Appendix M

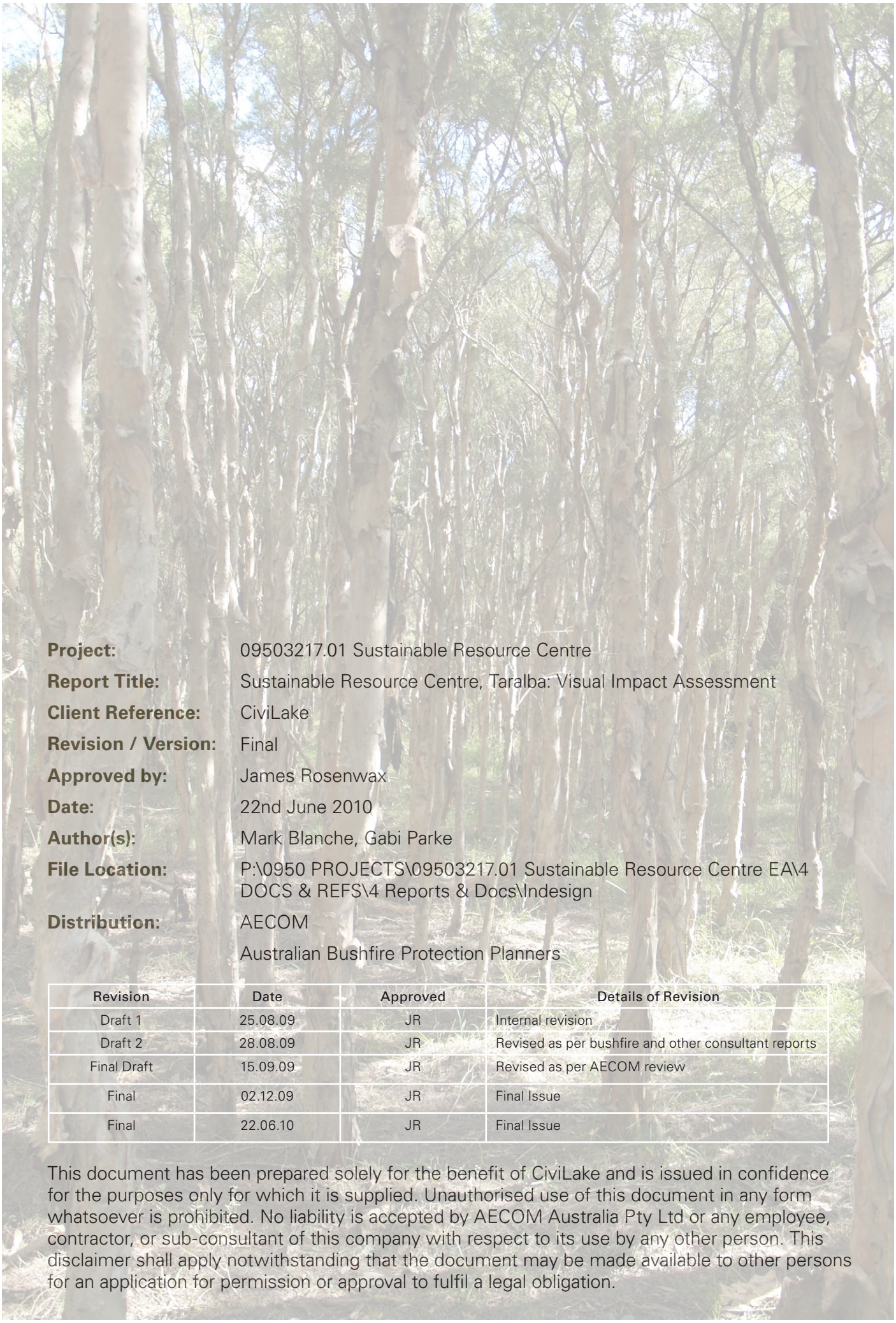
Visual Impact Assessment

EDAW | AECOM

SUSTAINABLE RESOURCE CENTRE, TERALBA

PREPARED FOR CIVILAKE | 22 JUNE 2010

VISUAL IMPACT ASSESSMENT



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Draft 1	25.08.09	JR	Internal revision
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Final Draft	15.09.09	JR	Revised as per AECOM review
Final	02.12.09	JR	Final Issue
Final	22.06.10	JR	Final Issue

TABLE OF CONTENTS

Cover photograph: View from southern boundary of the site, looking south to The Weir Road through remnant vegetation
Opposite photograph: Remnant vegetation within the south-western corner of the site

1.0

Introduction

1.1 SUBJECT SITE AND PROJECT DESCRIPTION

The proposal is for the development of a recycling facility for construction waste (Sustainable Resource Centre) on a 7ha. site off The Weir Road, Teralba (DP 16062), refer Figure 1.4.1.

The Sustainable Resource Centre (the facility) will process for reuse hard waste, construction and demolition materials including concrete, bricks, gravel and crushed rock road base, asphalt, soils, green waste and tiles generated by CiviLake, a business unit of Lake Macquarie Council.

This document will assess the visual impact of this development on surrounding land users and will make recommendations for any mitigation measures that may be required to reduce this impact, including provision of a concept landscape plan.

Opposite photograph: Detail of *Carex appressa* photographed in the south-eastern corner of the site

1.2 CONTEXT MAP - TERALBA LOCALITY

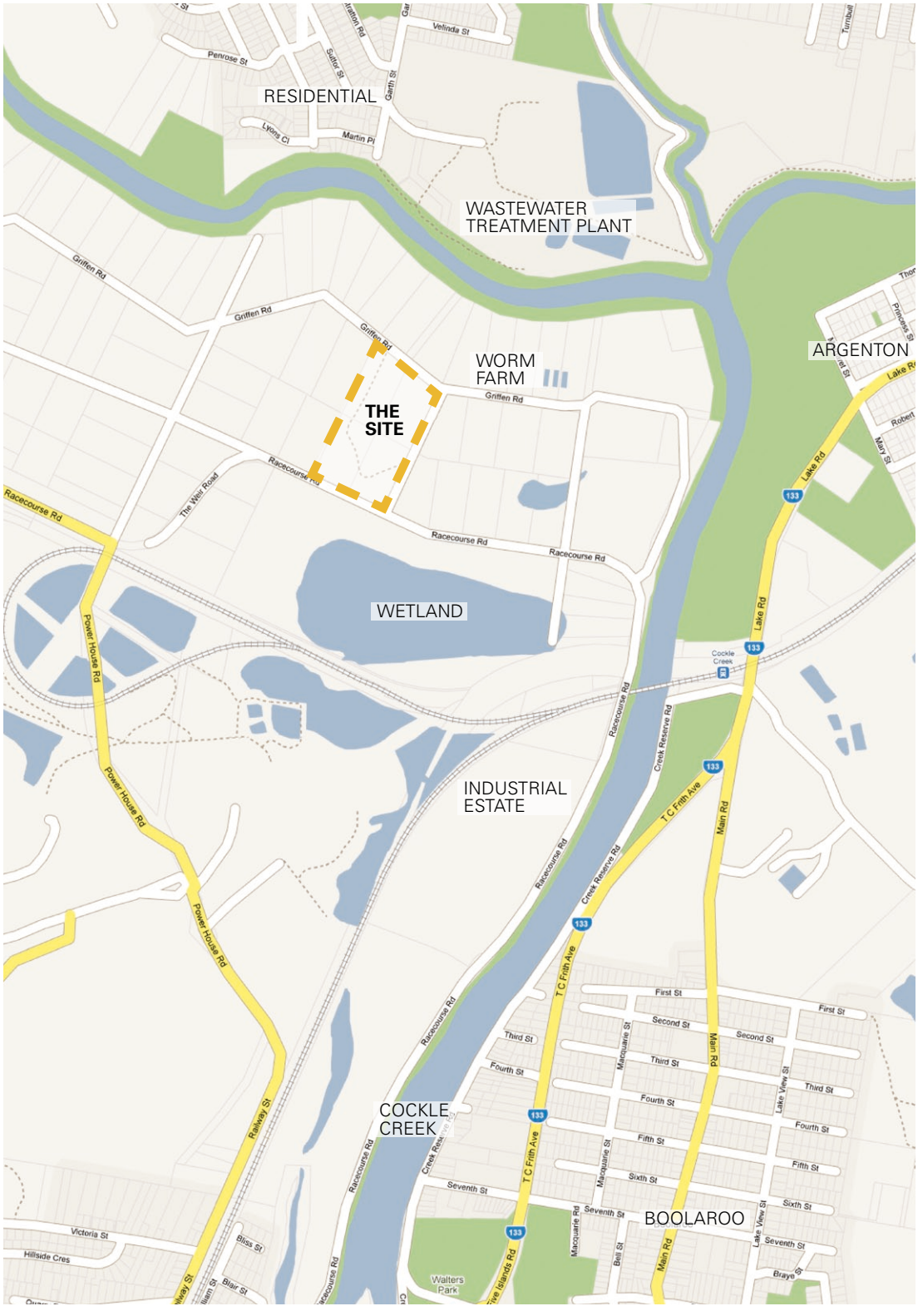


Figure 1.2.1: Map of Teralba locality and surrounding areas (Map from Google Maps)
Opposite Photograph: Swamp Mahogany / Paperbark / Woollybutt Swamp Forest

1.3 AERIAL PHOTOGRAPH - TERALBA LOCALITY

LEGEND

PROPOSED DEVELOPMENT SITE

Figure 1.3.1: Aerial photograph of The site and Teralba locality (Aerial photograph from Google Earth)

N

SCALE BAR

0 50 100 200

1.4 PROPOSED DEVELOPMENT: DIAGRAM TO BE UPDATED WITH FINAL DESIGN

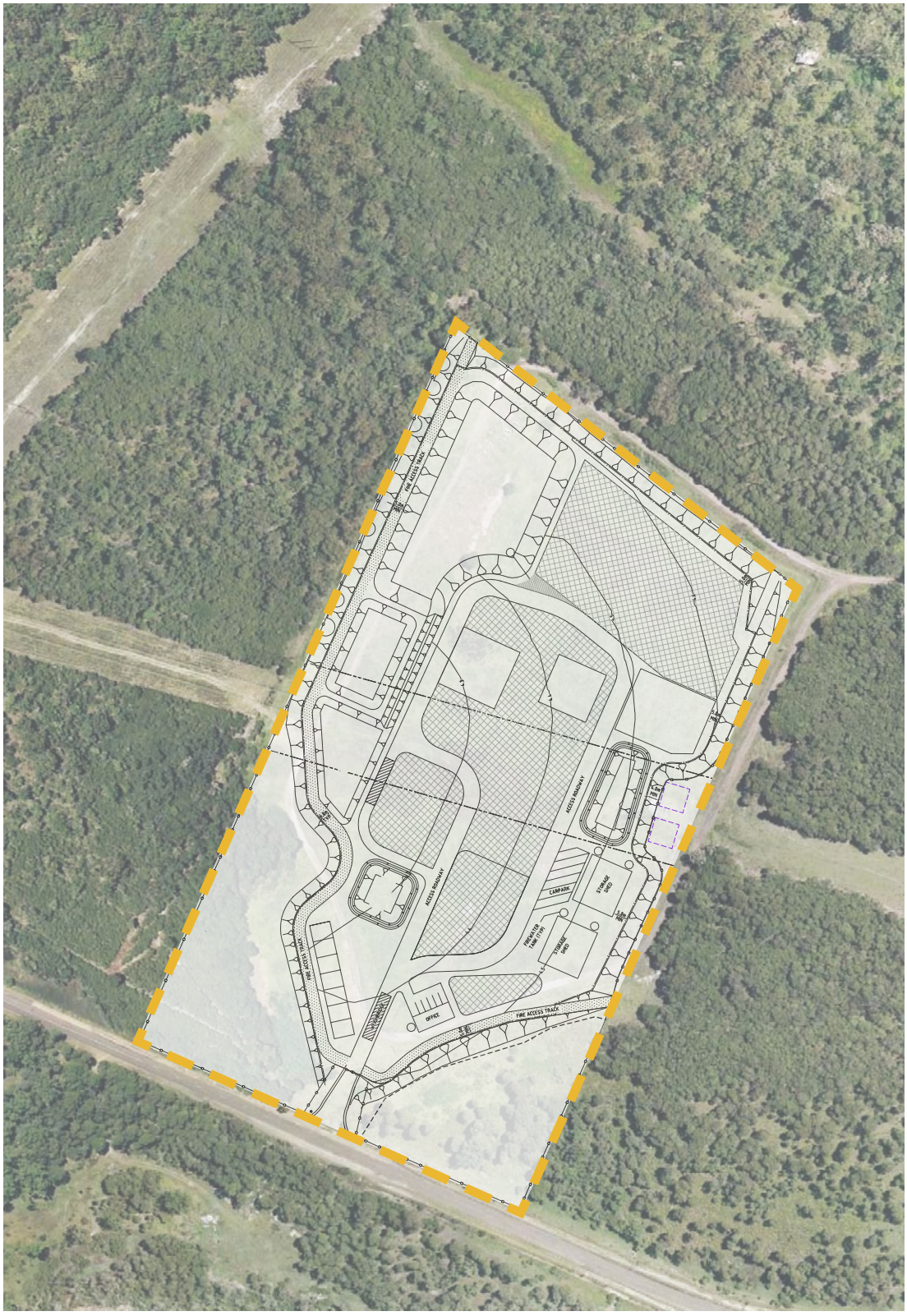


Figure 1.4.1: Schematic plan of the proposed development and aerial photograph (aerial photograph from Google Earth)

Visual Impact Assessment

2.0

2.1 SITE INFORMATION

The subject site (referred to as 'the site') is approximately 380m long at its longest point from northern and southern boundaries, and 202m wide between the eastern and western boundaries. The site is currently unused with exotic grassland cover and has an electrical easement running east-west across it.

The site is relatively flat, cleared, and bounded by a gravel road and an intermittent drainage swale (shown in photograph on opposite page). The site was used in the past for night soil disposal.

A majority of the site is zoned 7(2) Conservation (Secondary), with small portions of the south-western and south-eastern corners zoned 7(1) Conservation (Primary). Due to the past use for night soil disposal and agriculture, the cleared area of the site has low ecological value, whilst the south-west and south-east corners of the site (currently zoned 7(1)) have been deemed important to retain.

The site sits adjacent to a SEPP 14 wetland and three Endangered Ecological Communities (EEC's), being:

» Ball Honeymyrtle Swamp Forest,

» Swamp Mahogany / Paperbark / Woollybutt Swamp Forest, and

» Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest.

Opposite photograph: Existing drainage swale, photo taken from the north-eastern corner of The site, looking south. The drainage swale is proposed to be retained, with the development boundary located to right of the frame at the top of the swale batter.

2.2 DEVELOPMENT INFORMATION

The proposed development on the site will comprise of a recycling facility for construction waste generated by CiviLake, a business arm of Lake Macquarie Council. The facility will process up to 200,000 tonnes of construction and green waste every year, including concrete, asphalt, recycled asphalt pavement, road base, green waste, bricks, tiles and soil. Materials will be processed by crushing / screening, blending, shredding, mulching and composting, depending on the material being processed and the output. These products will then be sold for reuse or used by council.

The proposed development will consist of an administration building and gate office, a pug mill, asphalt recycler, concrete batching plant, two storage sheds, water tanks, parking facilities, access roads and a number of stockpiles for process feed materials and the end products for reuse. A number of product bins will also be built for storage. There will also be a number of surface water storage areas (ponds) and site grading to prevent site runoff into the surrounding areas. Figures 2.2.1, 2.2.2, 2.2.3 and 2.2.4 and 2.2.5 show machinery, infrastructure and typical stockpile types proposed for this site.

Figure 2.2.6 shows a section through the proposed development with approximate heights of the built elements in relation to the surrounding bushland.

Figure 2.2.1: Existing Pug Mill to be relocated to the site

Element	Height	Colour
Pug mill	17m	White
Asphalt recycler	8m	White
Communications receiver (mounted on building)	10m	White
Stockpiles	6-8m	Varies
Sheds	6m	White
Weighbridge / entry structure	6m	White
Concrete batching plant and silo	10m	White

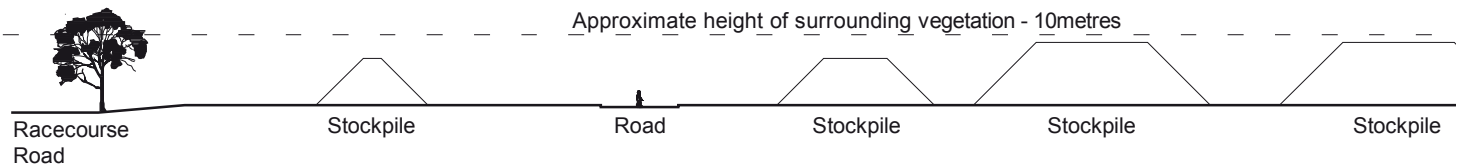


Figure 2.2.6: Typical north / south section through proposed development showing approximate heights of structures

2.3 METHOD

Figure 2.2.2: Existing asphalt recycling machine to be relocated to the site

Figure 2.2.3: Typical detail of processed and graded product stockpile

Figure 2.2.4: Typical detail of stockpiled concrete for processing

Observer Locations

Observer locations were chosen using a combination of topographic map interpretation and substantial exploration of the surrounding area by car and on foot. Observer Locations comprised of publicly accessible areas, as well as areas not able to be publicly accessed, but with the potential for views to the site from dwellings or other important observer types, e.g. from recreation areas.

Observer Locations that were not included in this report were either deemed not significant due to very low observer numbers, or the site being substantially obscured from view by landform or by other factors, e.g. housing, trees, etc.

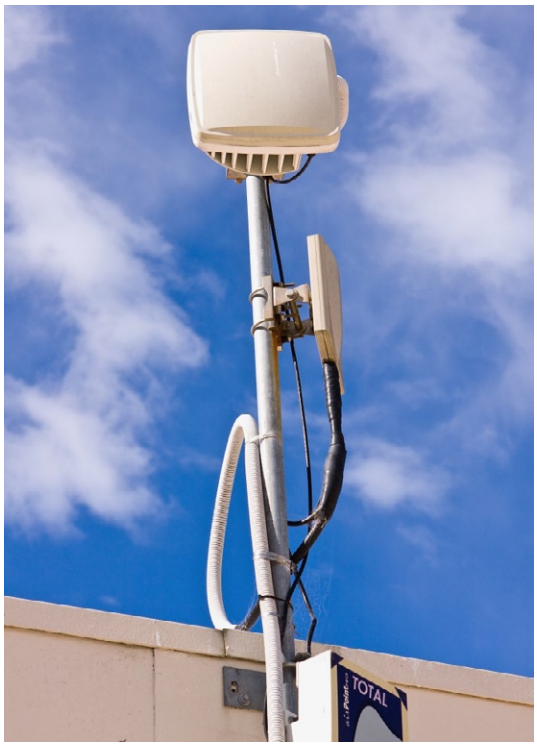
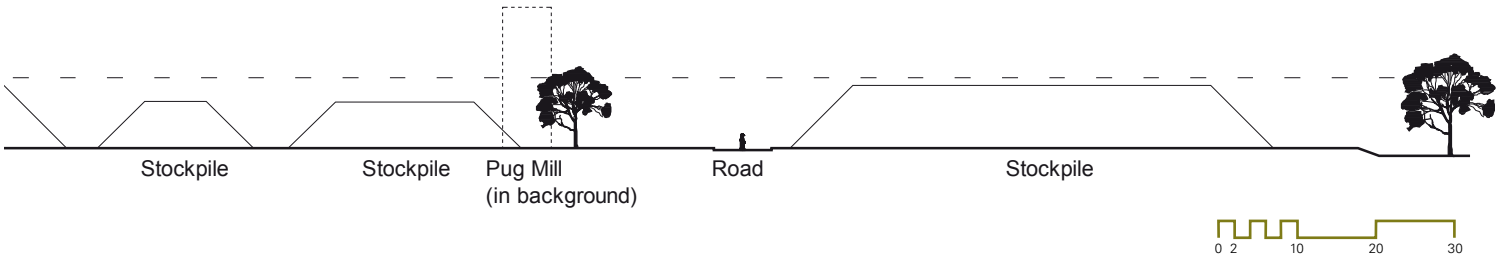


Figure 2.2.5: Communications receiver similar to that proposed to be mounted in the amenities building



2.4 MAP OF PHOTO POINTS AND OBSERVER LOCATIONS

Figure 2.4: Map of Photo Points and Observer Locations (Map from Google Maps)

Legend

Photo Points

1 Location 1: North-east corner of the site

2 Location 2: Mid-eastern edge of the site

3 Location 3: Southern boundary - Proposed entry to the site

4 Location 4: Mid-western edge of the site

Observer Locations

5 Observer Location: Waratah Golf Club
Possible view point south-east of the site

6 Observer Location: First Street
High point in residential street, Boolaroo

7 Observer Location: Fourth Street
High point in residential street, Boolaroo

Potential Observer Location

8 Potential Observer Location: 'Bunderra' development site
Former Pasminco Smelter site

The site

2.5 LOCATION 1

North-Eastern Corner of Site

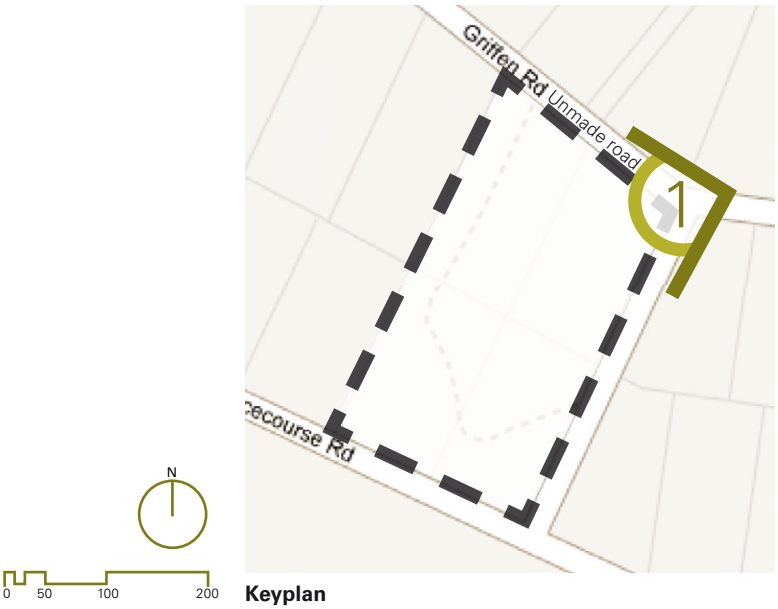
Entry to the site can be made at present though the north-eastern corner, along a gravel road (Griffen Road). The site at this point appears as a clearing amongst remnant bushland, as seen in Panorama 2.5.1. The heavily vegetated boundary of the site acts as a visual buffer to the surrounding areas. From this location no residential areas / housing could be seen.

From this location, the only vantage point overlooking the property was what appears to be coal processing equipment and the hillside beyond, which appeared to be heavily vegetated (refer Detail Photo 2.5.1).

The proposed development on the site is to be situated on the inner edge of the drainage swale (refer Panorama 2.5.1 and Detail Photo 2.5.2).

The bushland vegetation community to the east and north of this point is identified as Ball Honeymyrtle Swamp Forest (refer Detail Photo 2.5.3).

Panorama 2.5.1: View from north-eastern corner of The site.



Keyplan

DETAIL PHOTO 2.5.1

The proposed development boundary lies just beyond the existing drainage channel.

Detail Photo 2.5.1: Coal processing plant on the southern horizon line of the site

Detail Photo 2.5.2: Drainage Channel

Detail Photo 2.5.3: Ball Honeymyrtle Swamp Forest

2.6 LOCATION 2

Mid-Eastern Edge of Site

The thick vegetation that surrounds the site has been cleared in a strip along the electrical easement that runs east-west through it. Potential glimpse views could be obtained through this corridor to the site as it is one of the only places that the bushland does not act as a visual screen. Detail Photo 2.6.3 shows the view of the Waratah Golf Club at the end of the electrical easement view corridor, looking east from the site. Panorama 2.6.1 shows the view from the site boundary west across the site.

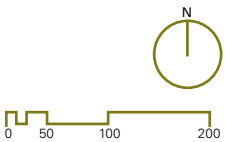
To the west, the only land high enough to possibly have views along this easement is too distant to warrant consideration as a viewer location (refer Detail Photo 2.6.1).

To the east, a number of buildings and a cleared hillside can be observed that may have views down along the easement into the site (refer Detail Photos 2.6.2 and 2.6.3). A further investigation of this area and adjacent hillside locations was undertaken (refer Observer Locations 6 and 7 and Potential Observer Location 8).

Panorama 2.6.1: Mid-eastern edge of the site

Figure 2.6.1: Aerial photo of locality (NTS, aerial photograph from Google Earth)

Keyplan



Detail Photo 2.6.1: Looking west across the site and down electrical easement

Detail Photo 2.6.2: View east along electrical easement

Detail Photo 2.6.3: Enlargement of view focus point from Detail Photo 2.6.2

2.7 OBSERVER LOCATIONS 5, 6 AND 7

Waratah Golf Club, Argenton

The view east along the electrical easement from the site terminates at a group of buildings and a cleared hillside beyond (refer Detail Photo 2.7.1). These buildings appear to be the Waratah Golf Club (Observer Location 5) and industrial buildings beyond, with some industrial and cleared land on the eastern adjacent hillside.

Although the golf club and designated area of industrial land may have some views through to the proposed development on the site, it is assumed that the visual prominence of the proposed development will be very low due to the distance from the site (approximately 960 metres from the Club to the centre of the site), in addition to the presence of a substantial patch of intervening vegetation within the golf course.

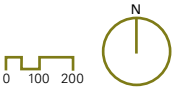
Residences, Boolaroo

A number of elevated sites in Boolaroo and Argenton were investigated, including the top of First Street (Observer Location 6), Second Street, Third Street and Fourth Street (Observer Location 7), Boolaroo (refer Detail Photos 2.7.2 and 2.7.3).

Although there are a number of individual houses near the cul-de-sac ends of these streets that may have views over the site, EDAW/AECOM could not find a position where a clear view of The site could be obtained. It is anticipated that only a small number of people will have views to the site from this location and that the visual prominence of the proposed development within the site will be low given the viewing distance, the relatively small area of the development within the broad extent of the forested floodplain, and the screening effect of the forest immediately adjacent to the site, which is in the order of 6 to 8 metres tall.

In addition, the key elements of the view from this location are dominated by industrial elements, including the coal processing plant to the south of the site. Viewed elements of the proposed development would therefore not be out of context within this setting.

Keyplan



LEGEND

- A — Photo (Detail Photo 2.7.1) taken from this point
- B — Photos (Detail Photos 2.7.2 & 2.7.3) taken from this point
- 5 — Observer Location 5: Golf club at 456 Lake Road, Argenton
- 6 — Observer Location 6: First Street, Boolaroo
- 7 — Observer Location 7: Fourth Street, Boolaroo
- The site

Detail Photo 2.7.1: Photo taken from Point A (the site)

Detail Photo 2.7.2: Photo taken from Point B (Racecourse Road)

Detail Photo 2.7.3: Photo taken from Point B (Racecourse Road) showing elevated dwellings with the potential for views to the site

2.8 POTENTIAL OBSERVER LOCATION 8

Proposed Bunderra Development Site.

The proposed Bunderra development site (Potential Observer Location 8, former Pasminco Smelter Site) has areas that are likely to be situated high enough on the hillside to provide views to the site (refer shaded area of Figure 2.8.1).

If this area were to be developed, it is expected that some of the taller elements of the proposed development would be visible, but as with the expected views at Observer Locations 6 and 7, the visual prominence of these elements would be expected to be very low due to the viewing distance and industrial context of the adjacent areas.

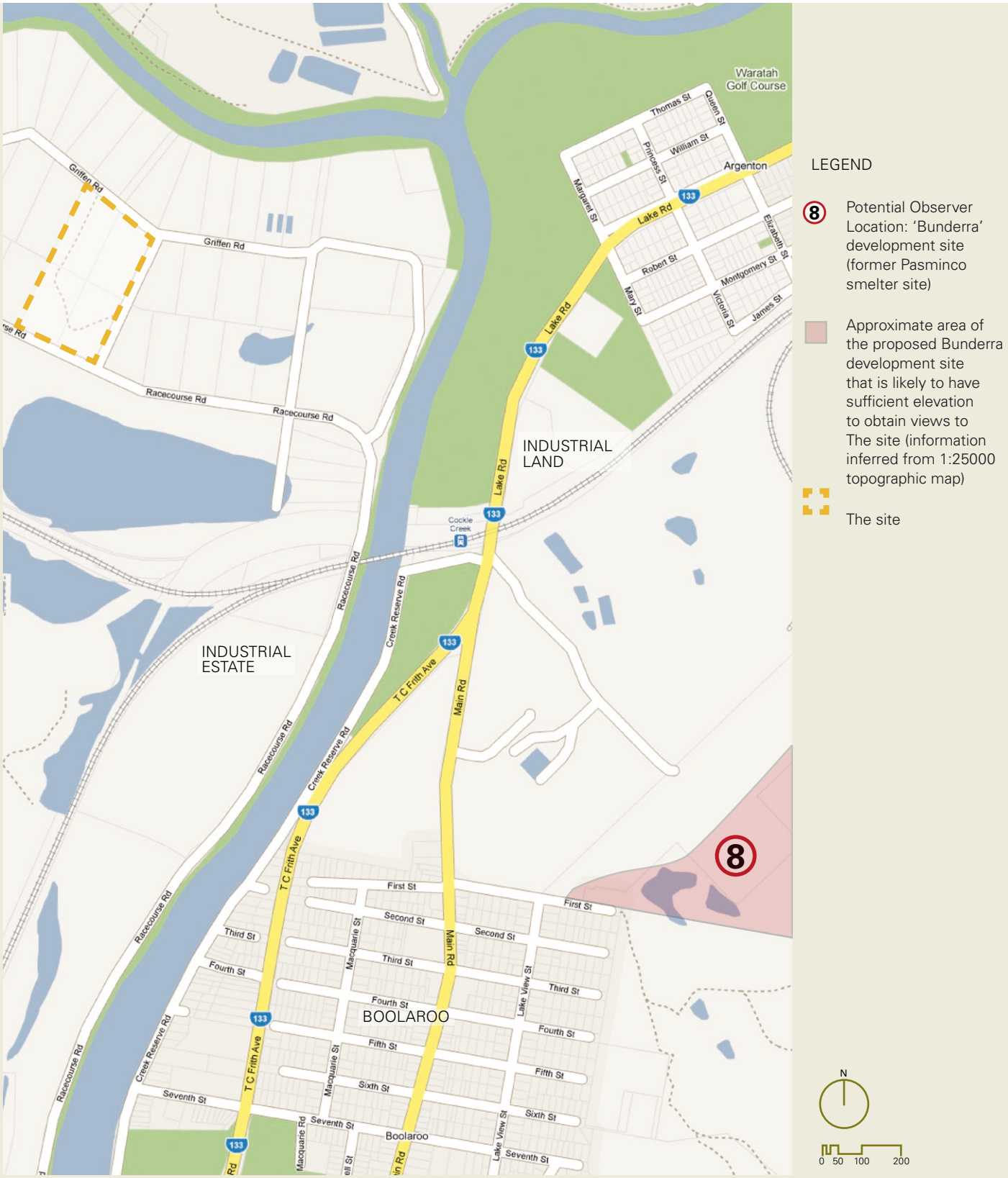


Figure 2.8.1: Map of Teralba locality showing elevated land within the proposed Bunderra development site (Map from Google Maps)

2.9 LOCATION 3

Southern Boundary (Proposed Entry) of The site

The middle of the southern boundary of the site is proposed as the entry point for the Sustainable Resource Centre. From this location, due to the vegetation that borders the site, a clear view from The Weir Road into the site is only possible for approximately 25 metres either side of the point of entry (refer Panorama 2.9.1).

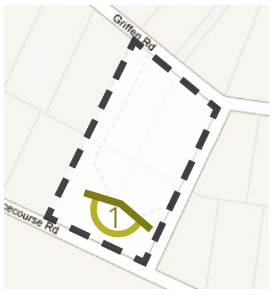
The vegetation on the southern boundary of the site has been identified as Swamp Mahogany / Paperbark / Woollybutt Swamp Forest (an Endangered Ecological Community, refer Detail Photo 2.9.4) which has sporadic weed infestation in areas that have been trampled by cattle. The open areas of this community are dominated by Melaleucas and *Carex appressa* (refer Detail Photo 2.9.3), whereas adjoining higher, filled areas have significant weed growth, mainly Tobacco Bush (refer Panorama 2.9.2).

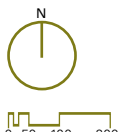
The Weir Road sits around a metre higher than the site (refer Panorama 2.9.2 and Detail Photos 2.9.1 and 2.9.2).

Panorama 2.9.1: View south from inside site boundary, towards The Weir Road (refer Keyplan)

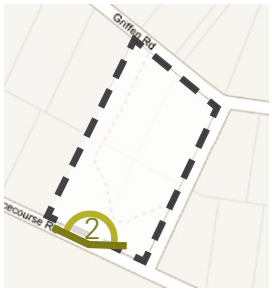
Detail Photo 2.9.1: View east from proposed entry

Detail Photo 2.9.2: View west from proposed entry





Keyplan: Panorama 2.9.1



Keyplan: Panorama 2.9.2

Keyplan: Panorama 2.9.3

Panorama 2.9.2: View north-west into the site from The Weir Road (refer Keyplan)

Panorama 2.9.3: View north-east into the site from The Weir Road (refer Keyplan)

Detail Photo 2.9.3: *Carex appressa*

Detail Photo 2.9.4: Swamp Mahogany / Paperbark / Woollybutt Swamp Forest

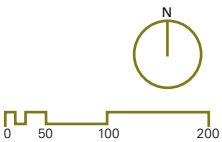
2.10 LOCATION 4

Western Boundary of The site

The ground plane on the western boundary of the site rises from the area adjacent to the road, which is boggy and colonised by remnant Swamp Mahogany / Paperbark / Woollybutt Swamp Forest (Detail Photos 2.10.5 and 2.10.6) to a dryer area north of the electrical easement. This dryer area is colonised by Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest (also an Endangered Ecological Community, refer Detail Photos 2.10.2, 2.10.3, and 2.10.4).

Panorama 2.10.1: View east across site, along electrical easement

Detail Photo 2.10.1: View east across site, along electrical easement



Keyplan

Detail Photos 2.10.2, 2.10.3 and 2.10.4: Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest

Detail Photos 2.10.5 and 2.10.6: Swamp Mahogany / Paperbark / Woollybutt Swamp Forest

2.11 LANDSCAPE REMEDIATION

Three primary treatment types are recommended for the landscape remediation of the site, as well as a number of options to further reduce the visual prominence of the proposed development within the landscape.

1. Bush Regeneration / Restoration Treatment

This treatment is proposed for the southern end of the site, external to the proposed embankment that surrounds the built elements. The Swamp Mahogany / Paperbark / Woollybutt Swamp Forest (refer Detail Photos 2.11.1, 2.11.2, 2.11.4) vegetation community inhabits this area, which is prone to periodic waterlogging. An elevated fill area within the south-west corner of the site that falls outside of the proposed embankment (refer Detail Photo 2.11.5) will have the fill removed to bring the area back to pre-development levels and hydrologic regime. This area will be planted out to a diverse planting suite from the species present in the adjoining Swamp Mahogany / Paperbark / Woollybutt Swamp Forest (refer Appendix A for relevant community species lists).

2. Entry Treatment

The proposed entry treatment is a simplified palette of species chosen from the Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest community (refer Appendix A), as the entry area will be raised above the surrounding low lying area, and therefore relatively less subject to periodic inundation and waterlogging than the adjacent remnant patches of Swamp Mahogany / Paperbark / Woollybutt Swamp Forest. The planting palette will include some dry-tolerant species (such as *Carex appressa,* refer Detail Photos 2.11.3 and 2.11.4) from the Swamp Mahogany / Paperbark / Woollybutt Swamp Forest community and would visually tie in the entry area with the adjoining retained landscape setting.

3. Perimeter Planting

A highly simplified plant palette chosen from the Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest vegetation community (refer Detail Photos 2.11.6, 2.11.7 and 2.11.8) will suit the drier soils on the embankment and batters surrounding the built elements on site.

The perimeter embankment planting will comprise of a dense cover of native grasses with strategically located small stands of trees. The planting approach facilitates the embankment perimeter planting being managed as an Asset Protection Zone (APZ) with the grasses required to be slashed at approximately three monthly intervals during the hotter period of the year to maintain reduced ground fuel loads.

Tall stands of trees on the embankment will also further reduce the visual prominence of the development when viewed from the surrounding areas.

4. Water Treatment Elements

A number of specialised planting palettes are proposed for the various water treatment elements on site. The Bioretention System utilises a palette of plants selected from the Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest and Swamp Mahogany / Paperbark / Woollybutt Swamp Forest communities. The proposed ponds utilise plants from the surrounding freshwater wetland communities.

Detail Photos 2.11.1: Swamp Mahogany / Paperbark / Woollybutt Swamp Forest

Detail Photos 2.11.2: Swamp Mahogany / Paperbark / Woollybutt Swamp Forest

Detail Photo 2.11.3 *Carex appressa*

Detail Photos 2.11.4: Swamp Mahogany / Paperbark / Woollybutt Swamp Forest with Carex grassland in the foreground

Three options have been discussed as techniques for further reducing the visual prominence of the proposed development from the surrounding area, as well as increasing both site biodiversity and amenity characteristics.

Option 1: Spot Planting at Key Locations

Targeted planting of trees within the proposed development site around taller built elements such as the Pug Mill would significantly reduce the visual prominence of this tall development from the surrounding areas.

Option 2: Equipment colour treatment

At present the taller equipment to be relocated to the site is white or a pale beige. These colours will stand out against a background of vegetation. Painting this equipment a soft green or grey would help it to visually recede into the background of the bushland canopy when viewed from elevated observer locations.

CiviLake may consider commissioning a colour consultant to provide an interesting colour palette, e.g. deep mauve or burgundy, that would also visually recede when viewed against the background forest canopy but would also create a visually interesting development.

Detail Photo 2.11.5: View north-west into the site from The Weir Road

Detail Photos 2.11.6: Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest

Detail Photos 2.11.7 and 2.11.8: Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest

3.0

Conclusions

CONCLUSIONS

The Subject Site is not readily viewed from any sensitive observer locations. Where it is viewed, the development is likely to be of low visual prominence due to:

» viewing distance,

» restricted height of observer locations, i.e. the viewing angle is very low and only affords low slanted views into the site,

» low numbers of viewers from these observer locations, and

» substantial screening from surrounding remnant vegetation.

Where elements within the site are viewed, it is likely they will be viewed within the context of adjacent mining and industrial development, thereby providing some visual context for the development.

Recommended Landscape Remediation Measures

The application of the recommended landscape remediation measures (refer 2.11 Landscape Remediation), i.e:

» bushland regeneration / restoration to southern area of The site,

» entry treatment

» perimeter planting

will further reduce the visual prominence of the proposed development from the surrounding areas.

Optional Additional Landscape Remediation Measures

Further landscape remediation options are recommended for consideration as follows:

» spot planting at key locations,

» ecological augmentation of stormwater detention pond, and

» equipment colour treatment.

The implementation of these options would provide a greater level of screening over and above the recommended landscape remediation measures, as well as providing significantly sustainable outcomes, with regard to:

» biodiversity / habitat creation

» amenity for the local workforce, and

» local amelioration of climate effects.

Opposite photograph: Typical photograph of Scribbly Gum / Red Bloodwood / Smooth-barked Open Forest vegetation community that it is proposed to mimic for the embankment planting.

4.0

PLANT SPECIES LISTS FOR SURROUNDING VEGETATION COMMUNITIES

Appendix A

Swamp Mahogany / Paperbark / Woolybutt Swamp Forest

Eucalyptus robusta

Eucalyptus resinifera

Eucalyptus scias

Eucalyptus longifolia

Eucalyptus tereticornis

Melaleuca linariifolia

Melaleuca nodosa

Melaleuca sieberi

Callistemon linearis

Melaleuca ericifolia

Acacia irrorata

Breynia oblongifolia

Carex appressa

Gahnia clarkei

Blechnum indicum

Adiantum aethiopicum

Hydrocotyle peduncularis

Ranunculus inundatus

Isachne globosa

Goodenia bellidifolia

Epaltes australis

Lomandra longifolia

Selaginella uliginosa

Hypolepis muelleri

Dichondra repens

Pratia purpurascens

Viola hederaceae

Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest

Eucalyptus signata

Angophora costata

Corymbia gummifera

Allocasuarina littoralis

Banksia serrata

Lambertia formosa

Banksia spinulosa

Banksia oblongifolia

Xanthorrhoea glauca

Leptspermum trinervium

Leptospermum polygalifolium

Persoonia linearis

Persoonia levis

Polyscias sambucifolia

Acacia sauveolens

Acacia ulicifolia

Dodonaea triquetra

Pteridium esculentum

Calochlaena dubia

Imperata cylindrica

Lindsaea linearis

Hibbertia aspera

Hibbertia riparia

Hibbertia linearis

Glycine spp

Entolasia stricta

Eragrostis brownii

Echinopogon caespitosus

Ball Honeymyrtle Swamp Forest

Melaleuca nodosa
Angophora inopina
Dodonaea triquetra
Breynia oblongifolia
Pultenaea paleacea
Callistemon linearis
Leptospermum polygalifolium
Notelaea longifolia
Gahnia sieberiana
Cheilanthes sieberi
Epaltes australis
Adiantum aethiopicum
Pellaea falcata
Hydrocotyle peduncularis
Dichondra repens
Goodenia belledifolia
Lomandra longifolia
Pratia purpurascens
Ranunculus inundatus
Entolasia marginata
Microlaena stipoides

Forest Red Gum / Woolybutt / Mahogany Floodplain Forest

Eucalyptus tereticornis
Eucalyptus longifolia
Eucalyptus resinifera
Eucalyptus paniculata
Eucalyptus scias
Angophora floribunda
Melaleuca nodosa
Melaleuca linariifolia
Callistemon salignus
Acacia falcata
Acacia irrorata
Polyscias sambucifolia
Notelaea longifolia
Breynia oblongifolia
Leptospermum polygalifolium
Imperata cylindrica
Centella asiatica
Dichondra repens
Pteridium esculentum
Cheilanthes sieberi
Adiantum aethiopicum
Commelina cyanea
Lomandra longifolia
Microlaena stipoides
Oplismenus aemulus
Pratia purpurascens
Entolasia marginata
Veronia cinerea
Hardenbergia violaceae
Clematis aristata

Ironbark / Rough-barked Apple / Mahogany Forest / Open Forest

Eucalyptus paniculata

Eucalyptus crebra

Eucalyptus acmenoides

Angophora floribunda

Melaleuca nodosa

Allocasuarina littoralis

Allocasuarina torulosa

Acacia falcata

Acacia falciformis

Acacia irrorata

Polyscias sambucifolia

Notelaea longifolia

Breynia oblongifolia

Hibbertia riparia

Pseuderanthemum variabile

Pteridium esculentum

Cheilanthes sieberi

Commelina cyanea

Lomandra longifolia

Wahlenbergia stricta

Leucopogon juniperinus

Imperata cylindrica

Desmodium varians

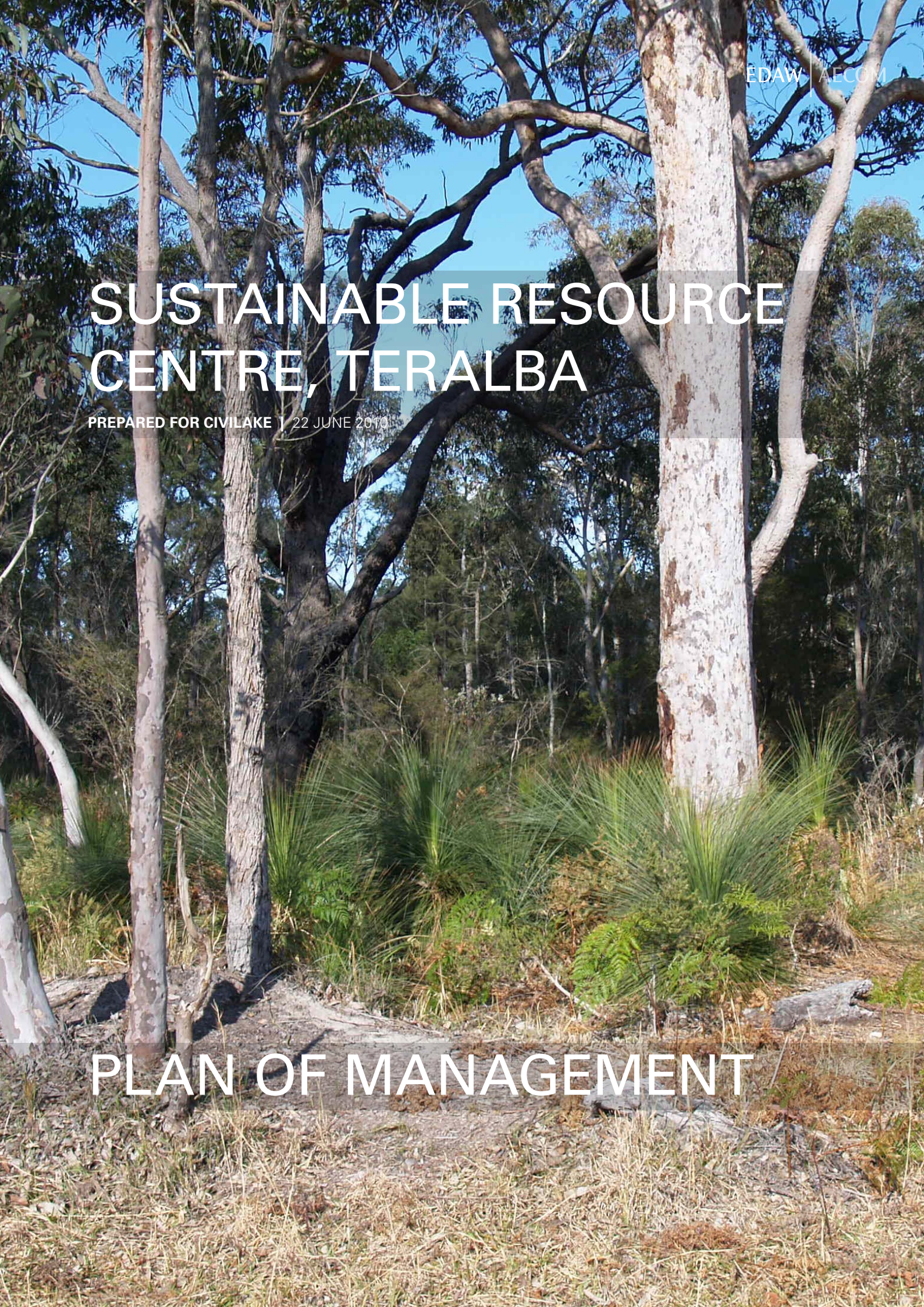
Microlaena stipoides

Pratia purpurascens

Veronia cinerea

Hardenbergia violaceae

Kennedia rubicunda



EDAW | AECOM

SUSTAINABLE RESOURCE CENTRE, TERALBA

PREPARED FOR CIVILAKE | 22 JUNE 2010

PLAN OF MANAGEMENT

Project:	09503217.01 Sustainable Resource Centre
Report Title:	Sustainable Resource Centre, Teralba: Plan of Management
Client Reference:	CiviLake
Revision / Version:	Final
Approved by:	James Rosenwax
Date:	22nd June 2010
Author(s):	Mark Blanche, Gabi Parke
File Location:	P:\0950 PROJECTS\09503217.01 Sustainable Resource Centre EA\4 DOCS & REFS\4 Reports & Docs\Indesign
Distribution:	EDAW / AECOM internal

Revision	Date	Approved	Details of Revision
Draft 1	12.11.09	James Rosenwax	Internal revision
Draft 2	22.06.10	James Rosenwax	Update to Authority feedback requirements

TABLE OF CONTENTS

Cover photograph: View from southern boundary of the site, looking south to The Weir Road through remnant vegetation
Opposite photograph: Remnant vegetation within the south-western corner of the site

1 INTRODUCTION

The proposal is for the development of a recycling facility for construction waste (Sustainable Resource Centre) on a 7ha. site off The Weir Road, Teralba.

The Sustainable Resource Centre will process for re-use hard waste, construction and demolition materials including concrete, bricks, gravel and crushed rock road base, asphalt, soils, green waste and tiles generated by CiviLake, a business unit of Lake Macquarie Council. It will consist of an administration building and gate office, a pug mill, asphalt recycler, concrete batching plant, two storage sheds, water tanks, parking facilities, access roads and a number of stockpiles for process feed materials and the end products for re-use. A number of product bins will also be built for storage. There will also be a number of surface water storage areas (ponds) and site grading to prevent site runoff into the surrounding areas. A plan of the site is shown overleaf.

The majority of the site is zoned 9 Natural Resources, with a small portion of the south-western and south-eastern corners zoned 7(1) Conservation (Primary).

The site sits adjacent to a SEPP 14 wetland and is adjoined by three (3) Endangered Ecological Communities (EEC's), being:

» Ball Honeymyrtle Swamp Forest (BHSF),

» Swamp Mahogany / Paperbark / Woollybutt Swamp Forest (SM/P/WSF), and

» Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest (SG/RB/SAOF).

This document is a Plan of Management intended for implementation once CiviLake takes possession of The Site upon the completion the construction and plant establishment project phases.

Opposite photograph: View from southern boundary of the site, looking south-east to The Weir Road through remnant vegetation (predominantly *Melaleuca linariifolia* and *Carex appressa*)

2 CONCEPT DESIGN

The landscape concept design responds to the landscape character, conservation value and resilience of the remnant bushland communities adjoining the site. These communities are adapted to a gradient of periodic flooding events and include Endangered Ecological Communities (EECs). Being densely vegetated, these communities also comprise a bushfire threat to the proposed development. The landscape concept design responds to these conditions in the following ways:

» The community of SM/P/WSF currently extant within the southern existing floodplain portion of the site is conserved (refer Photos 2.1, 2.2 and 2.4 overleaf, and **Community Type 1** on the Landscape Master Plan).

» The extent of SM/P/WSF is increased within the south-west corner of the site by the removal of fill, reinstating the pre-existing floodplain level and associated flooding regime necessary for the successful reconstruction of the community in this area (refer **Community Type 1a** on the Landscape Master Plan). The area will be planted out to a diverse suite of species present in the adjoining SM/P/WSF (refer Appendix A for relevant community species lists).

» The introduction of a simplified form of the adjoining SG/RB/SAOF community to the perimeter batters of the development area. This is one of the topographically 'highest', and least frequently inundated of the adjoining communities (refer Photo 2.3 and **Community Type 2** on the Landscape Master Plan). The simplified community form responds to the site bushfire threat, acting as part of the Asset Protection Zone (APZ), by means of its structural composition of small stands of readily manageable trees with a dense, weed suppressing ground layer.

» Utilisation of a simplified palette of plants from the adjoining SG/RB/SAOF and SM/P/WSF Communities to populate the Bioretention System. Plant species from these EECs are ideal for use in the Bioretention System as they are tolerant of sandy, free draining soil and periodic inundation (refer **Community Types 2b** and **2c** on the Landscape Master Plan and Appendix A for species list). The Bioretention System is designed to collect and filter runoff as the water percolates through a sandy soil filter media. Vegetation is a vital functioning element in Bioretention Systems, enhancing the filtering of water through key biological, physical and chemical processes.

» Utilisation of key, visually distinctive species fromadjoining SG/RB/SAOF and SM/P/WSF communities as a landscape treatment that refers to the broader landscape setting within which the site is situated (refer **Community Type 3** on the Landscape Master Plan).

» A **Community Type 4 i**s defined, which effectively maintains 2 small sections of unfilled land within the high voltage electrical easement in its current condition.

Photo 2.1: **Remnant** Swamp Mahogany / Paperbark / Woollybutt Swamp Forest

Photo 2.2: Swamp Mahogany / Paperbark / Woollybutt Swamp Forest with Carex grassland

Photo 2.3: **Remnant** Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest

» The introduction of a palette of submerged aquatic and emergent aquatic vegetation into the four proposed ponds on site (refer **Community 5** on Landscape Master Plan). Planting of pond batters with emergent aquatic vegetation assist in bank stabilisation and water filtration. Density of planting and species selection provide resistance to weed invasion and minimise habitat for mosquito breeding. Species are planted on pond batters in zones according to depth of water and frequency of inundation (refer species list in Appendix A). The pond floors are planted with submerged aquatic species, which:

  - trap sediment helping to maintain water clarity,
  - provide habitat for zooplankton that help control algal growth and phytoplankton populations, and
  - oxygenate sediment through oxygen leakage from roots, preventing anoxia which can result in the release of nutrients from sediment into the water column and promotes algal blooms or nuisance plant growth.

» (refer **Community 5a** on Landscape Masterplan).

» Utilisation of hardy grass and sedge species from the SM/P/WSF community (refer Photo 2.2) for dense planting of the swales. The swales collect and transport runoff to the Dirty Water Pond. The Bioretention Bypass Swale allows water to bypass the Bioretention System during high flow events (refer **Community 5b** on Landscape Master Plan and Appendix A for species list).

All of the above treatments are designed to:

» utilise plant material that is of local provenance, thereby assisting in the conservation of the adjoining / adjacent natural communities, and ensuring a robust landscape planting response using species that are inherently adapted to the local conditions

» draw upon discrete, visually attractive composition of elements from the adjoining / adjacent communities, providing a site landscape setting that is highly connected to its surrounds, and yet also distinctive within its own right

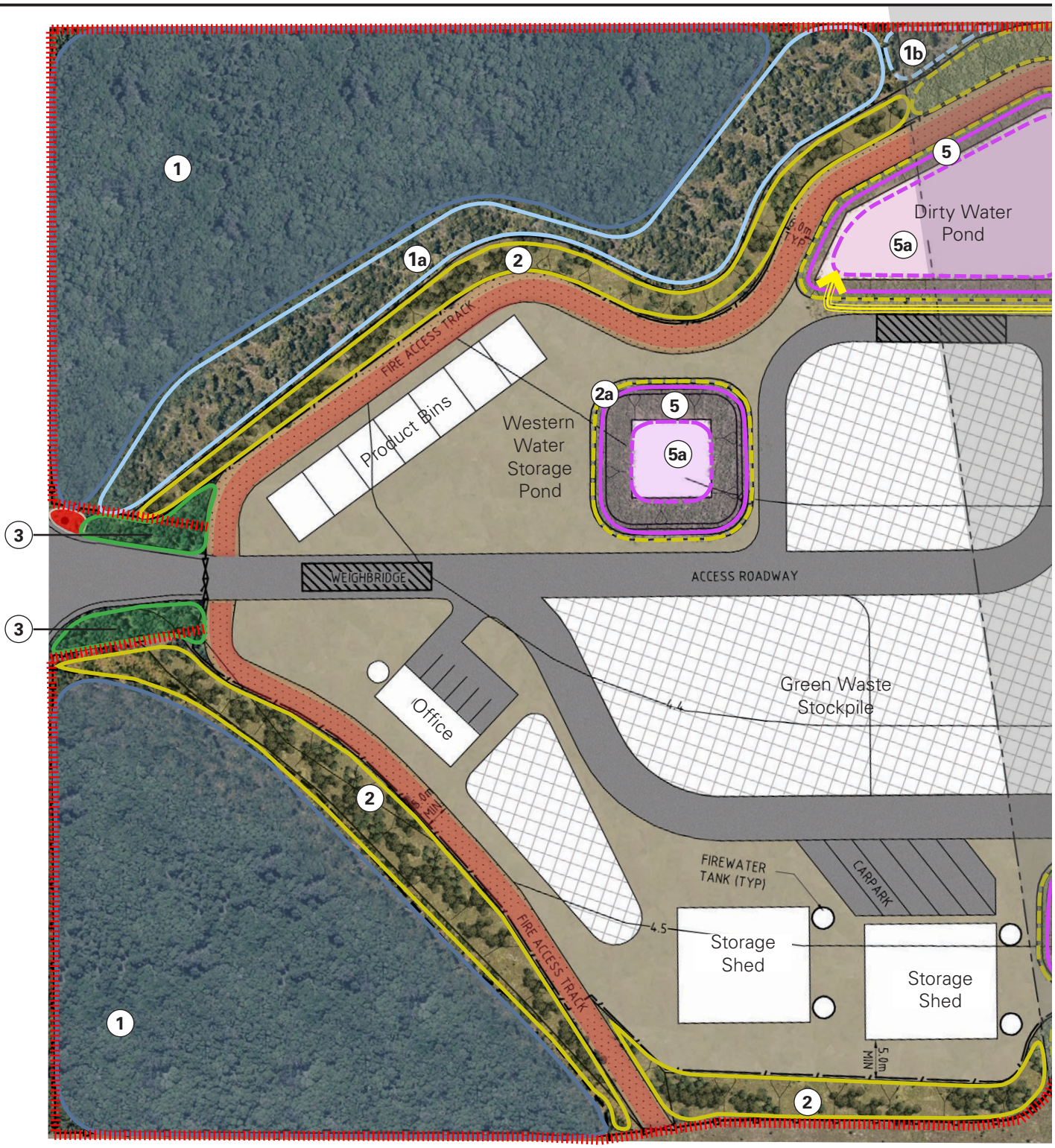
» provide an integrated response to the landscape and bushfire management of the site

» facilitate stormwater treatment using endemic, function-appropriate plant species

» facilitate a low maintenance management regime for the site, using environmentally sound bush regeneration techniques

» increase the extent of local natural habitat, and provide a managed buffer planting that will assist in the conservation of the adjoining natural communities by reducing edge effects from the development.

Opposite photograph (Photo 2.4): Remnant Swamp Mahogany / Paperbark / Woollybutt Swamp Forest



1 **Community Type 1:** Existing Swamp Mahogany / Paperbark / Woolybutt Swamp Forest

1a **Community Type 1a:** Landscape restoration of Swamp Mahogany / Paperbark / Woolybutt Swamp Forest

1b **Community Type 1b:** Landscape restoration to Swamp Mahogany / Paperbark / Woolybutt Swamp Forest modified for ground and shrub layer only

2 **Community Type 2:** Simplified Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest community with dense native grass layer and strategically located small stands of trees. Managed as an Asset Protection Zone

2a **Community Type 2a:** Dense ground layer only under electrical easement, on Pond batters, Bioretention System base and adjacent to fire access gates.

2b

2c

3

REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
01			DRAFT FOR APPROVAL	23/09/09

SCALES:

N

0 10 20 30

1:1000 @ A3

THE SIGNING OF THIS TITLE BLOCK CONFIRMS THE DESIGN AND DRAFTING OF THIS PROJECT HAVE BEEN PREPARED AND CHECKED IN ACCORDANCE WITH THE AECOM QUALITY ASSURANCE SYSTEM TO ISO 9001-2000

DESIGNED	M. BLANCHE	CHECKED	N. MAVLIAN
DRAWN	H. ROSSER	CHECKED	M. BLANCHE
APPROVED	M. BLANCHE	DATE	

Community Type 2b: Bioretention System planting

Community Type 2c: Bioretention System planting under electrical easement

Community Type 3: Simplified palette selected primarily from Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest with select species from Swamp Mahogany / Paper Bark / Woolybutt Swamp Forest

4

Community Type 4: Make-up and repair to match existing managed electrical easement beyond site

5

Community Type 5: Pond emergent aquatic and littoral zone planting, consisting of stratified planting groups according to water depth.

5a

Community Type 5a: Pond submerged aquatic planting

Community Type 5b: Swale planting

Fire Access Track

Electrical Easement

Low impact fence suitable to restrict stock from the site landscape restoration works

Electrical Substation

DESIGNER:
EDAW | AECOM
LEVEL 8, 17 YORK STREET, SYDNEY NSW 2000
T 61 2 8023 9333 F 61 2 8023 9399
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TERALBA SUSTAINABLE RESOURCE CENTRE

LANDSCAPE MASTER PLAN
VEGETATION COMMUNITIES

STATUS:	DRAWING NO:	REV:
CONCEPT	60101141-DWG-10-CI0009	01

3 LANDSCAPE RESTORATION TYPES

The approach to the landscape design for the site is one of natural bush restoration as opposed to conventional 'landscaping'.

There are a number of approaches that can be used for the restoration of bushland. DIPNR (2003)* offer a hierarchy of action that can be used to guide the choice of an appropriate bush restoration approach:

» Retention - Retain remnant indigenous vegetation;

» Regeneration - Regenerate where site resilience indicates potential for natural regeneration;

» Reconstruction - Revegetate where there is no regeneration potential.

Definitions of Bushland Regeneration, Bushland Reconstruction and the proposed form of Bushland Management follow.

Bushland Regeneration

Bushland regeneration is defined by the Australian Association of Bush Regenerators (AABR) as: "the practice of restoring bushland by focussing on reinstating and reinforcing the systems' ongoing natural regeneration processes". Bushland regeneration aims to stimulate or "trigger" the growth of native plant propagules (such as seed, tubers or rhizomes, etc.) already present on site or having the ability to migrate onto the site, and aided by suitable management, to allow natural regeneration processes to occur (DIPNR, 2003). Actions to improve conditions for regeneration can include:

» Reducing or eliminating degrading disturbances, e.g. controlling erosion; exclusion of human disturbances such as informal walking trails, exclusion of stock and motorbike trail riding, or incursion of garden species from neighbouring residences;

» Creating regeneration niches, e.g. laying of woody debris/brush on the ground; scarifying the soil in bare areas;

» Managing weeds; and

» Using 'triggers' to encourage regeneration, e.g. fire. smoke water or smoked mulch, soil or root disturbance.

*Department of Infrastructure, Planning and Natural Resources, 2003. *Bringing the Bush Back to Western Sydney.* Publ. June 2003. ISBN 0 7347 5374 8

Bushland Reconstruction

Bushland reconstruction is implemented when native plant resilience is depleted in areas due to past disturbance mechanisms, but site conditions are still favourable for the replanting and/or reseeding of functioning native plant communities. The technique involves the introduction of locally occurring native plant species, modelled on the diversity and structural characteristics of the original vegetation community. It is carried out by planting or by re-introducing propagules (DIPNR, 2003). Reconstruction generally entails the following:

- Non-selective mechanical and herbicide weed control;
- Soil tilling/preparation and amelioration;
- Planting of terrestrial tree, shrub and ground layers, and aquatic and emergent aquatic vegetation.

4 LANDSCAPE MANAGEMENT OBJECTIVES

For the purposes of this project, all three of the above approaches to the landscape restoration of the site have been undertaken as shown below. Also as shown below, these areas fall within different zones as defined under the Local Environmental Plan (LEP).

Zone 7(1) - Conservation (Primary)

» **Community Type 1** - Bushland Retention and Regeneration

» **Community Type 1a** - Bushland Reconstruction - fully structured, i.e. with all structural layers including ground, shrub, mid-stratum and canopy layers.

These two community types will be managed for biodiversity and conservation.

Zone 9 - Natural Resources

» **Community Types 1b, 2, 2a, 2b, 3, 4, 5, 5a** and **5b** - Bushland Reconstruction in modified forms.

These remaining eight community types will be managed in modified forms to meet the following objectives:

» **Community Type 1b** - Modified in accordance with the requirements of the authority responsible for the electricity easement within which the community sits, and to be managed for:

- conservation consistent with retention of the ground and shrub layer only,
- minimising of edge effects on the adjoining bushland, and
- maintenance of planting heights in accordance with the requirements of the electricity authority.

» **Community Type 2** - Modified in accordance with the Asset Protection Zone (APZ) requirements of the Bushfire Management Plan (BMP) for the site, and to be managed:

- to the fuel loads specified within the BMP,
- minimising of edge effects on the adjoining bushland,
- for landscape amenity, and
- conservation consistent with retention of a native ground layer and limited canopy layer only

» **Community Type 2a**: Modified in accordance with the APZ requirements of the Bushfire Management Plan (BMP) for the site, and to be managed for:

- fuel loads specified within the BMP,
- landscape amenity,
- conservation consistent with retention of a ground layer only, minimising of edge effects on the adjoining bushland,
- maintenance of planting heights in accordance with the requirements of the electricity authority, and
- maintenance of planting heights to facilitate access to ponds and Bioretention System on planted upper batters.

» **Community Type 2b**: Planting in the Bioretention System to aid filtering and general function, and to be managed for:

- maximisation of immediate and long term functionality of the system for effective stormwater filtration,
- self regeneration and ongoing resistance to weed invasion, and
- landscape amenity.

» **Community Type 2c**: Modified in accordance with the requirements of the authority responsible for the electricity easement. Planting in the Bioretention System to aid filtering and general function, and to be managed for:

- maximisation of immediate and long term functionality of the system for effective stormwater filtration,
- self regenerating and resistance to weed invasion,

- maintenance of planting heights in accordance with the requirements of the electricity authority, and
- landscape amenity.

» **Community Type 3**: Landscape entry treatment, to be managed for:

- landscape amenity (primary), and
- conservation (secondary) consistent with the retention of species of local provenance.

» **Community Type 4**: maintenance of infilled land within the high voltage electrical easement, to be managed for:

- maintenance of plant height in accordance with the requirements of the electricity authority.

» **Community Type 5**: Pond batter planting, to be managed for:

- maintenance of plant density to maintain the stability of batter slopes and prevent erosion,
- self regeneration and resistance to weed invasion,
- prevention of mosquito breeding through appropriate selection and maintenance of plant species, and
- additional filtering of stormwater.

» **Community Type 5a**: Pond base aquatic planting, to be managed to:

- trap sediment helping to maintain water clarity,
- provide habitat for zooplankton that help control algal growth and phytoplankton populations, and
- oxygenate sediment through oxygen leakage from roots, preventing anoxia which can result in the release of nutrients from sediment into the water column and promotes algal blooms or nuisance plant growth.

» **Community Type 5b**: Swale planting, to be managed for:

- plant density maintained to maximise the stability of swale batter slopes and base to prevent erosion,
- plant density maintained to facilitate filtering of sediment from stormwater and ensure no preferential flow path can form within the swale, and
- maintenance of plant density to resist / suppress weed invasion.

This approach to the landscape restoration and management of the site is designed to ensure both an attractive landscape setting that provides substantial screening from The Weir Road, and an ecologically compatible buffer between the development proper and the adjoining natural communities, including the three (3) Endangered Ecological Communities.

Contractor Experience

Bushland regeneration is to be undertaken by appropriately qualified bush regenerators. All bush regenerators must have attained or be in the process of completing the TAFE Certificate II course in Natural Area Restoration, or an equivalent qualification which has strong practical application of the principles of natural regeneration.

Team Leaders or Supervisors must:

» have completed or be in the process of completing the Certificate III in Natural Area Restoration or equivalent;

» have a minimum of five (5) years experience in the bush regeneration industry;

» be a member of or eligible for professional membership into the Australian Association of Bush Regenerators (AABR).

5 LANDSCAPE MANAGEMENT STRATEGIES

Five communities (or plant palettes) are proposed on the site, with differing levels of species diversity and management objectives, which in turn require different management strategies.

Bushland Management

Bushland regeneration is to be the sole form of management implemented to the below areas. Bushland regeneration techniques are generally to be in accordance with those recommended by the Department of Infrastructure, Planning and Natural Resources (2003), as applicable to the various levels of restoration, i.e. fully structured and modified.

Plant Community 1

The Swamp Mahogany / Paperbark / Woollybutt Swamp Forest (SM/P/W/SF) vegetation community is prone to periodic waterlogging.

The area will be fenced off to exclude stock that graze within the adjoining bushland.

Types within this community are as follows (refer to Landscape Master Plan on page 10 for position of individual community types):

Community Type 1

» Existing SM/P/W/SF.

» Weed cover is to be kept below 5%.

» Weed species are to be kept to less than 5% of the total species within the community.

Community Type 1a

» Reconstructed SM/P/W/SF - fully structured.

» Weed cover is to be kept below 5%.

» Weed species are to be kept to less than 5% of the total species within the community.

Community Type 1b

» Reconstructed SM/P/W/SF - modified to incorporate ground and shrub layer only.

» Weed cover is to be kept below 5%.

» Weed species are to be kept to less than 5% of the total species within the community.

» Remove any emergent taller species that naturally recruit to this area (keeping height low due to electrical easement).

Plant Community 2

The Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest (SG/RB/SAOF) community is adapted to less frequently inundated locations than all of the other nearby plant communities, hence it has been chosen as the reference community from which species have been chosen to landscape the batters surrounding the built elements on site.

Variations within this community type are as follows (refer to Landscape Master Plan on page 10):

Community Type 2

» Reconstructed, simplified SG/RB/SAOF community modified to contain only dense ground layer and strategically located small stands of trees.

» Weed cover is to be kept below 5%.

» Weed species are to be kept to less than 5% of the total species within the community.

» To be managed as an Asset Protection Zone. Bushland fuel hazard reduction method to be as follows (subject to confirmation within the BMP for the site):

- Council to facilitate an on-site meeting between the Bush Regenerator and a Bushfire Management Specialist (BMS) to confirm Asset Protection Zone management requirements
- Bush Regenerator to slash down native grasses (indicative method subject to confirmation from the BMS) within the Plant Community 2 area between 100 to 150 mm above ground level twice per year as follows:

    1. August / September
    2. December / January

Community Type 2a

» Reconstructed, simplified SG/RB/SAOF community - modified to contain dense native ground layer only due to location within an electrical easement and on batters adjacent to Bioretention Systems, swales and Stormwater Ponds.

» Weed cover is to be kept below 5%.

» Weed species are to be kept to less than 5% of the total species within the community.

» To be managed as an Asset Protection Zone, as described above.

Community Type 2b

» Reconstructed, simplified SG/RB/SAOF and SM/P/WSF communities - modified to contain dense native ground layer, shrubs and small stands of trees.

» Weed cover is to be kept below 5%.

» Weed species are to be kept to less than 5% of the total species within the community.

Community Type 2c

» Reconstructed, simplified SG/RB/SAOF and SM/P/WSF communities - modified to contain dense native ground layer only due to location of a portion of the Bioretention System within an electrical easement .

» Weed cover is to be kept below 5%.

» Weed species are to be kept to less than 5% of the total species within the community.

Plant Community 3

The proposed entry treatment comprises of a simplified palette of species chosen from the Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest (SG/RB/SAOF) community (refer Appendix A), as the entry area will be raised above the surrounding low lying area, and therefore relatively less subject to periodic inundation and waterlogging than the adjacent remnant patches of Swamp Mahogany / Paperbark / Woollybutt Swamp Forest (SM/P/WSF). The planting palette will include some dry-tolerant species from the SM/P/WSF community (such as *Carex appressa),* and will visually tie the entry area with the adjoining retained landscape setting.

Community Type 3

» Reconstructed entry planting of simplified palette selected primarily from SG/RB/SAOF, with select species from SM/P/WSF.

» Initial soil preparation, planting and mulching process.

» Weed cover is to be kept below 5%.

» Weed species are to be kept to less than 5% of the total species.

» Top up mulch to 50mm depth until native ground layer removes the requirement for this, i.e. the ground layer will be dense enough to naturally suppress weeds.

» Replace failed plants within three (3) months of plant failure.

Plant Community 4

» Maintain to match existing maintenance regime of the electrical easement either side of the site (refer photo 5.1).

Plant Community 5

The ponds, swales and high flow bypass channel are populated with a suite of plant species selected from the Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest and Swamp Mahogany / Paperbark / Woollybutt Swamp Forest communities, as well as species common to the surrounding permanently inundated areas.

Variations within this community type are as follows (refer to Landscape Master Plan on page 10):

Community Type 5

» Reconstructed pond batter planting of emergent aquatic plant species.

» Weed cover is to be kept below 5%.

» Weed species are to be kept to less than 5% of the total species.

» Replace failed plants within three (3) months of plant failure to maintain plant density. Replacement of plant species to be in accordance of existing water depth and extended detention (refer Appendix A for plant species selection for appropriate water depths).

Community Type 5a

» Reconstructed pond base planting of submerged aquatic plant species.

» Weed cover is to be kept below 5%.

» Weed species are to be kept to less than 5% of the total species.

» Water clarity is to be monitored in storage ponds for survival of submerged aquatic plants.

Community Type 5b

» Reconstructed swale planting of grass and sedge species.

» Weed cover is to be kept below 5%.

» Weed species are to be kept to less than 5% of the total species.

Handover Meeting

Council is to facilitate a handover meeting between the Landscape Restoration Contractor and the Bush Regenerator at completion of the plant establishment period. The purpose of the meeting is for the Landscape Restoration Contractor to pass on the detail of the site knowledge gained, and provide specific suggestions to assist the Bush Regenerator in taking over responsibility for the management of the site.

Photo 5.1: View east along electrical easement

6 ACTION PLAN

Task / Method	Duration	Responsibility
Facilitate meeting between Bush Regenerator and Bushfire Management Specialist	Singular action at project handover	Council
Facilitate handover meeting between Landscape Restoration Contractor and Bush Regenerator	Singular action at project handover	Council
Bush Regeneration	Ongoing	Bush Regenerator
Bushfire fuel hazard reduction works	August / September December / January	Bush Regenerator
Upkeep of fencing	Quarterly inspection	Council
Replacement planting and top up of mulch to Community Type 3	As required	Bush Regenerator
Draining and removal of built up sediment from Dirty Water Pond	As required	Council
Check function of stormwater treatment train using the attached checklists (refer Appendix B)	Monthly and after substantial storm events	Bush Regenerator

Opposite photograph: Remnant vegetation within the south-western corner of the site

7.0

PLANT SPECIES LISTS FOR SURROUNDING VEGETATION COMMUNITIES

Appendix A

7.1 ENDANGERED ECOLOGICAL COMMUNITY SPECIES LISTS

Ball Honeymyrtle Swamp Forest

Trees

Melaleuca nodosa

Angophora inopina

Shrubs

Dodonaea triquetra

Breynia oblongifolia

Pultenaea paleacea

Callistemon linearis

Leptospermum polygalifolium

Notelaea longifolia

Sedges

Gahnia sieberiana

Ferns and orchids

Cheilanthes sieberi

Epaltes australis

Adiantum aethiopicum

Pellaea falcata

Ground layer

Hydrocotyle peduncularis

Dichondra repens

Goodenia belledifolia

Lomandra longifolia

Pratia purpurascens

Ranunculus inundatus

Entolasia marginata

Microlaena stipoides

Swamp Mahogany / Paperbark / Woolybutt Swamp Forest

Trees

Eucalyptus robusta

Eucalyptus resinifera

Eucalyptus scias

Eucalyptus longifolia

Eucalyptus tereticornis

Melaleuca linariifolia

Melaleuca nodosa

Melaleuca sieberi

Shrubs

Callistemon linearis

Melaleuca ericifolia

Acacia irrorata

Breynia oblongifolia

Sedges

Carex appressa

Gahnia clarkei

Ferns and orchids

Blechnum indicum

Adiantum aethiopicum

Ground layer

Hydrocotyle peduncularis

Ranunculus inundatus

Isachne globosa

Goodenia bellidifolia

Epaltes australis

Lomandra longifolia

Selaginella uliginosa

Hypolepis muelleri

Dichondra repens

Pratia purpurascens

Viola hederaceae

Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest

Trees

Eucalyptus signata

Angophora costata

Corymbia gummifera

Allocasuarina littoralis

Banksia serrata

Shrubs

Lambertia formosa

Banksia spinulosa

Banksia oblongifolia

Leptspermum trinervium

Leptospermum polygalifolium

Persoonia linearis

Persoonia levis

Polyscias sambucifolia

Acacia sauveolens

Acacia ulicifolia

Dodonaea triquetra

Ferns and orchids

Pteridium esculentum

Calochlaena dubia

Ground layer

Imperata cylindrica

Lindsaea linearis

Hibbertia aspera

Hibbertia riparia

Hibbertia linearis

Glycine spp

Entolasia stricta

Eragrostis brownii

Echinopogon caespitosus

Xanthorrhoea glauca

7.2 PLANTING COMMUNITY SPECIES LISTS

Species list for Community Types 1, 1a and 1b

Swamp Mahogany / Paperbark / Woolybutt Swamp Forest

Trees

Eucalyptus robusta
Eucalyptus resinifera
Eucalyptus scias
Eucalyptus longifolia
Eucalyptus tereticornis
Melaleuca linariifolia
Melaleuca nodosa
Melaleuca sieberi

Shrubs

Callistemon linearis
Melaleuca ericifolia
Acacia irrorata
Breynia oblongifolia

Sedges

Carex appressa
Gahnia clarkei

Ferns

Blechnum indicum
Adiantum aethiopicum

Ground layer

Hydrocotyle peduncularis
Ranunculus inundatus
Isachne globosa
Goodenia bellidifolia
Epaltes australis
Lomandra longifolia
Selaginella uliginosa
Hypolepis muelleri
Dichondra repens
Pratia purpurascens
Viola hederaceae

Note: Typical species list only, species selection to be refined at documentation phase

Opposite photograph: *Carex appressa* detail

Species list for Community Type 2

Scribbly Gum / Red Bloodwood / Smooth-barked Apple Open Forest

Trees

Eucalyptus signata

Angophora costata

Corymbia gummifera

Allocasuarina littoralis

Banksia serrata

Shrubs

Lambertia formosa

Banksia spinulosa

Banksia oblongifolia

Leptspermum trinervium

Leptospermum polygalifolium

Persoonia linearis

Persoonia levis

Polyscias sambucifolia

Acacia sauveolens

Acacia ulicifolia

Dodonaea triquetra

Ferns and orchids

Pteridium esculentum

Calochlaena dubia

Ground layer

Imperata cylindrica

Lindsaea linearis

Hibbertia aspera

Hibbertia riparia

Hibbertia linearis

Glycine spp

Entolasia stricta

Eragrostis brownii

Echinopogon caespitosus

Xanthorrhoea glauca

Community Type 2a

Simplified SG/RB/SAOF

Ground layer

Imperata cylindrica

Lindsaea linearis

Hibbertia aspera

Hibbertia riparia

Hibbertia linearis

Glycine spp

Entolasia stricta

Eragrostis brownii

Echinopogon caespitosus

Note: Typical species list only, species selection to be refined at documentation phase

Species list for Community Type 2b

Bioretention System base planting

Trees

Eucalyptus robusta

Corymbia gummifera

Melaleuca linariifolia

Shrubs

Lambertia formosa

Banksia spinulosa

Callistemon linearis

Leptspermum trinervium

Leptospermum polygalifolium

Acacia ulicifolia

Dodonaea triquetra

Sedges

Carex appressa

Ficinia nodosa

Juncus usitatus

Ground layer

Imperata cylindrica

Entolasia stricta

Eragrostis brownii

Echinopogon caespitosus

Lomandra longifolia

Community Type 2c

Bioretention System base planting within electrical easement

Sedges

Carex appressa

Ground layer

Imperata cylindrica

Entolasia stricta

Eragrostis brownii

Echinopogon caespitosus

Lomandra longifolia

Note: Typical species list only, species selection to be refined at documentation phase

Community Type 3

Entry planting

Trees

Eucalyptus signata

Banksia serrata

Ground layer

Imperata cylindrica

Hibbertia linearis

Xanthorrhoea glauca

Species list for Community Type 5

Emergent aquatic pond batter planting

Deep Marsh

(-0.35 to -0.5m)

Baumea articulata

Eleocharis sphacelata

Schoenoplectus validus

Marsh

(-0.2 to -0.35m)

Bolboschoenus caldwellii

Schoenoplectus validus

Schoenoplectus mucronatus

Shallow Marsh

(-0 to -0.2m)

Bolboschoenus caldwellii

Carex fascicularis

Eleocharis acuta

Juncus usitatus

Persicaria hydropiper

Ephemeral Marsh

(+0.2 to 0.0m)

Carex appressa

Ficinia nodosa

Juncus usitatus

Restio tetraphyllus

Littoral Zone

(+0.5m to +0.2m)

Carex appressa

Ficinia nodosa

Juncus usitatus

Lepidosperma laterale

Poa labillardierei

Schoenus apogon

Themeda australis

Note: Typical species list only, species selection to be refined at documentation phase

Community Type 5a

Submerged aquatic pond base planting

Open Water

(-0.5m and deeper)

Potamogeton sp

Community Type 5b

Swale planting

Sedges

Carex appressa

Gahnia clarkei

Grasses

Imperata cylindrica

Note: Typical species list only, species selection to be refined at documentation phase

8.0

WSUD ELEMENT MAINTENANCE CHECKLISTS

1. BIORETENTION BASINS

2. CONSTRUCTED WETLANDS

3. SEDIMENTATION BASINS

4. PONDS

CHECKLISTS TAKEN FROM LANDCOM 2009, WSUD BOOK 4: MAINTENANCE. AVAILABLE HERE:

HTTP://WWW.LANDCOM.COM.AU/DOWNLOADS/UPLOADED/WSUD_BOOK4_MAINTENANCE_DRAFT_0409_5312.PDF

Appendix B

LANDCOM

www.landcom.com.au

Water Sensitive Urban Design

Book 4 | MAINTENANCE

DRAFT

Appendix B – Regular Maintenance Checklists

B.1 Bioretention Basins

Item		Performance Target	Schedule Maintenance or Investigation	Immediate Action Required	Comment	Action Processed
		(circle relevant category)				
1	GPT / trash rack/s	GPT clear of litter	GPT 10 percent full	greater than 30 percent full		
2	Inlet structures	Clear and undamaged	Partially Blocked Observed damage	Mostly blocked Severe damage		
3	Overflow pits	Clear and undamaged	Partially Blocked Observed damage	Mostly blocked Severe damage		
4	Underdrains	Clear and undamaged	Partially Blocked Observed damage	Mostly blocked Severe damage		
5	Sediment Forebay	Sediment absent	Sediment accumulation appears excessive	Sediment accumulated to half the basin depth		
6	Erosion	Erosion absent	Erosion damage visible, but function not impaired	Severe erosion. Damage impairing function of device	Location (mark on attached map of bioretention basin)	
7	Sediment accumulation (bioretention basin)	Sediment absent	Sediment accumulation appears excessive in sediment forebay. Fine sediment accumulation apparent on bioretention media surface.	Sediment accumulated to half the forebay depth Coarse sediment or large volumes of sediment accumulation apparent on the bioretention media surface	Location (mark on attached map of bioretention basin)	

Item		Performance Target	Schedule Maintenance or Investigation	Immediate Action Required	Comment	Action Processed
		(circle relevant category)				
8	Compaction of filter media surface	No compaction evident	Localised compaction or subsidence evident. Localised ponding longer than 24 hours after storm event	Water remains ponding longer than 24 hours after storm event	Location (mark on attached map of bioretention basin)	
9	Weeds	No weeds present	Weeds present	Noxious or environmental weeds present, or weed cover more than 25 percent	Location (mark on attached map of bioretention basin) Identify weed species	
10	Plant condition	Healthy vegetation	Poorly growing or visibly stressed	Die back / dead plants	Location (mark on attached map of bioretention basin) Identify species requiring replacement	
11	Litter (organic)	No litter visible	Litter visible	Litter thickly covers filter media surface or detracting from visual amenity	Location (mark on attached map of bioretention basin) Note type of litter removed	
12	Litter (anthropogenic)	No litter visible	Litter visible	Litter blocking structures or detracting from visual amenity	Location (mark on attached map of bioretention basin) Note type of litter removed	
13	Oil spills / inflows	No visible oil	Persistent but limited visible oil	Extensive or localised thick layer of oil visible		

B.2 Constructed Wetlands

Item		Performance Target	Schedule Maintenance or Investigation	Immediate Action Required	Comments	Action Processed
		(circle relevant category)				
1	GPT / trash rack	GPT clear of litter	GPT 10 percent full	GPT / trash rack for than 30 percent full		
2	Inlet pipe	Clear and undamaged	Partially Blocked Observed damage	Mostly blocked Severe damage		
3	Pipes connecting macrophyte cells	Clear and undamaged	Partially Blocked Observed damage	Mostly blocked Severe damage		
4	Outlet pit	Clear and undamaged	Partially Blocked Observed damage	Mostly blocked Severe damage		
5	Erosion	Erosion absent	Erosion damage visible, but structure functional	Severe erosion. Damage impairing function of device	Location (mark on attached map of wetland)	
6	Sediment build-up	Sediment absent	Sediment accumulation appears excessive	Sediment accumulated to half the basin depth	Location (mark on attached map of wetland)	
7	Aquatic weeds (submerged, emergent and floating)	No weeds present	Weeds present	Noxious or environmental weeds present	Location (mark on attached map of wetland) Identify weed species	

Item		Performance Target	Schedule Maintenance or Investigation	Immediate Action Required	Comments	Action Processed
		(circle relevant category)				
8	Terrestrial weeds (e.g. within the batter slopes)	No weeds present	Weeds present	Noxious or environmental weeds present	Location (mark on attached map of wetland) Identify weed species	
9	Algal blooms	No algae apparent	Algae visible	Algal growth prominent or extensive		
10	Plant condition (aquatic macrophytes)	Healthy vegetation	Poorly growing or visibly stressed	Die back / dead plants	Note species which require replanting	
11	Plant condition (terrestrial)	Healthy vegetation	Poorly growing or visibly stressed	Die back / dead plants	Note species which require replanting	
12	Litter (organic)	No litter visible	Litter visible	Litter blocking structures or detracting from visual amenity	Location (mark on attached map of wetland) Note type of litter removed	
13	Litter (anthropogenic)	No litter visible	Litter visible	Litter blocking structures or detracting from visual amenity	Location (mark on attached map of wetland) Note type of litter removed	

B.3 Sedimentation Basin

Item		Performance Target	Schedule Maintenance or Investigation	Immediate Action Required	Comment	Action Processed
		(circle relevant category)				
1	GPT / trash rack/s	GPT clear of litter	GPT 10 percent full	greater than 30 percent full		
2	Inlet structures	Clear and undamaged	Partially Blocked Observed damage	Mostly blocked Severe damage		
3	Overflow pits	Clear and undamaged	Partially Blocked Observed damage	Mostly blocked Severe damage		
4	Sediment Forebay	Sediment absent	Sediment accumulation appears excessive	Sediment accumulated to half the basin depth		
5	Erosion	Erosion absent	Erosion damage visible, but function not impaired	Severe erosion. Damage impairing function of device	Location (mark on attached map of sedimentation basin)	
6	Sediment accumulation	Sediment accumulated to less than half the basin depth	Sediment accumulated to half basin depth	Sediment accumulation greater than half the basin depth	Note timing since last desilting operation	

Item		Performance Target	Schedule Maintenance or Investigation	Immediate Action Required	Comment	Action Processed
		(circle relevant category)				
7	Weeds	No weeds present	Weeds present	Noxious or environmental weeds present, or weed cover more than 25 percent	Location (mark on attached map of sedimentation basin) Identify weed species	
8	Plant condition	Healthy vegetation	Poorly growing or visibly stressed	Die back / dead plants	Location (mark on attached map of sedimentation basin) Identify species requiring replacement	
9	Litter (organic)	No litter visible	Litter visible	Litter thickly covers filter media surface or detracting from visual amenity	Location (mark on attached map of sedimentation basin) Note type of litter removed	
10	Litter (anthropogenic)	No litter visible	Litter visible	Litter blocking structures or detracting from visual amenity	Location (mark on attached map of sedimentation basin) Note type of litter removed	
11	Oil spills / inflows	No visible oil	Persistent but limited visible oil	Extensive or localised thick layer of oil visible		

B.4 Ponds

Item		Performance Target	Schedule Maintenance or Investigation	Immediate Action Required	Comments	Action Processed
		(circle relevant category)				
1	Inlet pipe	Clear and undamaged	Partially Blocked Observed damage	Mostly blocked Severe damage		
2	Outlet pipe	Clear and undamaged	Partially Blocked Observed damage	Mostly blocked Severe damage		
3	Erosion	Erosion absent	Erosion damage visible, but structure functional	Severe erosion. Damage impairing function of device	Location (mark on attached map of pond)	
4	Sediment build-up	Sediment absent	Sediment accumulation appears excessive	Sediment accumulated to half the basin depth	Location (mark on attached map of pond)	
5	Aquatic weeds (submerged, emergent and floating)	No weeds present	Weeds present	Noxious or environmental weeds present	Location (mark on attached map of pond) Identify weed species	
6	Terrestrial weeds (e.g. within the batter slopes)	No weeds present	Weeds present	Noxious or environmental weeds present	Location (mark on attached map of pond) Identify weed species	

Item		Performance Target	Schedule Maintenance or Investigation	Immediate Action Required	Comments	Action Processed
		(circle relevant category)				
7	Algal blooms	No algae apparent	Algae visible	Algal growth prominent or extensive		
8	Plant condition (aquatic macrophytes)	Healthy vegetation	Poorly growing or visibly stressed	Die back / dead plants	Note species which require replanting	
9	Plant condition (terrestrial)	Healthy vegetation	Poorly growing or visibly stressed	Die back / dead plants	Note species which require replanting	
10	Litter (organic)	No litter visible	Litter visible	Litter blocking structures or detracting from visual amenity	Location (mark on attached map of pond) Note type of litter removed	
11	Litter (anthropogenic)	No litter visible	Litter visible	Litter blocking structures or detracting from visual amenity	Location (mark on attached map of pond) Note type of litter removed	

NOTE: A check for trash racks / nets has not been included, as the pond should not be designed as a water quality treatment system, but rather to provide storage capacity of attenuation of peak flows to downstream waterways.