to **Appendix E - Koala Management Plan** which Council was concerned about in Mod 2.

General comment:

- The bulk of the overall management plan comprises material from between 2006 and 2016 and it is difficult to interpret which previous study or work the published content refer to.

The Koala Management Plan is not supported in its current form due to the following:

- Hours of operation are proposed as the key threat mitigating factor in relation to koalas and vehicle strike. This does not satisfactorily account for winter, when the acknowledged high risk times of dawn and dusk occur during these hours of operation.
- The plan should note that koalas can be on the ground at any time of day or night.
- The plan should also identify the times of the year when risk is higher due to seasonal movements of young males, presence of females with back young and the concurrence of haulage times with dawn and dusk during winter as per above.
- All actions in relation to koala sightings and quarry related vehicle strike are assigned responsibility to the 'Planning and Environment Manager – NSW'. The document needs specify what organisation this relates to.
- No specific actions are proposed in response to quarry related vehicle koala strikes.
- There is no obligation or accountability for quarry staff to record koala sightings.
- 3 koala strikes per year is too many for the endangered population to sustain.
- 'Increased presence of koalas on haulage routes' is intimated as the likely cause for vehicle strikes. This is considered to be a premature and unfounded assumption.

Please contact me if you require any clarification on the matters raised above.

Regards,
Colleen

Colleen Forbes

Team Leader Development Assessment



p (02) 6670 2596

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Your actions matter: print less to save more

From: Ben Luffman [mailto:Ben.Luffman@ghd.com]
Sent: Thursday, 8 August 2019 12:52 PM
To: Colleen Forbes
Cc: Victoria Musgrove
Subject: Dunloe Quarry Management Plan consultation

Hi Colleen,

As discussed, we have updated the management plans for Dunloe Quarry following the recent approval of MOD2. The conditions of the Project Approval – SSD 06_0030 require the Landscape Management Plan to be prepared in consultation with Council. We have therefore attached the relevant plan for review.

The updates have mainly been a reformatting to remove duplication and inclusion of additional information to address the new requirements of the conditions.

We would appreciate your comments by 23 August 2019.

Please contact me if you have any questions.

Regards

Ben Luffman | A GHD Associate

B.App.Sc. (Hons) | Grad.Dip. Urban and Regional Planning | Environmental Auditor

Technical Director - Environment

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Appendix C – Long Term Management Strategy

Long Term Management Strategy

C.1 Introduction

The progressive rehabilitation of the wider site throughout the operational life of the Dunloe Sand Quarry is a commitment made by Holcim with the aim of providing for a well-established and long term environmentally sound landscape at the completion of operational works of the quarry. The following outlines the performance criteria to which Holcim or any future owners of the quarry will be required to meet, with an indication as to possible end uses of the land area.

End of operations management and monitoring commitments, to ensure adherence to the performance criteria are also described.

C.2 Background - Staged Rehabilitation

The Rehabilitation and Revegetation Management Plan (RRMP) presented in Appendix A, outlines a program of staged rehabilitation of various areas of the site. These rehabilitation areas were previously approved under Development Consent 06_0030. The RRMP, as amended from time to time, shows a detailed commitment to revegetating previously disturbed areas to create and enhance wildlife corridors, protect riparian areas and ensure the stability of ground and surface water quality within the catchment of Mooball Creek.

The detail outlined in the RRMP has been and continues to be implemented. These works will ensure that by the completion of sand extraction, the required rehabilitated areas will be well established with vegetation to a point of consolidation of continued growth. Upon completion of extraction operations, site conditions will be such that plantings can also be pursued to enhance the end of life appearance and function of the land.

The remainder of this document will outline the procedures for management and monitoring to achieve the objectives beyond the life of the quarry operations.

C.3 Objectives

- To ensure that rehabilitation works undertaken during the life of the quarry continue to thrive following the completion of operational works of the quarry.
- To implement management and monitoring procedures following the completion of quarry operations to provide for a permanent, healthy, local ecosystem that successfully functions within the natural parameters of the existing, localised, vegetative communities.
- To allow for and facilitate agricultural use around the perimeter of the extraction areas.
- Upon closure of the quarry operations the rehabilitated and revegetated areas are considered well established and capable of thriving without the need for continuing works and management.

C.4 Performance Criteria (Quarry Closure and Post-Extraction)

The following details the end of quarry operational life performance criteria:

- Healthy, thriving vegetation shall be well established upon closure of the quarry and be in a state considered to be capable of thriving into the future with minimal requirements for ongoing management.
- No visible weed infestations in those areas that have been rehabilitated or revegetated or the riparian zones associated with Mooball Creek within the site of the quarry.

- No visible erosion or sediment accumulation within rehabilitated areas and all erosion and sediment control preventative measures are in place prior to closure of the quarry.
- In regard to groundwater quality, target criteria to be used throughout the life of the quarry shall be required to be met upon closure of the quarry (refer to the Soil and Water Management Plan).
- In regard to surface water quality, target criteria to be used throughout the life of the quarry shall be required to be met upon closure of the quarry (refer to the Soil and Water Management Plan).
- Blue-green algae water quality targets presented in the following table and prescribed by Condition 9 of Schedule 3 of the Development Consent shall be met upon closure of the quarry:

Algae and Blue-green algae	No. cells/mL (M.aeruginosa)	<50,000
	mm ³ /L (total biovolume)	<4

C.5 Implementation

1. Surface water monitoring will continue to be undertaken in accordance with the approved schedule at nominated monitoring locations (including monitoring for blue-green algae within the lakes) (refer to the Soil and Water Management Plan) for a period of 12 months after completion of extractive operations or as long as is necessary to indicate that the extraction area will have no impact upon the environment.
2. Groundwater monitoring will be undertaken in accordance with an approved schedule at nominated environmental monitoring locations (refer to the Soil and Water Management Plan) for a period of no greater than 12 months after completion of extractive operations should the monitoring continue to show compliance with set requirements of the Development Consent.
3. All bunding and catch drain lines shall have been removed around each on-site excavation area to allow natural surface water flow to the remaining lakes.
4. Inspection of all rehabilitated areas in accordance with an approved schedule to ensure plantings have been successful and to ensure no weed infestation is present at any of these localities (covered by bond) (refer to the RRMP).

C.6 Monitoring

Quarterly surface water monitoring in accordance with the approved schedule (refer to the Soil and Water Management Plan) will continue following the cessation of extraction. This would continue for a period of 12 months only, if water quality objectives can be demonstrated.

If there is visual evidence of an algal bloom, samples will be collected immediately for algal cell count/identification analysis.

Quarterly groundwater monitoring in accordance with the approved schedule (refer to the Soil and Water Management Plan) will continue following the cessation of extraction. This would continue for 12 months only, if groundwater quality objectives can be demonstrated.

As the revegetated areas will essentially be stable forests upon cessation of quarry operations, monitoring of these areas will continue to be undertaken 12 months from the cessation of operations to ensure quality of the vegetation is maintained. The monitoring is to include weeds, erosion and plant health, density and diversity.

After 12 months, monitoring of the rehabilitation areas will cease should all areas be considered stable and effectively free of weeds and approved for no further management by the DPI&E or until such time that it can be demonstrated that no adverse impacts associated with the quarry exist.

C.7 Auditing

Groundwater, surface water, blue-green algae and revegetation area monitoring results will be reviewed quarterly for the first year following cessation of operations by the respective contracted environmental consultant/s. Results shall be compared with those found within previous AEMR documents to ensure compliance with criteria.

C.8 Corrective action

Should final monitoring of revegetated areas show the presence of significant areas of weed infestation at cessation of the operations, a program will be implemented to remedy this situation to the satisfaction of the DPI&E.

In regard to groundwater, surface water and blue-green algae, the recommended corrective actions presented within the Soil and Water Management Plan will be implemented.

C.9 Potential future uses

Potential future uses of the site following a project with a lengthy operational life such as this are difficult to accurately predict. Many variables could occur that may dictate end uses such as State, Regional and Local Government, strategies, policies and legislation changes and directions over time. The certainty is that the mitigation and remedial measures implemented during the operations and at the cessation of operations, as presented throughout the EMP, will ensure that the site will be remediated to the satisfaction of the company, the relevant Government agencies and the community, ensuring environmental quality in the locality.

The proposed rehabilitation and revegetation of the site will allow future agricultural activities to occur within the surrounds of the lakes

Much of the existing areas of the site that are presently under environmental protection through zoning within the Tweed Shire Council LEP may remain under various legislated forms of environmental protection. Those areas of rehabilitated land (particularly those linking and expanding wildlife corridors) not within these protected zones may overtime be included.

Similarly, agriculturally zoned lands within the site that will not be impacted by the sand quarry operations may remain under such zonings into the future.

The environmental measures presented throughout the EMP allow the site following cessation of operations to be suitable and capable of the potential end land uses.

Appendix D – Koala Management Plan

Koala Management Plan

D.1 Introduction

Koala habitat has been identified in areas surrounding the Dunloe Sand Quarry and access road, as well as the Pottsville Mooball Road which is used to access the quarry.

Schedule 3, Condition 28 (h) and (i) require the Dunloe Sand Quarry Rehabilitation and Revegetation Management Plan (RRMP) to include:

- A monitoring and reporting program of the project's impacts on Koalas, including road strike, to the satisfaction of the Secretary.
- Adaptive management options for managing impacts on Koalas, including specific impact triggers, developed in consultation with Council.

This Koala Management Plan (KMP) forms part of and should be read in conjunction with the RRMP, Landscape Management Plan and Environmental Management Strategy for the Dunloe Sand Quarry.

Koalas are mostly nocturnal animals and they are most active during the night and at dawn and dusk. However, it is noted that koalas can be on the ground at any time of day or night. Koalas are more active during the spring and summer breeding period. The birth of young Koalas generally takes place between November and February, with the young remaining in the pouch for six months. The joey will then ride on the mother's back for between six and 12 months.

D.2 Potential Impacts

D.2.1 Quarry-related vehicle strike

The quarry access road runs parallel with the northern Brushbox Forest (Community 3), which provides koala habitat.

Potential impacts from the project on koalas in the area may arise from vehicle strike where haulage/access routes are located close to koala habitat or areas used by koalas. Under the Development Consent 06_0030, haulage vehicle movements associated with delivery and distribution of quarry materials are restricted to the following operational hours:

- 7:00 am to 5:00 pm Monday to Friday
- 7:00 am to 12 pm Saturday

The risk of vehicle strike is likely to be higher during the winter months when dawn and dusk fall within the approved operational hours for the quarry. Similarly, the risk would be higher during the spring and summer breeding period.

D.2.2 Unauthorised clearing of koala habitat

Clearing of koala habitat will not be undertaken as part of the ongoing quarry operations, however unauthorised clearing in these habitat areas would have the potential to impact koalas.

As outlined in the Landscape Management Plan, approved disturbance areas will be demarcated and access restricted to areas outside these areas, except for monitoring and management purposes.

D.3 Monitoring

In order to monitor these potential impacts, Holcim will record any unauthorised clearing, koala sightings or vehicle strikes involving quarry-related vehicles in its online incident reporting system. This will allow such occurrences to be tracked and areas of koala activity and potential road strike identified. Reporting provisions are detailed in Section 5.4 of the Landscape Management Plan and the EMS.

The presence of koalas and any unauthorised clearing of koala habitat will also be noted during the monitoring program set out in Table 5-1 of the Landscape Management Plan.

D.4 Reporting

Records of any unauthorised habitat clearing, koala sightings and vehicle strikes involving quarry-related vehicles and koalas will be reported in the Annual Report, along with a discussion of any identified cause, trends such as specific area, time of day, time of year, climatic conditions, etc. associated with the occurrences.

D.5 Adaptive Management

Impacts to koalas as a result of quarry activities, specifically haulage, or unauthorised habitat clearing, will be reviewed annually as part of the review of monitoring results, which forms part of the Annual Report, to assess any adverse impacts to koalas. The monitoring results will also be used to identify any trends in occurrences of koala sightings or vehicle strikes.

Responses to the results of this monitoring will be required where certain triggers are met or exceeded. Details of the triggers, actions and responses for koala management are provided in Table D-1.

It should be noted that there have been no koala vehicle strikes as a result of quarry vehicles during the site's operation.

Table D-1 Koala management triggers

Trigger	Action	Responsibility
Approval of KMP (2021)	Incorporate koala impact management materials into site induction, identifying risk areas (i.e. haulage route particularly in proximity to the northern Brushbox Forest (Community 3)), seasonal considerations (i.e. breeding season November to April, potential presence of young/joeys throughout the year) and the requirement to report all koala sightings, near misses and vehicle strikes.	Quarry Manager
Approval of KMP (2021)	Install koala warning signage along internal haul route	Quarry Manager

Trigger	Action	Responsibility
Unauthorised clearing of koala habitat	Investigate cause of unauthorised clearing	Quarry Manager
	Implement measures to prevent recurrence of unauthorised clearing (will depend on cause identified)	Quarry Manager
	Compensatory planting at a ratio of 10 to 1.	Quarry Manager
Koala sightings along haul routes increases year on year	Investigate if any trends are determinable from these occurrences, including whether increased sightings correlates with increased quarry-related vehicle strikes	Planning and Environment Manager – NSW
	Continue to monitor koala sightings in subsequent years to determine if occurrences continue to increase	Planning and Environment Manager – NSW
Quarry-related vehicle koala strike is reported	Review all occurrences and investigate if any trends are determinable from these occurrences	Planning and Environment Manager – NSW
Quarry-related vehicle koala strike recorded for any two (2) years in a rolling five (5) year period	Investigate if any trends are determinable from these occurrences	Planning and Environment Manager – NSW
	Consult with local koala experts and Tweed Shire Council to understand potential causes for increased presence of koalas on or nearby haulage routes and/or incidence of koala vehicle strikes associated with quarry operations and to identify potential measures to be implemented to minimise impacts to koalas as a result of quarry-related vehicle strike.	Planning and Environment Manager – NSW

Potential management measures that could be implemented where impacts to koalas as a result of vehicle strike are identified are provided in Section 1.6. Any measures to be implemented will be selected in response to the findings of the investigation into the incident (e.g. location, contributing factors such as non-compliance with site rules, etc.) and in consultation with local koala experts and Tweed Shire Council.

D.6 Potential Management Measures

Measures that may be implemented to manage the risk of koala vehicle strike include:

- Fauna exclusion fencing
- Traffic calming measures
- Lighting
- Road verge maintenance
- Speed reduction signage.

The success of such measures will be monitored in line with Section 2 above and any specific monitoring program recommended by the appointed ecologist, reported in line with Section 3 above and further adaptive management measures progressed where impacts to koalas as a result of quarry-related vehicle strike continues to occur.

Appendix E – Monitoring forms

ROUTINE FAUNA BOX MONITORING FORM			
Location/Number of Fauna Box			
Description of Fauna Box			
Inspected by	Name: _____ Signature: _____		
Inspection date	/ /		
Element	N/Y?	Comments/description	Action Required
Empty Box			
Native Fauna Present			
Eggs Present			
Number of eggs			
Colour/description of eggs			
Nest present			
Partial nest present			
Hatchlings/fledglings present			
Box empty but scats/trace present			
Box occupied by pest species (i.e. bees, myna, black rat etc)			
Roof, hinges and/or supports broken or in need of repair/replacement			
Evidence of warping			
Evidence of vandalism			
Other comments/maintenance performed?:			

FORM A: ROUTINE QUARTERLY REHABILITATION MONITORING SHEET

General Management Has there been a fire within the last quarter? _____ Do the bushfire trails or adjacent pasture areas require slashing or maintenance to reduce fire risk? _____ Is there evidence of rubbish dumping within the rehabilitation zones? _____ Is there evidence of plant theft within the rehabilitation zone? _____ Does it appear that the rehabilitation zone has been utilized for stockpiling, vehicle parking, building waste dumping, cattle grazing or person traffic? _____ If yes, acknowledge below what works were undertaken to rectify/restore and the date _____	Weeds Have any areas of weeds re-established within the rehabilitation zones during the last quarter? _____ What species? _____ What management was undertaken to eradicate these weeds? _____ If management was undertaken acknowledge that such was performed in accordance with the approved rehabilitation management plan. _____	Vegetation regeneration Natural regeneration is occurring in (record height range estimate): - Tree species _____ - Shrub species _____ - ground covers _____ What are the dominant species within each layer? - Tree _____ - Shrub _____ - ground covers _____ Have you noticed any new native plant species since the last monthly inspection? _____ If yes name the species or take a photograph _____ Acknowledge that the required routine photographs have been taken within the rehabilitation zones
Biodiversity Have you spotted native fauna within the rehabilitation zone during inspection? If yes, what types? Koala _____ Kangaroo/wallaby _____ Possums/glidens _____ Small mammal (i.e. bandicoot, echidna) _____ Reptiles (i.e. snakes/lizards) _____ Birds of prey _____ Large nectar feeding birds (i.e. lorikeets, parrots, cockatoos) _____ Small tree and ground birds (i.e. finches, fairy wrens, treecreepers) _____ Glossy Black Cockatoos _____ Other _____	Modifications Have there been any structural additions (eg. new tracks, buildings) to the rehabilitation zones since the last visit? <u>What actions were undertaken to remove any illegal modifications?</u> Condition of fences _____ - Good _____ - Need minor repair _____ - Poor (need replacement) _____	Are any of the following performance criteria exceeded (refer Section 4.5 below)? Declared Weeds? _____ Extent of other Weeds? _____ Survival Rate of Plants? _____ Condition of Plants? _____ Canopy Coverage? _____ Tree, Small Tree & Shrub Diversity? _____ Groundcover Coverage? _____ General Coverage/Success? _____ If yes, what corrective action was performed (i.e. plant showed drought stress and so watering was undertaken, plant was dead so a replacement plant was pocket planted, canopy plant coverage was not achieved so relevant pioneer plants were pocket planted).

FORM B - ASSESSING SITE CONDITION

PROJECT DESCRIPTION Note: where options are given, put an 'X' next to the appropriate term(s):

Project name:		Project ID:
Site name:		Site ID:
Type of on-grounds: Assisted Natural Regeneration	Years since site commenced:	When was this site last assessed?
Current assessment conducted by:	Date of current assessment:	
Overall comments on site condition:		
Has the condition of the site changed since last assessment? YES or NO If Yes, briefly describe changes in this box, and provide details in table below.		

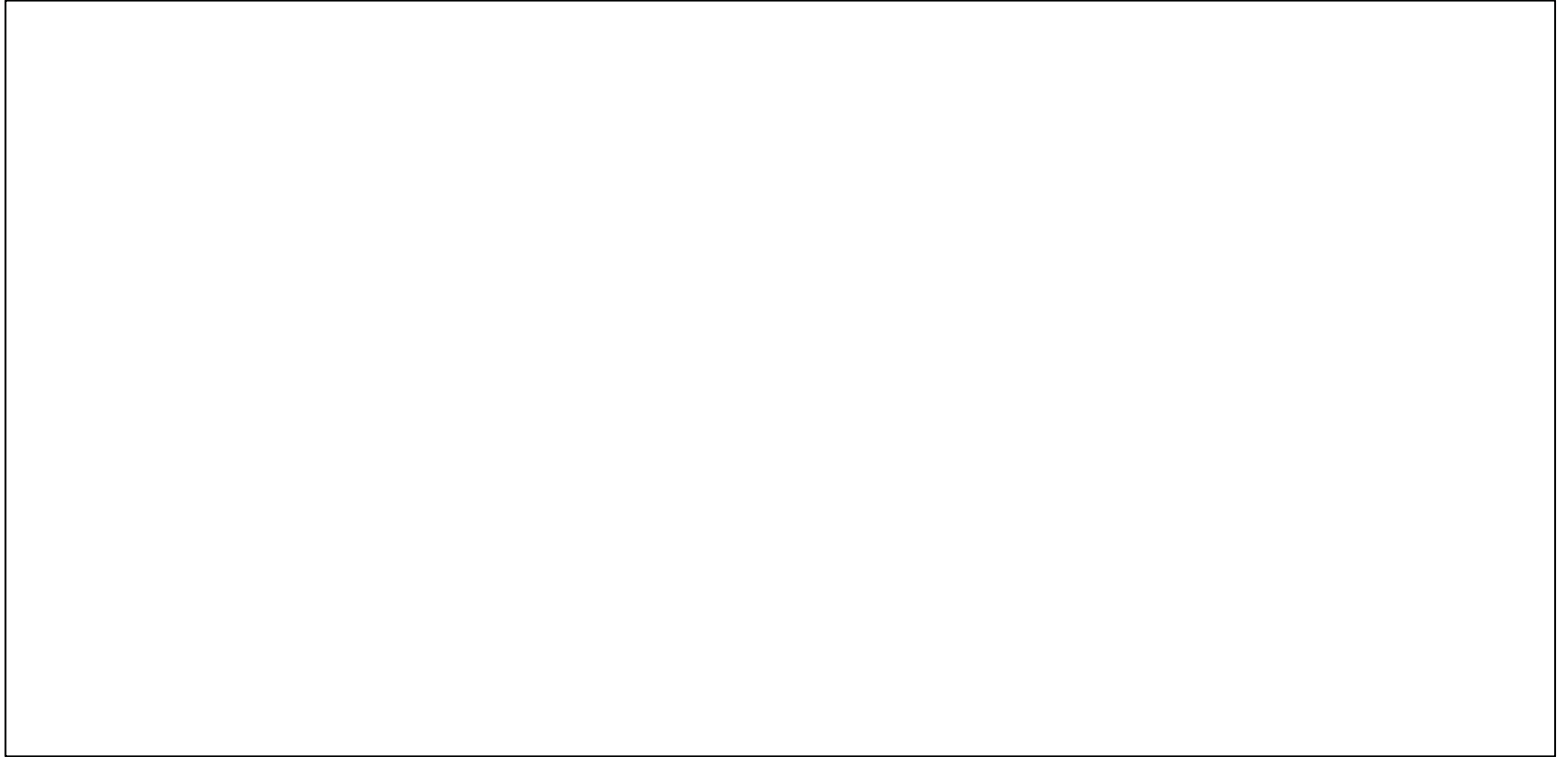
DETAILED DESCRIPTION OF SITE CONDITION Complete table quarterly, or if conditions have changed since last assessment. Also draw map.

[illegible]

MAP OF SITE CONDITION Note: also describe the condition of the site (previous page).

Draw a map of the site, showing variation in outcomes as zones (Zone A = OK, Zone B = Uncertain, Zone C = Poor).

Include an approximate scale (e.g. 0-100 m) and North arrow.



PROFORMA FOR MONITORING FOREST STRUCTURE

Project name:	Project ID:
Site name:	Site ID:
Assessed by:	Date:

LOCATION OF MONITORING PLOTS

Provide details and also mark on the map of the site	Plot
Location at 0 m point of plot (grid / GPS coordinates):	
Datum:	
Compass bearing / direction of transect (from 0 m point)	
Landform (e.g. plateau, crest, upper slope, mid-slope, lower slope, stream bank, floodplain)	
Slope (: e.g. flat/steep)	
Aspect (compass bearing / direction of fall of slope)	

MAP OF MONITORING PLOTS

In the box, insert a map of the site showing the location of monitoring plots (mark 0 m point) in relation to notable features of the site (e.g. property boundaries, roads, waterways). Also show notable features of the monitoring plots (e.g. non-standard layout, presence of remnant trees) and location of any landscape photopoints. Include a scale bar (e.g. 0-100 m) and North arrow.

Site name:	Date:
GROUND COVER, CANOPY COVER and CANOPY HEIGHT For each survey plot, lay out a 50 m transect. Then survey quadrats centred on the 5 m, 25 m and 45 m points	



Ground cover = proportion of ground covered by (a) vegetation within 1 m of ground (categorised by life form), (b) leaf litter and fine woody debris, (c) coarse woody debris, d) rock, (e) soil, or (f) other. At the 5 m, 25 m and 45 m points, define a 1 m x 1 m quadrat, using four 1 m sticks. Looking down at the quadrat from 1 m, estimate the % of ground covered by each type (as would be seen on a photo: total must add to 100%).

Ground Cover	Plot		
Location of quadrat:	5 m	25 m	45 m

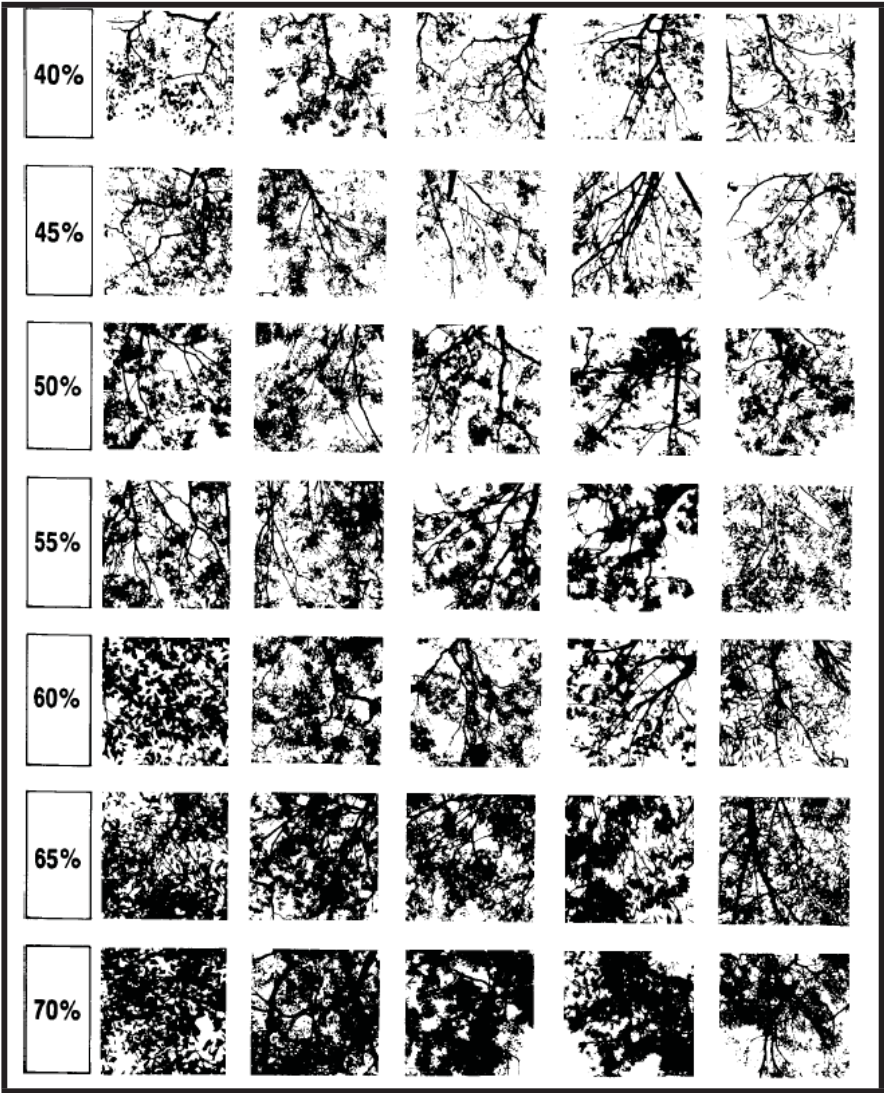
a)
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Grass (and sedges)	%	%	%
Herbs (soft-stemmed plants)	%	%	%
Ferns	%	%	%
Vines and scramblers	%	%	%
Tree seedlings and shrubs	%	%	%
Moss (and liverworts and lichens)	%	%	%
b) Leaf litter and fine woody debris <10 cm diameter	%	%	%
c) Coarse woody debris >10 cm diameter	%	%	%
d) Bare rock	%	%	%
e) Bare soil	%	%	%
f) Other (including tree trunks, roots, etc.)	%	%	%
TOTAL (must add up to 100%)	100%	100%	100%

Canopy (foliage) cover = projective cover of ecologically dominant layer above ground level (shade cast by foliage and stems, if the sun was overhead, assessed (approximately) above the entire 10 m x 10 m quadrat around each point. It can be estimated by eye (although this can be very subjective) or from a photo. 1. Estimate foliage cover visually, e.g. by comparison with reference photos. 2. Take a wide-angled digital photo looking up from the

centre of each 10 x 10 m quadrat, and use to calculate foliage cover). Record the number of each photo for later reference.

Canopy (foliage) cover	Plot		
Location of quadrat:	5 m	25 m	45 m
Visual estimate of canopy (foliage) cover	%	%	%
Canopy (foliage) cover calculated from photo	%	%	%
Record number of canopy photo for reference			



CANOPY COVER PHOTOGRAPHS PER WALKER AND HOPKINS (1990)

Canopy height The height of the tallest tree in the canopy of each 10 m x 10 m quadrat (the canopy is the layer of foliage forming the 'roof' of the forest: it may be broken by gaps or incomplete). In some sites, it may be necessary to distinguish canopy trees from emergents: i.e. trees projecting well above the canopy with crowns exposed on all sides Note: Estimating height is difficult. Use a clinometer & tape measure, or range finder, or other measure. Alternatively, place a 2.5 m pole against a tree, & standing at a distance, estimate height in multiples of 2.5 m.

Canopy height	Plot		
Location of quadrat:	5 m	25 m	45 m
Canopy height (tallest trees in canopy)			
Height of emergent trees (if present)			

Site name:	Date:
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SPECIAL LIFE FORMS: Record presence of life forms in each 10 m x 10 m quadrat centred on the 5 m, 25 m and 45 m points. If life forms are present on site, but not in quadrats, record in last column. Do not count no. of individuals.

Special Life Forms		Plot			On site?
Location of quadrat:		5 m	25 m	45 m	
Strangler figs Figs with network of roots around stem of host tree, rooted in ground					
Hemi-epiphytes Climbing plants adhering to tree trunks, rooted in ground, e.g. Pothos, climbing pandanus					
Vines Climbing woody-stemmed plants dependent on trees for support, and rooted in the ground	Slender (stem <5 cm diam.)				
	Robust (stem >5 cm diam.)				
Vine towers Dense columns of vines growing over and smothering tree crowns and stems					
Vine tangles Dense masses of interwoven vine stems in understorey or midstorey					
Thorny scramblers Thicket-forming vines or shrubs, often spiny, e.g. Calamus, lantana, cockspur, raspberry, other vines (e.g. Eleagnus, Maesa)	Individual plants present				
	Thickets present				
Palm trees Palms with stems >2 m high					
Understorey palms with stems <2 m high, e.g. walking stick palms (also includes juvenile palm trees)					
Tree ferns Ferns with stems usually >0.5 m high					
Ground ferns Ferns or fern-like plants without stems, growing on the ground					
Clumping epiphytic ferns e.g. staghorns, basket ferns					
Other epiphytes Growing on trees, e.g. trailing ferns, orchids, not rooted on ground					
Cordylines 'Palm-lilies': shrubs to 5 m high, occasionally branched, with long leaves					
Herbs with long wide leaves e.g. ginger, cunjevoi, bananas					
Herbs with long strap-like leaves e.g. lilies, mat-rush					
Cycads Plants with leathery palm-like foliage borne on stout stems or growing on ground (subterranean stems)	Stout stems, e.g. Lepidozamia				
	Ground cycads, e.g. Bowenia				
Pandanus Shrub / small tree with serrated strap-like leaves					
Other life forms: describe...					

Woody debris = fallen logs and branches lying on or within 1 m of the ground.

Tally the number of times logs are intercepted by the 50 m transect, by diameter class at the point of intersection. If a log is intercepted by the transect more than once, it is tallied each time, by diameter at each of the points of intersection

[illegible]

FORM D: PROFORMA FOR MONITORING FLORISTIC COMPOSITION

Project name:	Project ID:
Site name:	Site ID:
Assessed by:	Date:

LOCATION OF MONITORING PLOTS

Provide details and also mark on the map of the site	Plot
Location at 0 m point of plot (grid / GPS coordinates):	
Datum:	
Compass bearing / direction of transect (from 0 m point)	
Landform (e.g. plateau, crest, upper slope, mid-slope, lower slope, stream bank, floodplain)	
Slope (: e.g. flat/steep)	
Aspect (compass bearing / direction of fall of slope)	

MAP OF MONITORING PLOTS

In the box, insert a map of the site showing the location of monitoring plots (mark 0 m point) in relation to notable features of the site (e.g. property boundaries, roads, waterways). Also show notable features of the monitoring plots (e.g. non-standard layout, presence of remnant trees) and location of any landscape photopoints. Include a scale bar (e.g. 0-100 m) and North arrow.

Site name:	Date:
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GENERAL COMMENTS on the composition of vegetation at the site (e.g. dominant or notable species, variation across the site): record by strata as follows:

Canopy/ Ecologically Dominant Layer:

Midstorey:

Understorey/ Ground cover:

RECRUITMENT: What species are common recruits to the site? Any other comments about recruitment?

Does this site have any WEED or MAINTENANCE ISSUES that need attention?

Any other comments on the site? Mark an 'X' here _____and add extra page(s) as required.

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9/[https://projects.ghd.com/oc/Newcastle3/holcimdunloesandquar/Delivery/Documents/2220056_RPT_Dunloe Landscape Management Plan.docx](https://projects.ghd.com/oc/Newcastle3/holcimdunloesandquar/Delivery/Documents/2220056_RPT_Dunloe%20Landscape%20Management%20Plan.docx)

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	Planit					January 2009
1	Planit					February 2009
2	Holcim					October 2016
3	Holcim					July 2018
4	B Luffman	S Lawer		S Lawer		23/09/2019
5	B Luffman	S Lawer		S Lawer		04/06/2021

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