ECOLOGICAL
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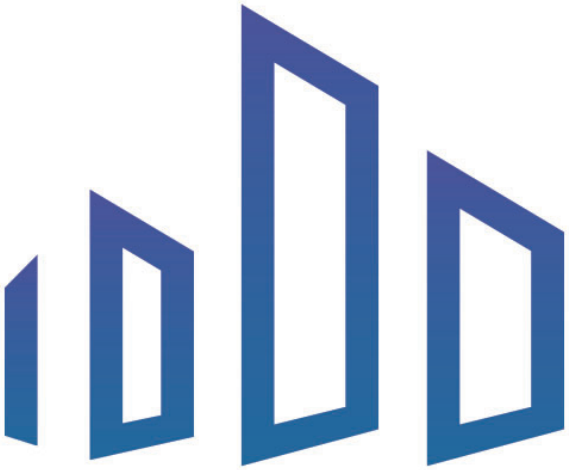
21-007



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PLANS AND DOCUMENTS
referred to in the PDA
DEVELOPMENT APPROVAL

Approval no: DEV2022/1288

Date: 10 May 2022

Queensland Government

Marine Plants Rehabilitation Monitoring Plan

WES BARRETT PARK

ECOLOGICAL ENGINEERING PTY LTD

AMENDED IN RED

By: Brandon Bouda

Date: 09 May 2022

Queensland Government

At 'Ecological Engineering' we integrate ecology and engineering to predict, design, construct, restore, and manage ecosystems that integrate "human society" with its natural environment, for the benefit of all.

ECOLOGICAL ENGINEERING

CONTENTS

REHABILITATION & MONITORING PLAN

Report Authorisation			
Client	Townsville City Council		
Client Contact	Tyson Schmid		
Project Name	Wes Barrett Park Marine Plants Rehabilitation & Monitoring Plan	REV	D
Prepared By	N. Grier	Date	18/04/2022
Reviewed By	M. Davis	Date	18/04/2022
Approved By			
	N. Grier	Date	18/04/2022

1 INTRODUCTION

This plan has been prepared on behalf of the Townsville City Council (TCC) for the Riparian Recovery Program for the Ross River. The proposed environmental works will stabilise and restore the bank of the Ross River at Wes Barrett Park, within the suburb of Idalia in postcode 4811.

1.1 PURPOSE OF THIS REPORT

TCC has engaged ecological Engineering Pty Ltd to prepare a Rehabilitation Monitoring Plan (RMP) for the southern bank of the Ross River between Milverton Circuit to the North and River Boulevard to the South within the suburb of Idalia postcode 4811. Part of the site is within the Oonoonba Priority Development Area (PDA)

From late January to early February 2019, Townsville was impacted by a significant monsoon trough event. This rain event caused significant flooding and environmental damage to the Ross River banks.

TCC received Disaster Recovery Funding Arrangements (DRFA) through the Queensland Government to redress some of this damage and stabilise the riverbank.

The work will include:

1. The repair of the severely eroded river and creek banks and reduce future sediment loss into the Great Barrier Reef downstream
2. Tree planting, revegetation and other restoration activities in degraded river/creek areas
3. Increase our understanding of the risk of future disasters to the environment
4. Improvement in the ability of the local environment to resist impact and recover from natural disasters.

As part of an Operational Works application, TCC received an information request from the State Assessment and Referral Agency (SARA) for Bulk Earthworks and Prescribed Tidal Works at Wes Barrett Park.

This request required clarification on the extent of impacts to marine plants assessed against performance outcome PO4 of State Code 11: Removal, destruction, or damage of marine plants.

This report has been prepared to respond to this information request.

The RMP provides a framework for compliance with rehabilitation conditions associated with any approvals. This RMP aims to provide management measures to be implemented during the construction, reinstatement and rehabilitation phase of the Project and to reinstate and rehabilitate

the riverbank marine plants and ancillary sites in a manner that is consistent with any relevant approval conditions.

This document should be read in conjunction with the Marine Plants Report REV B 28022022 and the Revegetation Plan.

1.2 SCOPE

The RMP has been developed in compliance with 'Fish Habitat Guideline FHG 002 - Restoration of Fish Habitats' and outlines the rehabilitation objectives and methods to:

- Enable the undertaking of a comprehensive reinstatement and rehabilitation program for areas disturbed as a result of construction activities.
- Facilitate reinstatement and rehabilitation programming.
- Enable the creation of a stable landscape.
- Maintain and enhance fisheries habitat and marine plants.

2 RESPONSIBILITIES AND REQUIREMENTS

This document assigns responsibilities for implementing the RMP as presented in Table 1.

Table 1 - RESPONSIBILITIES RELATING TO THE REHABILITATION PLAN

Position	Responsibility
Project Manager (PM)	• Ensuring that rehabilitation is conducted, approved and communicated; and • Ensuring the adequate provision of human and financial resources, organisational means, and proper assets for the effective implementation of this Rehabilitation Plan.
Environmental Manager (EM)	• Coordination of the implementation of the Rehabilitation Plan during the life of the Project. • Review of the Rehabilitation Plan for adequacy and functionality. • Ensuring that the rehabilitation plan is issued and up to date. • Maintenance of the Environmental Incident/Non-Compliance Register; and • Reporting of monitoring, corrective actions and outcomes.
Environmental Site Officer	• Ensuring all personnel comply with the RMP. • Implementation of the RMP. • Preparation of incident reports and implementation of corrective actions. • Recommending and coordinating amendments to the rehabilitation process based on onsite conditions and experience gained through the implementation of the RMP; and • Monitoring, corrective actions and reporting of outcomes.
Site Personnel	• Compliance with the rehabilitation plan.
Restoration/ Landscape Ecologist	• Provide advice and recommendations for areas where vegetation is not naturally regenerating, including seeding requirements and rates • Responsible for making recommendations for appropriate revegetation techniques or appropriate species for problematic locations within the project area.

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~~2.1 Rehabilitation Plan Reporting~~

~~An annual monitoring report will be submitted to the Department of Agriculture and Fisheries (DAF)~~

~~A summary of the previous 12 months' monitoring results obtained from the RMP undertaken by the consultant will be provided to TCC to form part of the required annual monitoring report (**Appendix 3**).~~

~~The information collected as part of monitoring will be assessed and summarised to provide an overview of rehabilitation progress within the site and ancillary areas. Additionally, an assessment of collected data will be used to identify the need to revise or amend rehabilitation processes as prescribed in this RMP.~~

~~The plan is to be provided to DAF via TCC Planning Services.~~

~~Incident Reporting for marine plant damage, fish kills or oil spills impacting fisheries follows TCC Integrated Environmental Management Systems (IEMS) processes and protocols.~~

~~Where required, notifications can be sent directly to DAF at notifications@daf.qld.gov.au~~

3 REHABILITATION PLAN OBJECTIVES AND STRATEGIES

3.1 Overall Objectives

This RMP provides a framework for the restoration of tidal lands below HAT disturbed by the Project to a condition consistent with that before site clearing and ensures:

- Safe landform for humans, flora and fauna;
- Non-polluting landform;
- Stable landform; and
- Preservation of fish habitat and marine plants.

Further, this RMP provides the basis for managing reinstatement and rehabilitation of disturbed land to maximise the potential for the land to progress toward long term rehabilitation objectives (final acceptance criteria as detailed in any approval). It acknowledges that the progress of the rehabilitation of disturbed areas of native vegetation will continue for years.

Consultant field assessments are carried out by Suitably Qualified and Experienced Persons (SQEPs).

3.1.1 Baseline Assessment

A baseline assessment was conducted by Ecological Engineering and is detailed in the 'Marine Plants Report REV A 24012022'.

Namely, the marine plant rehabilitation intends to, at minimum, achieve pre-site clearing coverage within five years of the following vegetation types, as detailed in Table 2.

Table 2 - Existing Marine Plant Types

Type	Species	SARA	PDA	Area m^2
Mangroves	Primarily *Avicennia marina* with *Rhizophora stylosa* and *Ceriops tagal* observed.	6.47	15.53	22m^2
Succulents	*Sueda australis, Sesuvium portulacastrum* and *Sarcocornia quinqueflora*	-	3,171	3,171m^2
Grasses	*Sporobolis virginicus*	-	6,779	6,779m^2

3.2 Type of Rehabilitation

Batter slope and access areas below HAT will be rehabilitated as per the revegetation plan and specification to attain the pre-clearing state through revegetation (marine grasses and succulents) and natural regrowth/recruitment of mangroves.

3.3 Rehabilitation Goals

The design of the riverbank works has considered the ecological values of the vegetation communities and habitat within and adjacent to the footprint. Although some temporary impacts on some natural ecosystems are unavoidable, the site has eroded significantly and is degraded.

4 REINSTATEMENT, REHABILITATION AND MAINTENANCE METHODS

In this RMP, the description of rehabilitation activities and methods has been broken into the following components:

- Reinstatement – The process of bringing the landscape back to the original profile of the surrounding environment, including the stabilisation of the site. This includes riparian revegetation;
- Rehabilitation – The process of establishing marine plants back onto the site following reinstatement, including the restoration of any fauna and fish habitat; and

- Ongoing maintenance involves ongoing management of rehabilitation areas to control pest species, minimise threats to rehabilitation success and rectify erosion, subsidence and landform stability issues identified during monitoring.

4.1 General Reinstatement Procedures

General techniques that Contractor will apply to construct and reinstate the riverbank are as follows (as per figures in **Appendix 1**):

- Topsoil to be stripped to the nominated depth and managed by the Revegetation Plan and Specification;
- Topsoil and mulched/chipped vegetation material to be stockpiled separately at the edges of the site, where working space allows;
- Reinstatement of the site will commence as soon as practicable after civil works and no later than one month after completion of riverbank construction activities by the Revegetation Plan;
- During backfilling of the riverbank, soils will be replaced so that the topsoil depth is consistent with the surrounding soil;
- The construction area will be re-profiled to new, stable contours;
- Subsoil scarifying will be used to reduce compaction and will be applied to disturbed areas as required, and in consideration of soil type;
- Except for locations to remain clear for operational access purposes, chipped/mulched vegetation will be respread over the site above HAT where available to assist in the revegetation, promote seed establishment, provide ground cover and provide shelter for fauna;
- Other ground covers will be utilised, including any organic material, leaf litter, mulch, hydromulch, living or dead plant material, rocks, logs, other woody material or erosion control materials.
- Sterile cover crops will be utilised in slope areas to promote ground cover above HAT rapidly;
- Sterile cover crops will be utilised in marine plant regeneration areas where erosion potential is considered significant.

4.2 Rehabilitation Methods

Long-term rehabilitation of marine plants will rely on natural regeneration from the soil seed bank and reproductive plant material delivered by the tides.

4.2.1 Marine Plants

Disturbed areas of marine plants will be rehabilitated based on pre-clearing conditions, original assessment data, and surrounding vegetation conditions, considering normal successional processes.

Mangrove rehabilitation will rely on natural regeneration in the first instance. Natural regeneration depends on germination from the soil seed bank, propagules in the soil and natural plant dispersal mechanisms to recolonise disturbed areas.

For the riverbank and tidal terrace, and where topsoil and organic matter reinstatement do not meet rehabilitation performance criteria, assisted regeneration (or revegetation) will commence planting and direct seeding of mangroves to enhance rehabilitation progress in year three.

Selective weed management will ensure that weed control methodologies complement rehabilitation objectives. Monitoring will assess the effective establishment of species representative of original site data and surrounding vegetation.

4.2.2 Soil Seedbank Management

Topsoil will be stockpiled and stabilised to preserve its biological and chemical properties and used for rehabilitation purposes according to the RMP, Revegetation Plan and the Erosion and Sediment Control Plan (ESCP).

4.2.2.1 Sodic Soils

Sodic soils are common along the Ross River. Sodic soils are highly erosive and can inhibit plant growth as they can create significant waterlogging above the soil B horizon, which can kill plants or result in the poor performance of plants. Sodic soils, when encountered, will be blended with gypsum to reduce dispersiveness before stockpiling and appropriately protected from erosion following the ESCP.

4.2.2.2 Acid Sulfate Soils

An Acid Sulfate Soils (ASS) investigation will be undertaken for the site that potentially contains ASS.

Any ASS investigations or management plans prepared for the Project will be undertaken and prepared following the relevant guidelines, including:

- Queensland Acid Sulfate Soil Investigation Team (QASSIT) (1998) *Sampling and Analysis Procedure for Lowland Acid Sulfate Soils in QLD*, Revision 4.0; and
- State Planning Policy 2/02 (SPP 2/02), *Planning and Managing Development Involving Acid Sulfate Soils*, November 2002.

If ASS is encountered, mitigation measures will be applied as per SPP2/02.

4.3 Revegetation Methods

Revegetation refers to the active management of vegetation during the reinstatement and rehabilitation phases of the Project. Revegetation involves direct seeding and planting. Revegetation will be employed as a stabilisation measure where riparian vegetation communities are disturbed or recreated during construction.

Ground cover will be established at disturbed sites as soon as possible after respreading of topsoil during reinstatement. Ground cover can include organic material, leaf litter, mulch, hydromulch, living or dead plant material, rocks, logs, other woody materials or erosion control materials. Disturbed areas may be sown with a cover crop immediately following topsoil respreading. The following sections discuss the revegetation methods implemented for different land uses to meet the rehabilitation objectives and the acceptance criteria.

4.3.1 Cover Crop

Seeding with a sterile cover crop may be undertaken at reinstatement to rapidly establish vegetation cover to stabilise disturbed land and minimise potential erosion.

4.4 On-going Maintenance Program

4.4.1 Weed Management

Previous field assessments by Ecological Engineering in 2021 have confirmed the presence of 15 weed species and no declared species under the Biosecurity Act.

Weed control will occur before clearing and construction activities to minimise the spread of weed species. Weed control, consistent with the Revegetation Plan and the objectives of this Rehabilitation Management Plan, will continue throughout the rehabilitation phase.

Herbicide application will be the preferred method of weed control throughout the site, including in rehabilitation areas. The use of chemicals in rehabilitation areas will be undertaken by licensed professionals with verified specific experience in native plant and weed identification. All chemical weed control will follow the registered label or current minor use permit, Material Safety Data Sheet (MSDS) and appropriate safety standards. Chemical use in the vicinity of waterways will be restricted to herbicides and adjuvants registered for use in or near aquatic environments.

Unless carefully planned, implemented, and monitored, chemical weed control operations pose a substantial risk to successful natural regeneration processes. Planning considerations relevant to weed control operations in natural or assisted rehabilitation areas include:

- Selection of personnel based on demonstrated experience and skill in selective weed control methods in regeneration areas;
- Timing of proposed application to recent or planned rehabilitation works;
- Weed control techniques in rehabilitation areas are selected to promote germination and recruitment of native species, reduce competition from non-native species and avoid harmful effects on rehabilitation progress.

Implementation phase controls include:

- Avoidance of spraying in conditions conducive to chemical drift (windy conditions);
- Use of low drift air-induction nozzles (or similar) operating at minimal pressures to avoid the generation of fine spray droplets;
- Use of spray adjuvants designed to reduce drift and enhance efficacy at lower concentrations;
- Use of plant shields or nozzle shields;
- Personnel to carry spray bottle on a belt with clean water to immediately wash off accidentally over-sprayed native vegetation;
- Avoidance of broad-spectrum chemical application in areas of active erosion.

Monitoring measures include:

- Adapt the RMP to inform the weed control program (presence of particular weeds and native species to enable specific weed control planning);
- Monitoring and reporting of non-conformances associated with detrimental impacts of weed control on rehabilitation progress;
- Focus on the adaptation of weed control program to include rehabilitation goals in addition to declared species;
- Communication of positive and negative monitoring outcomes to weed control operators to enable adaptive management of weed control operations.

4.4.2 Maintenance and Corrective Actions

Following rehabilitation works, limited access to infrastructure will be allowed to perform essential maintenance. All other traffic is prohibited on topsoil areas and must remain off the rehabilitation areas to successfully establish groundcover.

Monitoring following the RMP will identify where performance criteria are at risk of not being met, including:

- Topsoil respreading success;
- Subsidence or slumping;
- Erosion and sedimentation;
- Poor ground cover;
- Lack of germination or recruitment as a result of topsoil respreading issues;
- Stressed or poorly performing marine plants.

Where further rehabilitation works are required, the following may be undertaken depending on the situation:

- Re-contouring of erosion control measures, reseeding, or reinforcement of scour protection on banks damaged during flood activity;
- Implementing appropriate erosion and sediment control measures where existing standards are found to be inadequate;
- Additional revegetation is subject to assessing natural regeneration, topsoil respreading success and seasonal factors.
- Application and upkeep of plant protection measures where necessary, including guards and animal deterrents;
- Backfilling of subsidence depressions and revegetation;
- Supplementary weed control where rehabilitation progress is inhibited by competition;
- Fencing of rehabilitation areas where necessary to exclude the public temporarily, in consultation with residents.

All maintenance works will be conducted in consultation with the relevant stakeholders.

Follow-up watering may be undertaken in planted areas or where particular species have been translocated where rainfall is insufficient to achieve successful rehabilitation outcomes.

5 REHABILITATION ASSESSMENT AND COMPLETION

Assessment of reinstatement and rehabilitation completion will be undertaken at specified intervals throughout the rehabilitation phase to sign off completed sections of the site to TCC or reach an agreement on specific management actions necessary to attain sign off at a later assessment inspection.

It is acknowledged that progress in the rehabilitation of disturbed areas of native vegetation will continue for years. Therefore the final acceptance criteria as stipulated in any approvals for the Project do not apply to the Contract.

Revegetation and rehabilitation are considered complete when all performance criteria outlined in the revegetation Plan have been met to the reasonable satisfaction of the Parties and consistent with the time frame provided for in the Contract for the performance of the revegetation works by the Contractor.

It is understood that, after this phase, the long-term rehabilitation of the site will be managed and maintained by TCC.

6 REFERENCES

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Earth Environmental 2021, *Marine Plants Regulated Vegetation*, prepared for Townsville City Council

Ecological Engineering 2021, *Wes Barrett Park: Vegetation Assessment Report,* prepared for Townsville City Council, Townsville.

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Hopkins, E., White, M. and Clarke, A. (1998) *Restoration of Fish Habitats: Fisheries Guidelines for Marine Areas*, Department of Primary Industries, Queensland, Fish Habitat Guideline FHG 002, 44 pp.

Neldner, V.J., Wilson, B.A., Thompson, E.J. and Dillewaard, H.A. 2012, *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*, Version 3.2, Updated August 2012, Queensland Herbarium, Queensland Department of Science, Information Technology, Innovation and the Arts, Brisbane.

Pollock, A.B. (ed.) 2018, *Technical Descriptions of Regional Ecosystems of the Brigalow Belt North*, Queensland Herbarium, Department of Environment and Science, Brisbane (March 2018).

Queensland Government 2014, *Queensland Environmental Offsets Policy: Significant Residual Impact Guideline*, Department of Environment and Heritage Protection, Brisbane.

Queensland Herbarium 2016, *Regional Ecosystem Description Database (REDD*), Version 10.0 (December 2016), Department of Science, Information Technology and Innovation (DSITI), Brisbane

1 APPENDIX 1 – REVEGETATION PLAN

Ross River Riparian Recovery Program: Wes Barrett Park - Revegetation Plan

Works proposed external to the Priority Development Area are not approved through this approval .

AMENDED IN RED
By: Brandon Bouda
Date: 09 May 2022

Queensland Government

DRAWING No.	DESCRIPTION
LP-001	Title sheet
LP-002	Landscape plan - existing
LP-003	Planting plan
LP-004	Planting schedule
LP-005	Revegetation specifiction
LP-006	Revegetation specifiction
LP-007	Revegetation specifiction & planting details
LP-008	Planting palette

PRIORITY DEVELOPMENT AREA (PDA) BOUNDARY

REV	DESCRIPTION	APPROVAL	DATE
D	FOR CONSTRUCTION		18.04.2022
C	FOR CONSTRUCTION		29.03.2022
B	FOR CONSTRUCTION		17.11.2021
A	DRAFT		11.11.2021

CLIENT: **Townsville City Council**

TITLE: **Ross River - Wes Barrett Park - Revegetation Plan**

PROJECT ADDRESS: **Wes Barrett Park / Ross River**
Idalia/Oonoonba QLD 4811
Lot 905 SP 189833
Lot 1299 SP 286570

Project No.	21-009
Drawing No.	LP-001
Revision	D

City of Townsville

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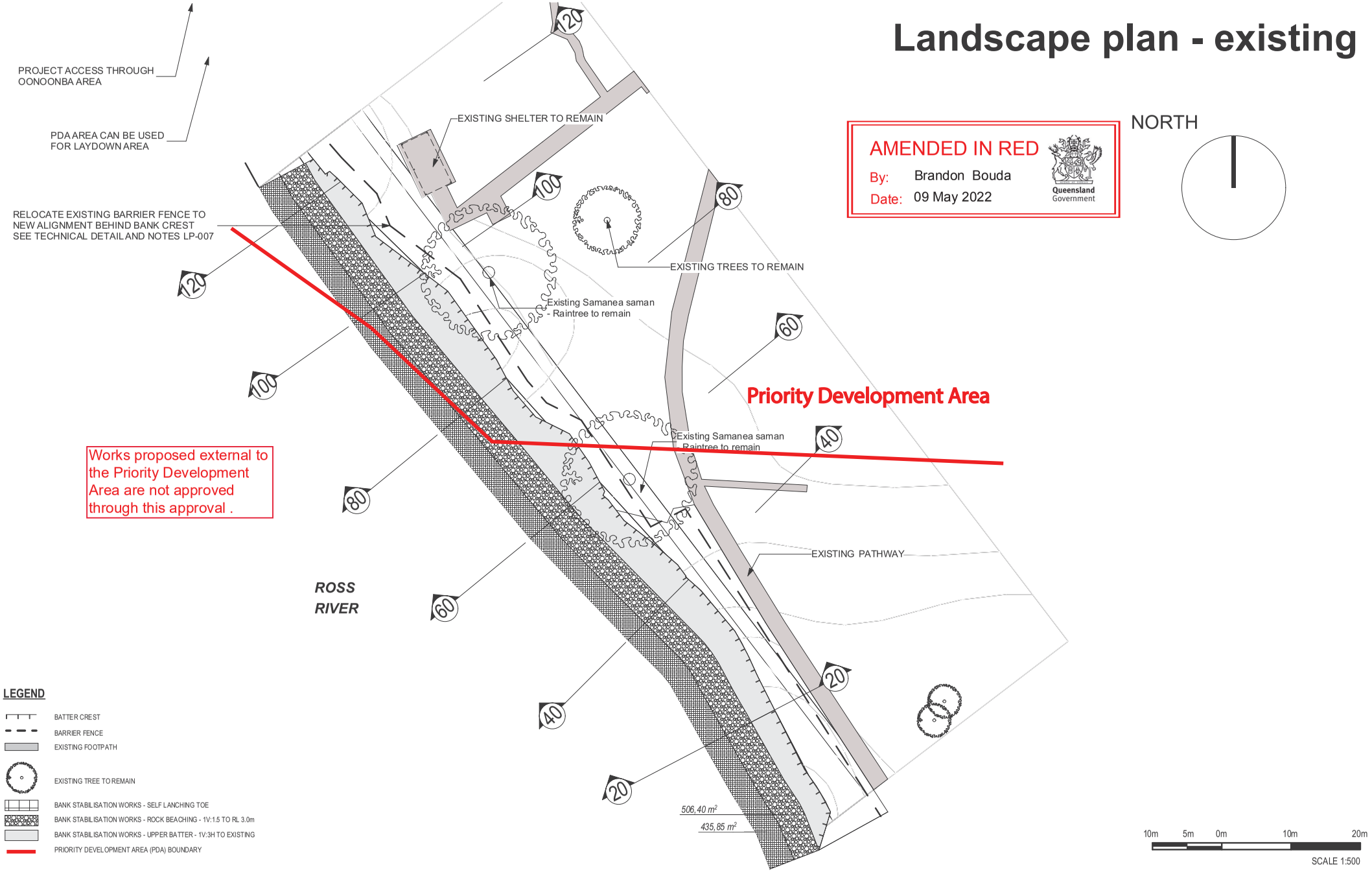
Landscape plan - existing



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Lot 1299 SP 286570

Project No.	21-009
Drawing No.	LP-002
Revision	D

City of Townsville

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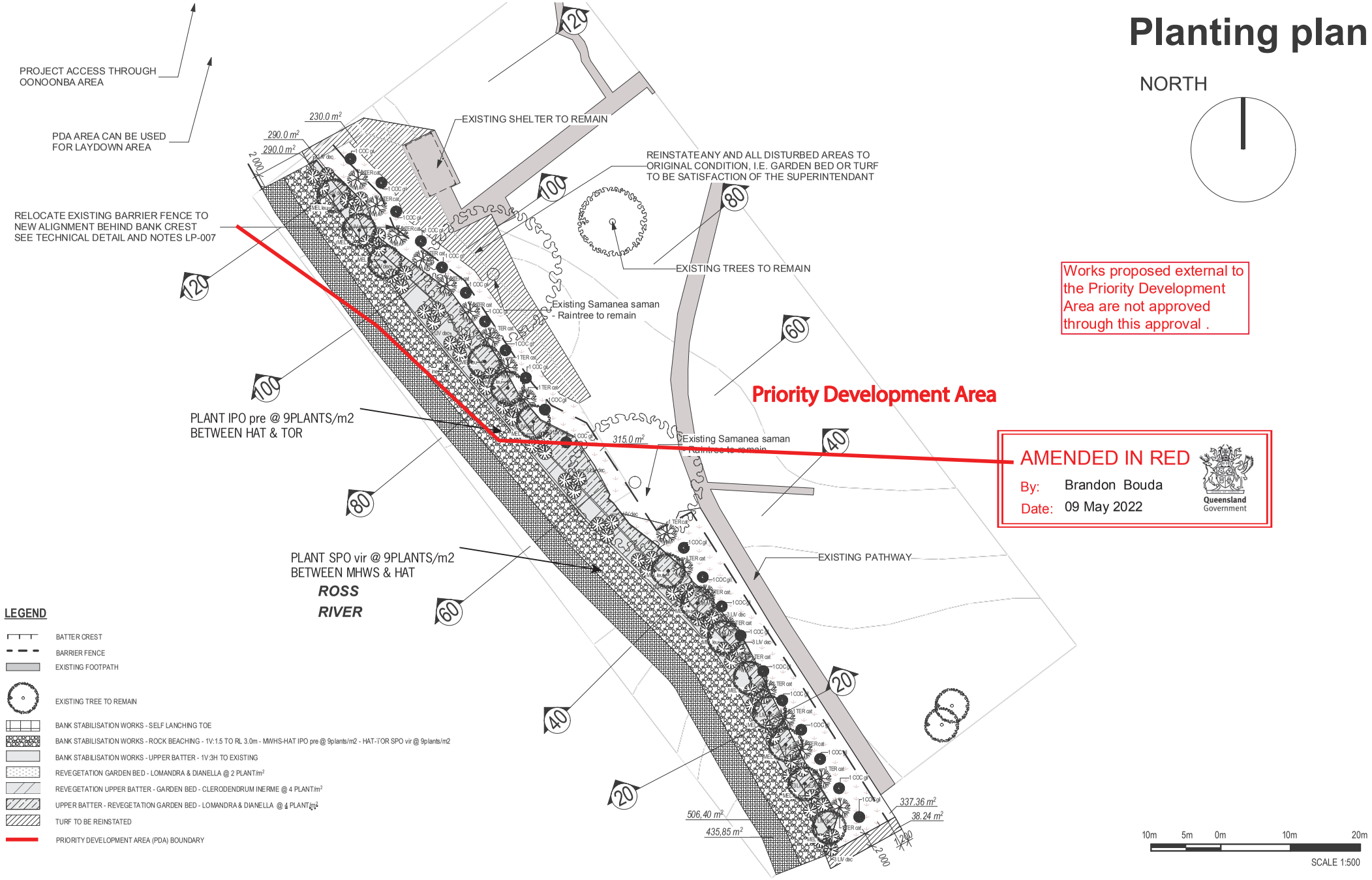
Planting plan



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LEGEND

- BATTER CREST
- BARRIER FENCE
- EXISTING FOOTPATH
- EXISTING TREE TO REMAIN
- BANK STABILISATION WORKS - SELF LANCHING TOE
- BANK STABILISATION WORKS - ROCK BEACHING - 1V:1.5 TO RL 3.0m - MWHS-HAT IPO pre @ 9plants/m2 - HAT-TOR SPO vir @ 9plants/m2
- BANK STABILISATION WORKS - UPPER BATTER - 1V:3H TO EXISTING
- REVEGETATION GARDEN BED - LOMANDRA & DIANELLA @ 2 PLANT/m²
- REVEGETATION UPPER BATTER - GARDEN BED - CLERODENDRUM INERME @ 4 PLANT/m²
- UPPER BATTER - REVEGETATION GARDEN BED - LOMANDRA & DIANELLA @ 4 PLANT/m²
- TURF TO BE REINSTATED
- PRIORITY DEVELOPMENT AREA (PDA) BOUNDARY

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Lot 905 SP 189833
Lot 1299 SP 286570

Project No.	21-009
Drawing No.	LP-003
Revision	D

City of Townsville

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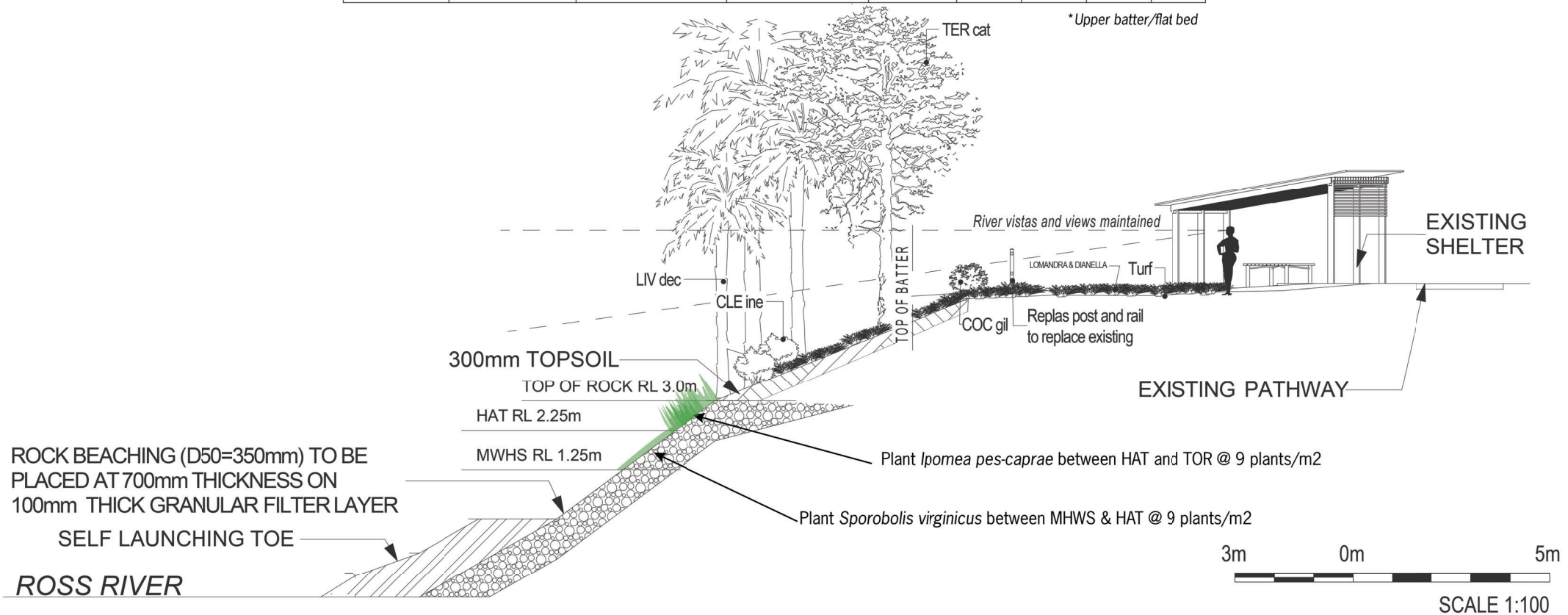
Planting schedule

PLANTING SCHEDULE								
PLANT TYPE	PLANT SYMBOL	BOTANICAL NAME	COMMON NAME	POTSIZE	CCS	SARA	PDA	TOTAL
Groundcovers								
	CLE ine	*Clerodendrum inerme*	Glory bower	Tube	500mm	762	358	1,120
	DIA cae	*Dianella caerulea*	Blue flaxlily	Tube	500*/1,000	843	397	1,240
	IPO pes	*Ipomea pes-caprae*	Goats foot	Tube	300mm	995	469	1,463
	LOM lon	*Lomandra longifolia*	Mattrush	Tube	500*/1,000	843	397	1,240
	SPO vir	*Sporobolis virginicus*	Saltcouch	Virocell	300mm	1377	648	2,025
Trees								
	COC gil	*Cochlospermum gillivraei*	Kapok	Tube	5m	11	10	21
	LIV dev	*Livistona decora*	Weeping cabbage palm	Tube	Indicated	17	37	54
	MEL leu	*Melaleuca leucadendra*	White paperbark	Tube	Indicated	4	10	14
	TER cat	*Terminalia cattapa*	Indian beach almond	Supertube	Indicated	12	8	20

*Upper batter/flat bed



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Lot 905 SP 189833
Lot 1299 SP 286570

Project No.	21-009
Drawing No.	LP-004
Revision	D

City of Townsville

ECOLOGICAL ENGINEERING

REVEGETATION SPECIFICATION

SEQUENCE OF OPERATIONS

Unless otherwise detailed in the Drawings the sequence of operations must be:

1. **WEED CONTROL**
2. **CLEARING AND TOPSOIL STRIPPING**
3. **PREPARATION OF BATTERS AND GROUND SURFACES**
4. **MULCH SPREADING**
5. **PLANTING**
6. **ESTABLISHMENT OF VEGETATION**
7. **MONITORING**
8. **AS BUILT HANDOVER**
9. **FINAL COMPLETION**

1. WEED CONTROL

a. The Contractor must implement an approved weed control program, and as necessary to control all weed species prior to undertaking any other works.

b. Any changes to the timing and sequence of weed control operations must be confirmed with the Revegetation Superintendent

c. Existing plants to be retained and new planting areas must be protected during any herbicide spraying, if necessary, by fitting guards onto spray units or around existing plants.

d. The Contractor must exercise absolute care in the application of herbicide to avoid spray drift onto private property or public thoroughfares.

e. For spot spraying a non-toxic, water-soluble, biodegradable coloured dye must be added to the herbicide spray mix that will be clearly visible for at least 48 hours after the herbicide application.

f. Treated areas must remain undisturbed for two weeks or as recommended by the herbicide manufacturer.

2. CLEARING & TOPSOIL STRIPPING

a. Existing vegetation and topsoil must be removed where nominated in the Civil Drawings. All clearing, stockpiling and treatment of cleared vegetation must be undertaken in accordance with civil design instructions.

b. Where nominated in the Civil Drawings or as specified, the Contractor must undertake the lifting, transport and storage of selected vegetation using accepted industry practices. The replanting of this vegetation must be in accordance with this Specification at the locations as shown in the Drawings (if any).

c. The Contractor must remove tree trunks nominated for salvage (if any) as specified in the Drawings and ensure that the tree trunks are not broken by equipment during removal, transport or placement.

d. Unless specified otherwise in the Drawings, the Contractor must place nominated tree trunks (if any) salvaged from clearing operations and retained for use as fauna habitat logs or in the revegetation works parallel to the contours.

3. PREPARATION OF BATTERS AND GROUND SURFACES

a. All areas nominated for revegetation must be cleared of all surface rubbish and any material that may hinder plant growth before any further surface preparation works are commenced.

b. **Cultivate:**

i. All areas nominated for revegetation must be cleared of all surface rubbish and any material that may hinder plant growth before any further surface preparation works are commenced.

ii. The Contractor must prepare all nominated finished soil surfaces where necessary by ripping, raking, tracking or other means to form a loose and roughened surface in preparation for other revegetation works to a minimum depth of 300 mm and at not more than 500 mm spacing or as otherwise specified in the Drawings.

iii. Surface preparation must be carried out along the contour.

iv. Benched and stepped batters must not be ripped prior to topsoil/mulch respread.

v. The Contractor must protect all finished and prepared soil surfaces from soil erosion and weed infestation as necessary until further revegetation works can occur or a Certificate of Practical Completion has been issued.

c. **Soil Conditioning/Fertiliser:**

i. Apply Humisoil (or equivalent) at a rate of 1kg/m2 (1t/100m3 for stockpile amelioration).

d. **Topsoiling:**

i. Approved site suitable topsoil and/or imported topsoil (as specified) must be respread as soon as practical following construction operations.

ii. Where suitable spoil has been identified from the works this must be spread first, followed by the topsoil. Topsoil must be uniformly spread over the nominated finished and prepared ground surfaces to the depth, levels and slope as shown in the Drawings.

iii. As specified in the Drawings minimum depths of Topsoil required are:

a.	Upper Batter	300mm
b.	Overbank	200mm

4. MULCH SPREADING:

a. Unless detailed otherwise in the Drawings, the Contractor must spread approved mulch (as specified) as soon as is practical after surface preparation, topsoiling, soil improvements, and the placement of weed control or erosion control matting.

b. Unless otherwise specified or detailed in the Drawings, mulch must be placed before any planting.

c. If a rainfall event occurs before the mulch can be spread, creating soil erosion, the Contractor must replace the eroded material and prepare the soil surface before spreading the mulch.

d. If not specified in the Drawings a nominal depth of 100 mm must be placed.

e. Mulch must be uniformly spread over the ground surface to an even depth by hand or machine and if required the surface raked to present an even surface.

f. Unless specified otherwise the Contractor must apply fertiliser over mulch that has not been aged for at least three months, to neutralise any potential soil nitrogen loss.

g. Unless specified otherwise in the Drawings or if being used as a soil improver, mulch must not be mixed in with the in-situ soil or buried in the soil during the spreading operations.

h. The Contractor must avoid spreading mulch on plants, structures, roadways, and paths, road shoulders and grassed areas and leave the site in a neat, clean condition. Mulch must not be placed closer than 150 mm from the stem of any existing vegetation or new plantings. Existing vegetation or new plants accidentally covered by mulch must be uncovered as soon as possible.

5. PLANTING:

a. **Plant Supply:**

i. All plants to be supplied to the Contractor by the Principal.

ii. The Contractor must ensure all supplied plants are in good condition and:

1. The root system must be fibrous and firmly established but not root bound and with no large roots growing out of the container.
2. The root mass must retain its shape and hold 90% of the root ball material when removed from the container.
3. Leaves must be of normal size, colour and texture for the specified species.

iii. No substitutions can be made without written approval from the Superintendent. Any proposed substitutions must include details of the species, size, number and be forwarded to Superintendent consider the substitutions not adequate then the originally specified plants must be grown and planted in the following planting season.

iv. **The purchase of plants must not occur until the Superintendent approves the list of plant supply. (HOLD POINT).**

b. **Ready to Plant:**

i. **Not less than 5 working days prior to commencing any planting operations on site, the Contractor must certify to the Superintendent that:**

1. **The nominated areas for planting are correctly defined.**
2. **No obstructions, obstacles, hazards or factors likely to cause delays or failures of the operations have been identified.**
3. **The soil surfaces are ready for the planting operations.**
4. **Adequate soil moisture content is present for planting.**
5. **All staff are competent, experienced, and skilled in planting operations.**
6. **A program for the planting operations is documented and submitted for approval.**

ii. **The Contractor must confirm with the Superintendent any changes to the operations that may be necessary following approval. (HOLD POINT)**

c. **Setting out Plants:**

i. The Contractor must set out individual plants within a planting area in accordance with the spacings, layout and setbacks shown in the Drawings.

ii. If the placement of transplanted materials or advanced plants is not nominated in the Drawings, the Contractor must request the Superintendent for direction on Site prior to setting out and planting.

d. **Planting Out:**

i. Prior to any planting into erosion or weed control matting, each individual planting hole must be prepared by first slitting open and laying back the matting to allow for each planting hole to be excavated and prepared for planting.

ii. Prior to planting any mature plants into mulch, each individual planting hole must be prepared by first moving clear sufficient mulch to allow for each planting hole to be excavated and prepared for planting and space for the excavated soil.

iii. For each planting hole any substandard excavated material or excess soil must be spread evenly around the planting hole, used to create a watering well around the plant or disposed of as specified.

iv. The planting hole must be excavated vertically to accommodate the root ball of the plant, such that the top of the plant root ball finishes below the existing ground surface and creates a watering saucer suitable for the size of the plant.

v. If necessary, the base of the hole must be broken up to a minimum depth of 100 mm and the sides of the planting hole loosened.

vi. Individual plants must be removed from containers so as to minimise damage to leaves, stem and root ball.

vii. The root ball of plants must not be left exposed or allowed to dry out and planted without delay.

viii. Plants must not be planted into standing water within an individual planting hole.

ix. Individual plants must be placed in the centre of the planting hole and set plumb. The backfill must be firmed progressively after placing to eliminate air pockets and minimize settlement. After firming and settlement the top of the root ball must be covered with soil and sit below the finished lowest level of the surrounding watering saucer shaped during planting.

x. The outside lip of the watering saucer must be approximately three times the diameter of the plant container and capable of holding a sufficient volume of water necessary for any follow-up watering for the plant container size. When planting on batter slopes a raised horizontal terrace must be formed as a watering saucer, down slope and equal to the diameter of the planting hole.

xi. Frayed or broken roots of bare rooted plants must be cut cleanly before planting.

xii. Fertiliser as specified in 3a. must be blended through each

REV	DESCRIPTION	APPROVAL	DATE
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C	FOR CONSTRUCTION		29.03.2022
B	FOR CONSTRUCTION		17.11.2021
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CLIENT: **Townsville City Council**

TITLE: **Ross River - Wes Barrett Park - Revegetation Plan**

PROJECT ADDRESS: **Wes Barrett Park / Ross River**
Idalia/Oonoonba QLD 4811
Lot 905 SP 189833
Lot 1299 SP 286570

Project No.	21-009
Drawing No.	LP-005
Revision	D

City of Townsville

ECOLOGICAL ENGINEERING

planting hole in accordance with good horticultural practice.

xiii. Mulch must be respread so that the mulch tapers down to soil level 25 mm from the stem of the plant.

xiv. Plants must be watered in immediately after planting, sufficient to thoroughly saturate the soil to twice the area of the root ball.

e. **Completion of Works**

i. Prior to completion of the works the Contractor must remove all rubbish and surplus materials accumulated during construction and the Site must be left in a neat and tidy condition.

ii. Prior to the commencement of the 13 week Establishment Period the Contractor must ensure that:

1. As constructed drawings detailing all seeding, planting and grassing works are signed by a suitably experienced and qualified person, in environmental, botanical, horticultural and/or related fields who is familiar with Council requirements, have been prepared and presented to the Superintendent.

2. A Vegetation Establishment Program for the Works is documented and submitted to the Superintendent for approval.

3. A monitoring program for the Works is documented and submitted to the Superintendent for approval.

iii. The Contractor must give the Superintendent at least 7 days' notice that the works are ready to be inspected for completion.

iv. **The Contractor must certify to the Superintendent that all the revegetation and landscaping works have been completed in accordance with the requirements of the Contract and the Vegetation Establishment Program has commenced before seeking approval to commence the Establishment Period. (HOLD POINT)**

6. VEGETATION ESTABLISHMENT

a. The Contractor must establish and monitor the condition and development of the Works during the 13 week Establishment Period.

b. Prior to commencing the Establishment Period, the Contractor must provide to the Superintendent for approval, a detailed program of all activities including timing to be undertaken by the Contractor to establish the vegetation in accordance with this Specification.

c. The approved Vegetation Establishment Program must include at least one fortnightly inspection of the Works and the Contractor must notify the Superintendent of any vandalism of the Works, any faults or defects to irrigation, or any other damage within 5 days of detection.

d. The Contractor must be responsible for the operation, inspection and maintenance of any irrigation system until the end of the Establishment Period for the Works. The Contractor must adjust the height of all sprinkler heads, valve boxes and any other associated plant and equipment as directed by the Superintendent during the irrigation warranty period.

e. The designated activities to establish the works must include but not be limited to:

i. Progressive weed control.

ii. Inspections.

iii. Repair and replace any erosion rills in soil surfaces.

iv. Repairs and replacement of damaged or failed areas of seeding or hydromulching or hydroseeding.

v. Replacement of plants that have failed.

vi. Watering of all plantings as necessary.

vii. Maintenance of trees and groundcovers.

f. Water must be applied to all plants as often and in sufficient amount as conditions may require keeping the plants in a healthy and growing condition until the end of the Vegetation Establishment Period.

g. Failed or damaged plants or plants that do not meet the acceptance criteria must be removed and replaced during the Establishment Period to the original plant specifications. The Superintendent may determine this requires an extension of the Vegetation Establishment Period at the Contractor's expense.

7. MONITORING

a. The Contractor must undertake monitoring and fortnightly reporting on the condition and development of the works during the Establishment Period.

b. Prior to commencing the Establishment Period, the Contractor must provide to the Superintendent, a detailed program of all the monitoring and reporting activities including timing to be undertaken by the Contractor.

c. Each monitoring report must:

i. Outline the works undertaken during the reporting period.

ii. Compare development of revegetation with the relevant outcome-based completion criteria.

iii. Identify any follow up remedial works to be undertaken.

iv. Set out a program for the remedial works.

v. Photos from agreed photo monitoring points.

d. Electronic copies of each report must be supplied to the Superintendent within 14 days of the end of the reporting period.

e. The final monitoring report at the end of the Vegetation Establishment Period must be included in the Hand-over report submitted at Final Completion.

8. AS BUILT HANDOVER

a. The Contractor must be responsible for preparing reproducible as constructed drawings of the works in accordance with the specification,

b. As Constructed Drawings must be completed detailing all seeding and planting works signed by a suitably experienced and qualified person, in environmental, botanical, horticultural and / or related fields who is familiar with tropical revegetation.

c. The hand-over report must include:

i. The Final Monitoring Report.

ii. Record any outstanding defects for correction and the proposed timing.

iii. Provide a summary of activities undertaken during the Establish ment Period and detail the recommended ongoing maintenance activities for the Contract area.

9. FINAL COMPLETION

a. The Contractor must give the Superintendent at least 7 days' notice that the works are ready to be inspected at the end of the Establishment Period.

b. Acceptance of the works by the Superintendent at the end of the nominated Vegetation Establishment Period, shall be subject to:

i. Satisfactory preparation and submission of monitoring reports.

ii. Satisfactory preparation and submission of As Constructed Drawings.

iii. Satisfactory completion of all additional maintenance and remedial works as directed by the Superintendent.

iv. The revegetation Works meeting the completion criteria for final completion.

REV	DESCRIPTION	APPROVAL	DATE
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CLIENT: **Townsville City Council**

TITLE: **Ross River - Wes Barrett Park - Revegetation Plan**

PROJECT ADDRESS: **Wes Barrett Park / Ross River**
Idalia/Oonoonba QLD 4811
Lot 905 SP 189833
Lot 1299 SP 286570

Project No.	21-009
Drawing No.	LP-006
Revision	D

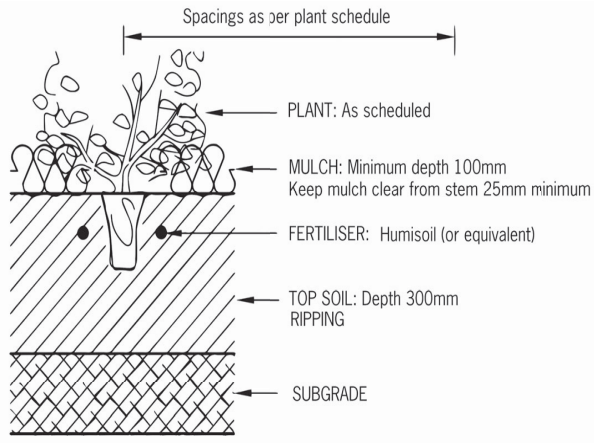
City of Townsville

ECOLOGICAL ENGINEERING

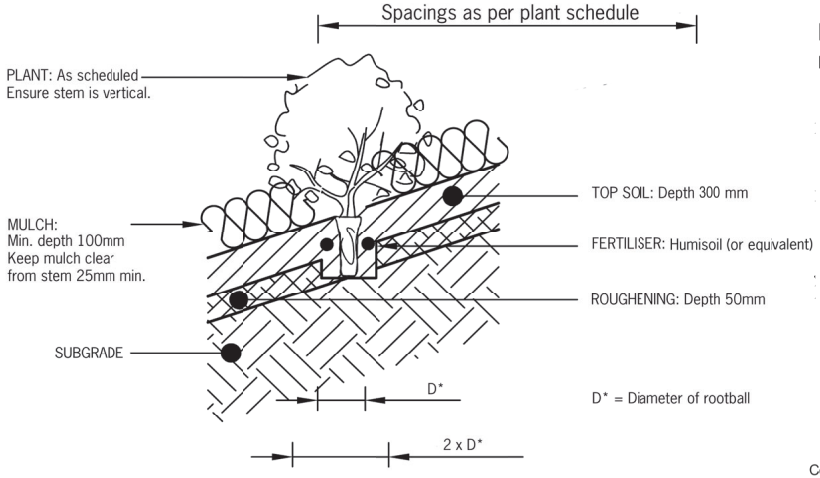
Revegetation specifiction & planting details

1 BILL OF QUANTITIES			
ITEM	DESCRIPTION	QUANTITY	UNIT
	300mm TOPSOIL	396	m3
	ROCK BEACHING (D50=350mm) TO BE PLACED AT 700mm THICKNESS ON 100mm THICK GRANULAR FILTER LAYER	refer Civil BOQ	m3
	SELF LAUNCHING TOE	refer Civil BOQ	m3
	BANK STABILISATION WORKS - ROCK BEACHING - 1V:1.5 TO RL 3.0m	refer Civil BOQ	m^2
	BANK STABILISATION WORKS - SELF LANCHING TOE	refer Civil BOQ	m^2
	BARRIER FENCE	130	m
	REVEGETATION GARDEN BED - LOMANDRA & DIANELLA @ 2PLANT/m^2	680	m^2
	UPPER BATTER REVEGETATION GARDEN BED - CLERODENDRUM INERME @ 4 PLANT/m^2	280	m^2
	UPPER BATTER - REVEGETATION GARDEN BED - LOMANDRA & DIANELLA @ 4 PLANT/m^2	280	m^2
	TURF TO BE REINSTATED	285	m^2
	REVEGETATION GARDEN BED - ROCK BEACHING - MHWS-HAT SALTCOUCH @ 9PLANT/m^2	225	m^2
	REVEGETATION GARDEN BED - ROCK BEACHING - HAT-TOR GOATS FOOT @ 9PLANT/m^2	163	m^2

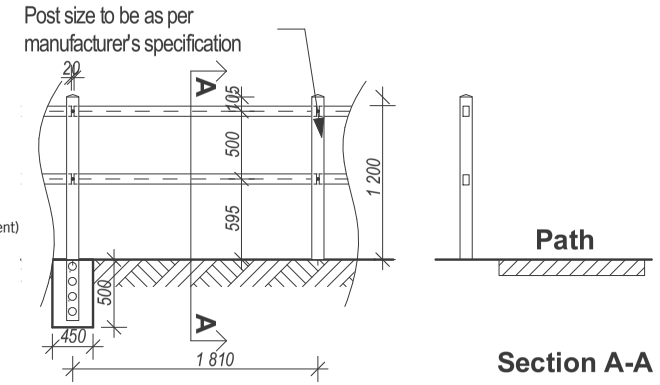
Tubestock less than 1 on 4 revised



Tubestock more than 1 on 4 revised



Detail for the Replas fence construction



Construction notes:
1. Rails to be salvaged from the existing (new to be supplied by contractor as needed)
2. New posts to be supplied by contractor (old posts to be removed and disposed of)
3. Top of rail height to be 1.2 m
4. Rail spacing to comply with design guide and manufacturer's specification
5. Post size to be as per manufacturer's specification
6. Posts to have minimum 500 mm embedment in concrete
7. Holes to be minimum 450 mm diameter and 200 mm deeper than bottom of post
8. Engineering certification of fence detail and construction to be by coordinated by the contractor

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PROJECT ADDRESS: **Wes Barrett Park / Ross River**
Idalia/Oonoonba QLD 4811
Lot 905 SP 189833
Lot 1299 SP 286570

Project No.	21-009
Drawing No.	LP-007
Revision	D

City of Townsville

ECOLOGICAL ENGINEERING

Planting palette

Clerodendrum inerme

Clerodendrum inerme

Cochlospermum gillivraei

Cochlospermum gillivraei

Dianella caerulea

Dianella caerulea

Livistona decora

Lomandra longifolia

Melaleuca leucadendra

Melaleuca leucadendra

Ipomea pes-caprae

Sporobolis virginicus

Terminalia cattapa

Terminalia cattapa

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REV	DESCRIPTION	APPROVAL	DATE

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Townsville City Council

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Lot 1299 SP 286570

Project No.	21-009
Drawing No.	LP-008
Revision	D

City of Townsville

ECOLOGICAL ENGINEERING

2 APPENDIX 2 – REHABILITATION MONITORING PROGRAM

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REHABILITATION MONITORING PROGRAM

1. Introduction

This Rehabilitation Monitoring Program (RMPr) has been developed to monitor the progress and success of rehabilitation detailed in the Rehabilitation Monitoring Plan (RMP).

2. Baseline Assessment

2.1. Pre-clearance Surveys

Before clearing the site and associated areas, the pre-disturbed conditions will be subject to an ecological assessment (pre-clearance survey). The aim of the ecological assessment is to establish baseline data on the condition of the site. In addition to the original assessment data (**section 3.2**) and the condition of the surrounding landscape, the baseline data is used to inform site rehabilitation, as described in the RMP. Much of the baseline data has already been collected and documented in the relevant ecological reports or captured as spatial data and include:

- Declared weeds (pre-clearance survey reports);
- Waterways and drainage lines (pre-clearance survey reports);
- Soil suitability and erosion potential; and
- Marine plants (pre-clearance survey reports).

2.2. Photo Monitoring Sites

Photo monitoring sites will be established at key locations before disturbance to monitor the rehabilitation progress of disturbed sites. These sites will be identified using pre-clearance data and detailed in the Revegetation Plan **Appendix 1**. Photo monitoring sites will be permanent locations that are assessed regularly. Photo monitoring forms are included in **Appendix 3**. A photo monitoring site layer is maintained and updated by either TCC or their Restoration/Landscape Ecologist and is available in map or spatial data format. Photo monitoring is conducted per Ecological Engineering's Photo Monitoring Procedure (**Appendix 4**).

3. Performance Criteria

The RMPr has been developed to monitor specific success criteria), as detailed in section 3.1 (of the main report). Aspects of the RMPr about each of the agreed criteria are set out in the following table:

APPENDIX 1 TABLE 1 - PERFORMANCE CRITERIA

No	Element	Performance Criteria Final - (F), Progressive - (P)	Contractor's Success Criteria*
1	Rehabilitation	Rehabilitation is commenced immediately upon completion of Civil Works. (P)	Rehabilitation is commenced no later than one-month post-civil works.
2	Landform	Landform is safe for humans and fauna (F)	The landform is safe for humans and fauna, as measured by photo monitoring points, Visual Inspection Monitoring Forms and TCC- Contractor field inspections: Reinstated site is stable and exhibits negligible movement of soil, surface organic litter, rock etc. • Reinstated site exhibits negligible erosion or subsidence • Sloping areas of the site have sufficient cross-contour erosion control methods in place (e.g. cross-contour drains, logs, erosion control mesh/matting etc.) that are well maintained and functional in preventing movement of soil and other material • Vehicle tracks retained for maintenance purposes are kept free from debris, erosion and other hazards, with erosion controls in place • Reinstated fauna habitat features (habitat logs, rocks etc.) are installed securely and do not represent a hazard from collapse or movement, • No waste materials/ litter/contamination associated with construction activities to be left on site
		Reshape land to a stable landform (P) with no subsidence or erosion gullies for at least three years (F)	disturbed land will be reshaped to a stable landform consistent with pre-disturbed landscape and surrounding landscape, measured by photo monitoring points, Visual Inspection Monitoring Forms and TCC- Contractor field inspections
3	Soils	Reinstate the top layer of the soil profile (P).	Topsoil is managed per the Revegetation Specification for the period until rehabilitation completion. This means: Topsoil is stockpiled within site during construction. Topsoil is reinstated evenly before rehabilitation.
		Actual or potential acid sulphate soils are not disturbed, are submerged or are treated appropriately if disturbed (P)	ASSs that are disturbed are treated per the Acid Sulfate Management Plan for the period until rehabilitation completion. Environmental impacts resulting from disturbed ASSs will be rectified to a condition accepted by TCC.
4	Erosion	Significantly disturbed land must be vegetated with ground cover to minimise erosion (P).	Ground cover will be established at disturbed sites as soon as possible after respreading of topsoil. High-risk erosion areas (areas greater than 20° slope) will have ground cover reinstated within ten days of topsoil respreading. Ground cover can include organic material, leaf litter, mulch, hydromulch, living or dead plant material, rocks, logs, other woody materials or erosion control materials.
		The site must exhibit no subsidence or erosion gullies for the five years of the Rehabilitation Plan.	All disturbed land will be reshaped to a stable landform consistent with pre-disturbed landscape and surrounding landscape, measured by photo monitoring points, Visual Inspection Monitoring Forms and TCC- Consultant field inspections.
5	Marine plants Composition, structure, and foliage cover	Vegetation of floristic species composition found in original sites must be established (P).	Marine plants sites below HAT undergoing rehabilitation show regeneration of species found in pre-clearing data, relevant original sites, and surrounding vegetation community.
		All significantly disturbed land is reinstated so that the distribution of marine plants represents the original site. (F)	Weed cover is the same or less than that for surrounding undisturbed land, measured by VRA Forms and TCC- Contractor field inspections. Weed species richness is the same or less than that for surrounding undisturbed land, measured by VRA Forms and TCC- Contractor field inspections.
		All dominant species within each strata are re-established at densities similar to the original site (F).	No weed species are present on disturbed lands that are not present on surrounding undisturbed land, measured by VRA Forms and TCC- Contractor field inspections.
		A minimum of 100% foliage cover is observed compared to the relevant original site (F).	Appropriate maintenance activities, including weed control and watering revegetated areas as required, are conducted within regenerating vegetation communities such that harmful effects on progressive rehabilitation criteria are avoided or negligible, including factors relating to weed competition and damage to regenerating native plants from weed control operations, measured by VRA Forms and TCC- Contractor field inspections.

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4. Post- Construction Monitoring

4.1. Landform, Soil and Erosion

Following reinstatement and respreading of topsoil, visual monitoring of landform, landscape consistency, erosion, and subsidence will be undertaken using the Visual Inspection Form (**Appendix 3**).

Instances of subsidence or erosion observed during monitoring will be recorded, and any corrective actions required/implemented will be documented. Photographs and GPS locations of all observed and rectified erosion will be taken and stored following the monitoring form.

Any erosion areas that develop after reinstatement will be monitored every seven days for 120 days or until stability can be demonstrated.

Permanent photo monitoring sites will be established and monitored regularly until these sites are stabilised.

Photo monitoring sites are identified in **Appendix 1**. Additional photo monitoring points may be established if required.

After significant rainfall events (50mm/24hours), additional monitoring will be undertaken at high-risk areas such as known erosion areas using the Visual Inspection Form.

4.2. Progressive Rehabilitation Monitoring

REVEGETATION AREA MONITORING

Revegetated areas (direct-seeded and planted marine plant areas, including vegetated riparian communities) will be monitored in table 2 to determine critical establishment parameters, including watering requirement, browsing and insect damage.

See **Appendix 3** for the monitoring form applicable to revegetation area monitoring.

After that, regenerating communities and those assisted with revegetation will be monitored every three months using the VRA Form for five years.

Photographs will be taken of regenerating communities every three months.

Photo monitoring sites are identified in the revegetation Plan in **Appendix 1**. Additional photo monitoring points may be established where required.

4.3. Declared Weeds

During quarterly, opportunistic, and vegetation assessments (**Section 4.2**).

The detection of new weeds along the riverbank in previously un-infested areas will be reported to the Environmental Manager. Appropriate corrective actions will be implemented to contain and eradicate new infestations.

Corrective actions may include treating weed infestations and further monitoring.

5. Monitoring Intervals

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APPENDIX 1 TABLE 2 - MONITORING INTERVALS

Rehabilitation Criteria	**Monitoring Type and Frequency**			
	Visual Inspection Monitoring	**Marine Plant Rehabilitation Assessment**	**Revegetation Area assessment**	**Photo monitoring***
Soil and land suitability	Every three months	-	-	Before clear and grade, then every three months after that
Visual consistency with surrounding land surface, drainage lines and contours				
Landform stability and erosion				
Backfilled trench subsidence				
Groundcover				
Marine plant regeneration		Once before three months, then every three months after that	-	Before clear and grade, then every six months after that
Establish revegetated areas (direct seeding/planting), including riparian zones.	-	every three months	Month 1-2: fortnightly	Before clear and grade, then every six months after that
			Months 3- 6: monthly	
			After that, rely on Rehabilitation Assessment	
Declared weeds	Every seven days for 120 days, then monthly after that until stabilised	every three months	-	-

*Photo monitoring conducted at key locations
** Opportunistic monitoring is used to identify non-conformances and corrective actions (other than during monitoring activities). This column indicates the elements that apply to this form of monitoring.

6. Compliance and Corrective Actions

Corrective actions identified through programmed monitoring activities will be implemented and monitored until compliance is obtained.

Corrective actions will be site-specific and may include:

- Reworking the site to reform the land and topsoil to a stable condition;
- Reinstalling erosion and sedimentation control mitigation measures;
- Reseeding or re-establishing groundcover/vegetation;
- Tubestock planting;
- Treating soil;
- Treating weeds;
- Amending watering;
- Establishing fencing/ exclusion areas

Corrective actions will be implemented in response to monitoring outcomes and recorded for reporting purposes.

7. Reporting Requirements

Reporting requirements applicable to the rehabilitation phase of the Project are detailed in **Table 3 and Table 4**. Records and results must be compiled, stored, and made available upon request.

APPENDIX 1 TABLE 3 - REPORTING REQUIREMENTS APPLICABLE TO THE PROJECT DURING REHABILITATION

Requirement	Monitoring Details	Frequency	Date
This plan	Reporting of monitoring undertaken and CARs initiated/closed.	Monthly	With monthly environment report
DAF Condition/s	Detailed report of permanent marine plant loss (if any), including area, species affected, and mapping of affected areas within twelve (12) months of completion of construction.	Once	Within 12 months of practical completion or before Contract completion
TCC/DAF	Summary of previous 12 months of monitoring: dates, times and locations of monitoring, results, non-compliances, evaluation, data analyses, and any other actions undertaken to reduce environmental harm	Annually	Twelve months from practical completion.

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APPENDIX 1 TABLE 4 - REVEGETATION & REHABILITATION PLAN MONITORING SCHEDULE

Performance Criteria	Timeframe					
	ESTABLISHMENT	YR 1	YR 2	YR 3	YR 4	YR 5
Month	3	15	27	39	51	63
Drone Survey	Yes	Yes	Yes	Yes	Yes	Yes
Performance Reporting	Establishment Report	Maintenance Report 1 Submitted	Maintenance Report 2 Submitted	Maintenance Report 3 Submitted	Maintenance Report 4 Submitted	Maintenance Report 5 Submitted
Photo Point Monitoring Month	3	9 & 15	21 & 27	33 & 39	45 & 51	57 & 63
Weed Cover %	< 10%	< 10%	< 10%	< 10%	<5%	<5%
Revegetation Progress – Marine Grasses & Samphire's	<5%	>20%	>40%	>60%	>80%	100%
Revegetation Progress - Riparian	<5%	>20%	>40%	>50%	>60%	>70%
Revegetation Losses	<5%	<5%	<2%	0%	0%	0%
Regeneration Progress - Mangroves	0%	20%	40%	60%	80%	100%
Consider Mangrove Revegetation	No	No	No	Yes	Yes	Yes
DAF Reporting (FHG002) Month	NA	15	27	39	51	63

8. Review

This monitoring plan provides indicative schedules only. On-ground experience may identify the need for a different monitoring regime than that detailed in this plan. Where applicable, this RMPr may be reviewed and updated with relevant information. Any requested changes to the monitoring regime due to on-ground experience will be discussed with TCC before implementation.

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3 APPENDIX 3 – MONITORING TEMPLATES

4 APPENDIX 4 - PHOTO MONITORING PROCEDURE

1. Objective

Photo monitoring is used to represent the progressive change in an aspect of interest visually. TCC will utilise photo monitoring at defined locations in the Revegetation Plan to show progress in site rehabilitation and site stability throughout the post-construction rehabilitation phase of the Project.

2. Locations

Photo monitoring sites are in environmentally significant areas, including areas of existing or likely soil erosion and areas that represent the diversity of vegetation communities impacted by the Project. Locations are determined based on pre-clearance data. Photo monitoring sites are identified on a map and have unique identifiers (for example, Photo Monitoring Site 5 or PM Site 5).

Other significant areas identified during construction by field personnel may require new photo monitoring sites as a Corrective Action.

A dynamic map of the locations of PM sites will be maintained and available (excel file, shapefile or map format).

3. Frequency

Progressive rehabilitation and site stability will be compared with pre-disturbance conditions; therefore, it is necessary to capture baseline photographs before disturbance. Following the disturbance, photo monitoring must be repeated every three (3) months at each location.

4. Responsibilities

Environmental Manager	Consideration of requests for new PM sites based on information received from Field Personnel.
Field Personnel	Carry out photo monitoring following this procedure.
Restoration/Landscape Ecologist	Maintain and update the GIS layer detailing locations and PM site numbers. Produce maps showing PM sites for use by Field Personnel.

5. Planning

For repeat photos, always refer to previous monitoring photos to ensure that frame of reference is identical (take a copy into the field with you).

Equipment needed/used:

- Blank photo monitoring forms (one per site) and a pen;
- Fence dropper and appropriate hammer;
- High visibility spray paint;
- Permanent marker pen;
- Good quality digital camera (or mobile phone), with resolution set to medium to high (aim for image size between 1-3M) and date stamp set to display on image. Where aspect ratio can be adjusted, ensure that aspect ratio is set to 1:1.
- 1.5m height staff / pre-measured stick;
- GPS;
- Compass;
- Measuring tape.

Environmental conditions:

- Avoid rainy days or early mornings/late afternoons, wherever possible.

6. Implementation

- Set permanent marker post to 1.2m height;
- GPS location and record on PM sheet;
- Spray the top of the post and mark with the PM number;
- Use camera in landscape orientation;
- Stand 2m behind marker post;
- Position camera at 1.5m height and as level as possible;
- Ensure the marker post is visible in the centre of the photo;
- For each image, ensure the frame of reference matches the previous shot as closely as possible;

For vegetation communities:

- Take four photos in the north, east, south, and west sequence – do not vary from this sequence. Use the compass to orient a line from your position behind the marker, through the marker post, at precisely 360^0(N), 90^0(E), 180^0(S), 270^0(W).

For erosion areas:

- Take 1 – 4 photos as necessary to capture the extent of erosion in the north, east, south, west directions, as described above;
- Ensure that number of photos matches previous photo monitoring.

For river:

- Take four photos in the sequence of the north, east, south-west, as described above;
- Take one photo upstream and one photo downstream.

Monitoring form:

- Complete all fields as necessary (not all comment fields will be required, depending on feature);
- Ensure that photos are recorded in order of north, east, south and west, going from top to bottom on the monitoring form.

7. Document management and Record-Keeping

Ensure all relevant fields are filled out

Ensure photo file numbers match the photo monitoring form.

Save the photograph image files (jpg) and scanned photo monitoring form (pdf) into the Environmental Field Report Folder located at ……..

Create a new folder for each PM Site.

Naming protocol:

- Image files: *date_PM number* (e.g., *01052022_PM5_6321*)
- Photo monitoring forms (PMF): *date_PM number* (e.g., *01052022_PM5_PMF*).