RIPARIAN CORRIDOR
VEGETATION MANAGEMENT PLAN

2 MACPHERSON STREET
WARRIEWOOD

AUGUST 2017
REF: 7038

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PREFACE

This Final Riparian Corridor Vegetation Management Plan has been prepared by *Conacher Consulting* to identify matters in relation to the management of vegetation within the identified riparian corridor area within 2 Macpherson Road, Warriewood.

PROJECT TEAM

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SECTION 1

INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This Vegetation Management Plan has been prepared by *Conacher Consulting* for a proposed development within 2 Macpherson Street Warriewood. The primary objective of this Vegetation Management Plan is to provide details and management measures for the protection, restoration and rehabilitation of a vegetated riparian corridor within the subject site.

This report has been prepared in accordance with the NSW Office of Water Guidelines for Controlled Activities (2012) and Council's Pre-Lodgement Report for the proposed development.

The planning and cadastral details of the subject site are provided in Table 1.1. A plan of the subject site showing the proposed development and vegetation management areas is provided as Figure 1.1.

TABLE 1.1
SITE DETAILS

Location (Subject site)	Lot 25 Section C DP 5464, 2 Macpherson Street, Warriewood.
Area	Approximately 2.2 hectares
Local Government Area	Northern Beaches
Existing Land Use	Vacant Land (previous nursery)

1.2 PROPOSED DEVELOPMENT

The proposed development is for civil works including earthworks, and the provision of road and drainage infrastructure.

Detailed plans of the proposal have been provided as separate documentation to this report.

1.3 PROCEDURE FOR PREPARING VEGETATION MANAGEMENT PLAN

Document and Literature Review
In preparing this Vegetation Management Plan, a number of existing guidelines, reports and documents have been reviewed. Brief details on these are provided below:

i. NSW DPI Office of Water Guidelines for Controlled Activities

A controlled activity is an activity undertaken on waterfront land. The NSW DPI Office of Water has issued the following relevant guidelines for Controlled Activities on Waterfront Land:

- Vegetation Management Plans;
- Riparian Corridors;
- In-stream Works; and
- Outlet Structures.

These guidelines were considered during the preparation of this VMP.

ii. Flora and Fauna Assessment Report (Conacher Consulting 2017)

The Flora and Fauna Assessment Report prepared for the site by Conacher Consulting was utilised to inform the preparation of this report.

iii. Northern Beaches Council Pre-Lodgement Report (June 2017)

Council's Pre-lodgement Report was reviewed to determine Council's requirements for the proposed Riparian Corridor.

Site Inspection
A site inspection was undertaken on 8 June 2017 to assess the current condition and characteristics of the waterfront land within the subject site and to determine the characteristics of the vegetation present. Photographs of the riparian corridor areas of the site are provided in Appendix 1 of this report.

1.4 DETERMINATION OF RIPARIAN CORRIDOR LOCATION & WIDTH

The topographic map for the site shows that Narrabeen Creek, a second order watercourse, intersects the site northern and eastern sections of the subject site. .

The NSW Office of Water Guidelines for Riparian Corridors identify that a 20 metre Vegetated Riparian Zone is recommended from the top of bank on both sides of second order watercourses.

Council's Pre-lodgement Report for the site identifies that a 25 metre Riparian Corridor (measured from the creek centreline) applies to the sections of Narrabeen Creek which intersect the site. Council have identified that this area is required to be dedicated to Council.

Council have also identified that an additional Private Buffer of 25 metres is required to the riparian zone at a distance of 25 to 50 metres from the centreline of Narrabeen Creek. The management of this area will be determined one a future land use has been determined for the site.

This report has been prepared specifically for the 25 metre Riparian Corridor Area of the site.

1.5 EXISTING VEGETATION CHARACTERISTICS

A detailed description of the vegetation characteristics of the site is provided within the Flora and Fauna Assessment Report prepared by Conacher Consulting (2017).

The Riparian Corridor area within the site contains Cleared Land / Exotic Vegetation with small scattered patches of Disturbed Swamp Oak Forest vegetation.

Disturbed Swamp Oak Forest vegetation present consists of remnant canopy trees over an understorey of exotic flora species and patches of regrowth Swamp Oaks within the abandoned previously cleared nursery areas of the site.

1.6 COMPLIANCE WITH NSW OFFICE OF WATER CRITERIA FOR PREPARING A VEGETATION MANAGEMENT PLAN ON WATERFRONT LAND

The criteria addressed below relates specifically to the designated Riparian Corridor area of the site. The criteria addressed, follows the Guidelines for Vegetation Management Plans on Waterfront Land (DPI Office of Water 2012).

TABLE 1.2
NSW OFFICE OF WATER
GUIDELINES FOR VEGETATION MANAGEMENT PLANS CRITERIA ASSESSMENT

Criteria	Where Addressed in this Report
An appropriate width for the riparian corridor should be identified by consulting the development consent, the relevant environmental planning instrument or the NSW Office of Water guidelines for riparian corridors. The VMP should consider the full width of the riparian corridor and its functions including accommodating fully structured native vegetation.	The riparian corridor has been identified following consideration of the approved development areas and consultation within the NSW Office of Water.

TABLE 1.2 NSW OFFICE OF WATER GUIDELINES FOR VEGETATION MANAGEMENT PLANS CRITERIA ASSESSMENT	
Criteria	**Where Addressed in this Report**
Maps or diagrams which clearly identify the riparian corridor; the existing vegetation; the vegetation to be retained; the vegetation to be cleared; the footprint of construction activities; and areas of proposed revegetation etc. should be prepared.	See Figure 1.1.
The location of the bed and banks or foreshore of waterfront land and the footprint of the riparian corridor should be clearly identified. Vegetated riparian zones must be indicated.	See Figure 1.1.
Photographs of the site should be supplied and photo points should be identified. To assist with future monitoring and reporting requirements, the photo points should be identified by GPS coordinates or by survey. This is particularly important for large scale earthworks or extractive industries.	Photographs of the site are provided in Appendix 1. Locations for future monitoring points are shown in Figure 1. Due to the relatively small size of the site, identification of photo monitoring points by GPS coordinates or survey is considered not necessary.
Measures for controlling long term access and encroachments (bollards, fences, etc.) into the riparian corridor should be identified.	See Section 2.2.5
Vegetation species composition, planting layout and densities should be identified. The required mix of plant species relates to the actual community to be emulated and the size of the area or areas to be rehabilitated but mature vegetation communities are generally well structured, comprising trees, shrubs and groundcovers species. Planting densities should achieve quick vegetative cover and root mass to maximise bed and bank stability along the subject watercourse.	See Section 2.2.3
Seed or plant sources should be identified. Where possible, native plants and seed sources of local provenance should be used.	See Appendix 2.
Exotic vegetation should be avoided. The use of exotic species for temporary soil stabilisation is permitted provided they are sterile, non-invasive and easily eradicated when permanent vegetation is established.	Use of exotic vegetation is not proposed.
Details of the planting program, rehabilitation methods and staging should be provided. Techniques such as hydro-seeding, direct seeding, brush matting or assisted natural regeneration may be considered.	See Section 2.2, Section 3.1 and Appendix 2.
Maintenance requirements should extend for a minimum of two years after the completion of works or until such time as a minimum 80 per cent survival rate of each species planted and a maximum 5 per cent weed cover for the treated riparian corridor controlled activity is achieved.	See Section 2.5.
Project tasks should be defined and described, including a schedule detailing the sequence and duration of works necessary for the implementation of the VMP.	A works program is provided in Section 3.

TABLE 1.2 NSW OFFICE OF WATER GUIDELINES FOR VEGETATION MANAGEMENT PLANS CRITERIA ASSESSMENT	
Criteria	**Where Addressed in this Report**
Costings for the implementation of all components and stages of the work including materials, labour, watering, maintenance which includes plant replacement, monitoring and reporting should be prepared.	Costings have not been provided as part of this report. A qualified Landscape Contractor or Bushland Regenerator should be consulted to determine the costs associated with implementing this Plan.
Processes for monitoring and review, including a method of performance evaluation should be identified. This should include replacing plant losses, addressing deficiencies, problems, climatic conditions and successful completion of works.	See Section 2.5.
Regular reporting on the implementation and status of works covering progress, success or failures and completion should be provided. The number and duration of reporting periods will be identified in the CAA. Works as executed plans and reports detailing how the components of the VMP have been implemented will be required prior to the release of any security held by the NSW Office of Water.	Reporting requirements are detailed in Section 2.5.

SECTION 2

VEGETATION MANAGEMENT STRATEGY

2.1 IDENTIFIED MANAGEMENT AREA & WORKS

The management area of relevance to this plan is the Riparian Corridor Area shown in Figure 1.1. In order to restore and rehabilitate the riparian corridor area the following works are likely to be required:

- Civil works (channel realignment, stabilisation and bed control works);
- Land amelioration and soil preparation works;
- Weed management; and
- Re-planting of endemic vegetation.

2.2 RIPARIAN CORRIDOR AREA MANAGEMENT DETAILS

The Riparian Corridor Area will be managed to enable the establishment of a Vegetated Riparian Corridor in accordance with Controlled Activity Guidelines for Riparian Corridors on Waterfront Land (NSW DPI Office of Water 2012). A detailed description of the Riparian Corridor works is provided as follows.

2.2.1 Civil Works and Land Amelioration Works

Future civil works and land amelioration works will be required to enhance the Riparian Corridor areas of Narrabeen Creek within the site. These works are likely to the following:

- Removal of exotic vegetation, introduced materials and reshaping of the riparian corridor area to emulate natural topographical conditions,
- Machine assisted removal of exotic vegetation,
- Regrading and stabilisation works including possible rock armouring.
- Topsoil amelioration and management works.

For areas where it is determined that the topsoil is not adequate to support replanting of vegetation, an organic soil mix and soil stabilisation matting should be utilised within the riparian corridor area.

Areas of Disturbed Swamp Oak Forest vegetation are to be prioritised for retention, where possible within the proposed Riparian Corridor Area. Where vegetation cannot be retained it is to be replanted.

2.2.2 Weed Management and Removal

Primary weed management is to be undertaken within the Riparian Corridor Area prior to revegetation works. Follow up weed management is to be undertaken following revegetation works.

Weed Management Protocol

The following protocol is to be implemented to reduce the risk of transfer of noxious weeds and environmental weeds onto or from the Riparian Corridor during site clearing, construction and maintenance works:

- No plant material identified to contain weeds is to be transported into the Riparian Corridor. All introduced plant material is to be checked for weeds prior to entering the site;
- Prior to entering the Riparian Corridor all clearing and vegetation maintenance contractors, machinery and equipment are to be cleaned of all vegetative material and soil. Any foreign vegetative or soil material is to be bagged and disposed of at an approved waste facility;
- Plant material brought onto the Riparian Corridor is to be limited to vegetative material required for revegetation works;
- Weeds cleared during the course of works are to be removed from the Riparian Corridor;
- Only weed free mulch is to be used within the Riparian Corridor;

- Piling of soil that may contain seeds of exotic species must be located at least 20 metres away from retained native vegetation to prevent transportation to adjacent areas during rainfall or wind events;
- Any noxious weeds are to be managed in accordance with the *Noxious Weeds Act* (1993);
- At the completion of works all contractors, machinery and equipment are to be cleaned of all vegetative material and soil prior to leaving the site.

Primary Weed Control and Removal

The implementation of weed management and removal strategies will minimise the ecological risk posed by weed invasion and aid in the maintenance of the long term environmental and ecological values of the site. Where weeds are identified as occurring or re-occurring following land amelioration works appropriate weed control will be undertaken. Weed control can be carried out either through physical control methods or the careful and localised use of herbicides as outlined in the following description.

Physical Control Methods

Heavy machinery is to be utilised for initial exotic canopy and understorey vegetation control and to prepare the soil for planting within the Riparian Corridor Area.

Herbicide Control Methods

Chemical control methods involve the use of herbicides. These herbicides can be specific to a particular plant or more broad ranging types of chemicals. Problems with the use of herbicides include chemical residues affecting soils, herbicide runoff into water bodies and the health and safety of the operator involved in the application of the herbicide. Advantages of herbicide use include the low time taken to spray weeds as opposed to physically removing them, especially for large infestations of weeds. Broad area spray application is considered inappropriate for this program. Herbicides will be applied by cut and paint or hand held application methods only. Suitable physical control methods are to be the preferred option. Further detailed descriptions of herbicide control techniques are provided in Appendix 2.

Target Weed Species

Table 2.2 contains a list of exotic flora species which are to be prioritised eradication during primary and/or secondary weed control works. Future monitoring may also identify additional invasive environmental weed species for targeted weed control works. Monitoring and maintenance of weed infestations is to be undertaken in accordance with the requirements outlined in Section 2.5 of this report.

TABLE 2.1
EXOTIC FLORA SPECIES TARGETED FOR ERADICATION

Scientific Name	**Common Name**
Trees	
*Erythrina crista-galli**	Cockspur Coral Tree
*Erythrina x sykesii**	Coral Tree
*Ficus benjamina**	Weeping Fig
*Ficus elastica**	Rubber Fig
*Salix babylonica**	Weeping Willow
Shrubs	
*Phoenix canariensis**	Canary Island Date Palm
*Ricinus communis**	Castor Oil Plant
*Senna pendula var. glabrata**	
*Ligustrum lucidum**	Large-leaved Privet
*Ligustrum sinense**	Small-leaved Privet
*Ludwigia peruviana**	
*Arundo donax**	Giant Reed
*Lantana camara**	Lantana
*Monstera deliciosa**	Fruit Salad Plant
*Xanthosoma violaceum**	Chinese Taro

TABLE 2.1 EXOTIC FLORA SPECIES TARGETED FOR ERADICATION	
Scientific Name	**Common Name**
*Zantedeschia aethiopica**	Arum Lily
*Ageratina adenophora**	Crofton Weed
*Ageratum houstonianum**	
*Bidens pilosa**	Cobbler's Pegs
*Tradescantia fluminensis**	Trad
*Myriophyllum aquaticum**	Parrots Feather
*Andropogon virginicus**	Whisky Grass
*Cortaderia selloana**	Pampas Grass
*Cestrum parqui**	Green Cestrum
Climbers	
*Trachelospermum jasminoides**	Star Jasmine Vine
*Asparagus aethiopicus**	Asparagus Fern
*Asparagus asparagoides**	Bridal Creeper
*Anredera cordifolia**	Madeira Vine
*Ipomoea indica**	Morning Glory

Secondary Weed Control
Secondary weed control should be undertaken surrounding replanted and retained vegetation. These works are to be undertaken either by or under the supervision of a qualified Bushland Regenerator or Landscape Contractor, secondary weed control techniques are provided in Appendix 2 and are to be limited to low impact physical control methods and targeted herbicide control.

2.2.3 Riparian Corridor Plantings

Re-vegetation works are to be undertaken within the Riparian Corridor following land amelioration and weed control works.

Plants are to be planted into suitably prepared areas within the Riparian Corridor. Following civil works the topsoil is to be regraded and jutemesh matting is to be installed where additional stabilisation is necessary. The flora species, planting areas and planting densities identified in Table 2.2 and Figure 1 are to be used for replacement planting. The species selected have been identified in the Warriewood Valley Urban Release Area Landscape Masterplan and Design Guidelines. Revegetation will ensure bed and bank stability within the disturbed areas of the proposed Riparian Corridor. Further detailed methodologies for undertaking replanting works are provided in Appendix 2.

TABLE 2.2 RECOMMENDED SPECIES FOR REPLANTING WITHIN RIPARIAN CORRIDOR		
Planting Area	**Recommended Species**	**Planting Density**
Canopy Trees	*Eucalyptus robusta* *Ficus coronata* *Tristaniopsis laurina* *Casuarina glauca* *Melaleuca ericifolia* *Livistona australis* *Banksia integrifolia* *Eucalyptus punctata* *Eucalyptus botryoides* *Acmena smithii* *Glochidion ferdinandi* *Schizomeria ovata* *Ceratopetalum apetalum* *Cyathea australis*	1 plant / m^2
Understorey Shrubs	*Cyathea australis* *Acacia suaveolens*	3 plants / m^2

TABLE 2.2 RECOMMENDED SPECIES FOR REPLANTING WITHIN RIPARIAN CORRIDOR		
Planting Area	**Recommended Species**	**Planting Density**
	Banksia spinulosa *Banksia integrifolia* *Ceratopetalum gummifera* *Grevillea sericea* *Macrozamia communis* *Melaleuca hypericifolia* *Callicoma serratifolia* *Hibbertia scandens*	
Native Grasses and Aquatics	*Xanthorrhoea spp.* *Cissus hypoglauca* *Juncus spp.* *Gahnia sieberana* *Lomandra longifolia* *Microlaena stipoides*	4 plants / m^2

Where possible, replanting stock is to from local provenance stock sourced within the catchment area within which the site is located. Seed and plant sources are to be identified by the bushland regeneration contractor or landscape contractor engaged to undertake the works. Exotic species are not to be used for replanting or rehabilitation works.

Monitoring and maintenance of revegetation works is to be undertaken in accordance with the requirements outline in Section 2.5 of this report. Revegetation of other areas outside of the Riparian Corridor will be undertaken in accordance with site landscaping requirements.

2.2.5 Vegetation Protection and Access Management

Vegetation Protection and Access Management during Works
The following management strategies are proposed to minimise damage to trees and native vegetation to be retained during the proposed works.

- Temporary **Vegetation Protection Zones (VPZs)** are to be established at the outer limit of works adjoining retained native vegetation.
- VPZs are to be established for the duration of works to minimise impacts to trees and vegetation outside of the works area.
- VPZs are to have regard to the tree protection zones specified for individual trees identified in accordance with Australian Standard AS 4970—2009.
- Before construction commences VPZs are to be adequately marked and sign posted using chain-link fencing, star pickets and wire, high visibility tape or plastic net fencing;
- Approved tree removal operations in the vicinity of retained trees are to be undertaken in a manner that avoids canopy damage and soil compaction. Such works are to be supervised by a consulting ecologist / or arborist;
- All trenches footings and major earth movement should avoid vegetation protection zones;
- Stockpiling materials and soils within vegetation protection zones is to be avoided;
- Machinery is to avoid vegetation protection zones during all operations;
- All construction waste material is to be disposed of offsite. No construction waste materials are to enter the VPZs or the Riparian Corridor.

Permanent Vegetation Protection and Access Management

Following the completion of riparian corridor works permanent access controls are to be installed and shall consist of post and rail fencing, bollards or similar.

2.2.6 Stormwater Outlet Structures

All stormwater outlet structures are to be designed and implemented in accordance with the NSW DPI Office of Water (2012) Guidelines for Controlled Activities – Outlet Structures.

2.2.7 Watercourse Crossings

No watercourse crossings are proposed within the Riparian Corridor area.

2.3 ASSET PROTECTION ZONE DETAILS

Asset protection zones are to be located outside of the Riparian Corridor Area.

2.4 SOIL EROSION AND DRAINAGE ISSUES

The objective of stormwater management is to ensure drainage from the construction area does not have a negative impact on vegetated areas and surrounding waterways. A site specific Sediment and Erosion Control Plan is to be implemented during works.

Erosion and sediment control measures are to be implemented prior to the commencement of the development to minimise adverse effects as a result of increased erosion and sediment loading. Erosion and sediment control measures to be implemented during construction include:

- Coordinated work practices aimed at minimising land disturbance;
- The minimisation of groundcover disturbance through the dedication of vegetation protection zones;
- Implementation of sediment erosion control fencing as per the Sediment and Erosion Control Plan;
- Routine site inspections of drains, channels, sediment control structures and water quality;
- Identification of potential erosion areas;
- Installation and maintenance of flow control structures and soil stabilising vegetation wherever required;
- Construction of all outlet structures in accordance with the published guidelines.

The minimisation of soil erosion will be achieved through soil stabilisation measures, sediment erosion control fencing and water control techniques. Soil stabilisation measures to be implemented include immediate revegetation of cleared surfaces via seeding, planting of native species and the installation of biodegradable blankets.

2.5 ONGOING MONITORING AND MAINTENANCE ACTIVITIES

It is recommended that regular monitoring inspections be undertaken at 6 monthly intervals for 2 years after primary weeding and replanting works have been undertaken. This will allow for the assessment of the health of the vegetation and may include identification of any areas suffering from disturbance or in need of additional rehabilitation, weed control, sediment or storm water control, bank and soil stabilisation or maintenance of rehabilitated or regenerating areas.

Monitoring and review will include a performance evaluation of the works and will include assessment for replanting where losses have occurred, addressing any deficiencies observed, and determining a successful outcome. A successful outcome is usually defined as a minimum of 80% survival rate for all plantings and a maximum of 5% weed cover for the treated areas.

Following these monitoring inspections a report with accompanying photos (taken at standard locations) will be prepared for the Council's records and submitted the NSW Office of Water. Photo point monitoring is to be undertaken at the locations shown in Figure 1.1.

Maintenance is to be undertaken weekly following re-planting works for one month, or in accordance with the prevailing environmental and weather conditions, to facilitate the initial establishment of plantings and then monthly thereafter for the remaining maintenance period. Maintenance will include watering, replacement planting, weeding (herbicide or low impact physical weed removal as required), re-erecting sediment erosion control fencing, mulching, removing rubbish and regular inspections and performance assessment.

All monitoring and maintenance is to be the responsibility of the land owner.

SECTION 3

WORKS PROGRAM

3.1 WORKS PROGRAM

A proposed works program is outlined in Table 3.1.

TABLE 3.1
SCHEDULE OF VEGETATION MANAGEMENT WORKS

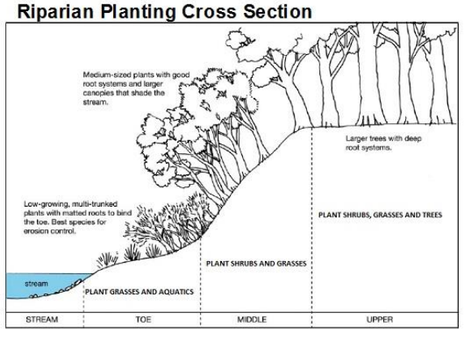
Management Tasks	Stage					Works to be undertaken by
	Pre-construction	Construction	First Month Post Construction	1 Month to end of Year 1	Year 1 to end of Year 2	
Collection of seed / plant propagation						Bushland regenerator
Identify and install protective fencing for retained vegetation						Contractor and project Ecologist
Installation and maintain erosion and sediment controls						Civil contractor
Land amelioration works						Civil contractor
Primary weed control works						Civil contractor
Vegetation Replanting						Bushland regenerator / Landscape contractor
Installation of access exclusion measures						Civil contractor
Planting maintenance and secondary weed maintenance			Weekly	Monthly	Monthly	Bushland regenerator / Landscape contractor
Monitoring and Reporting Inspections				Biannually	Biannually	Ecologist

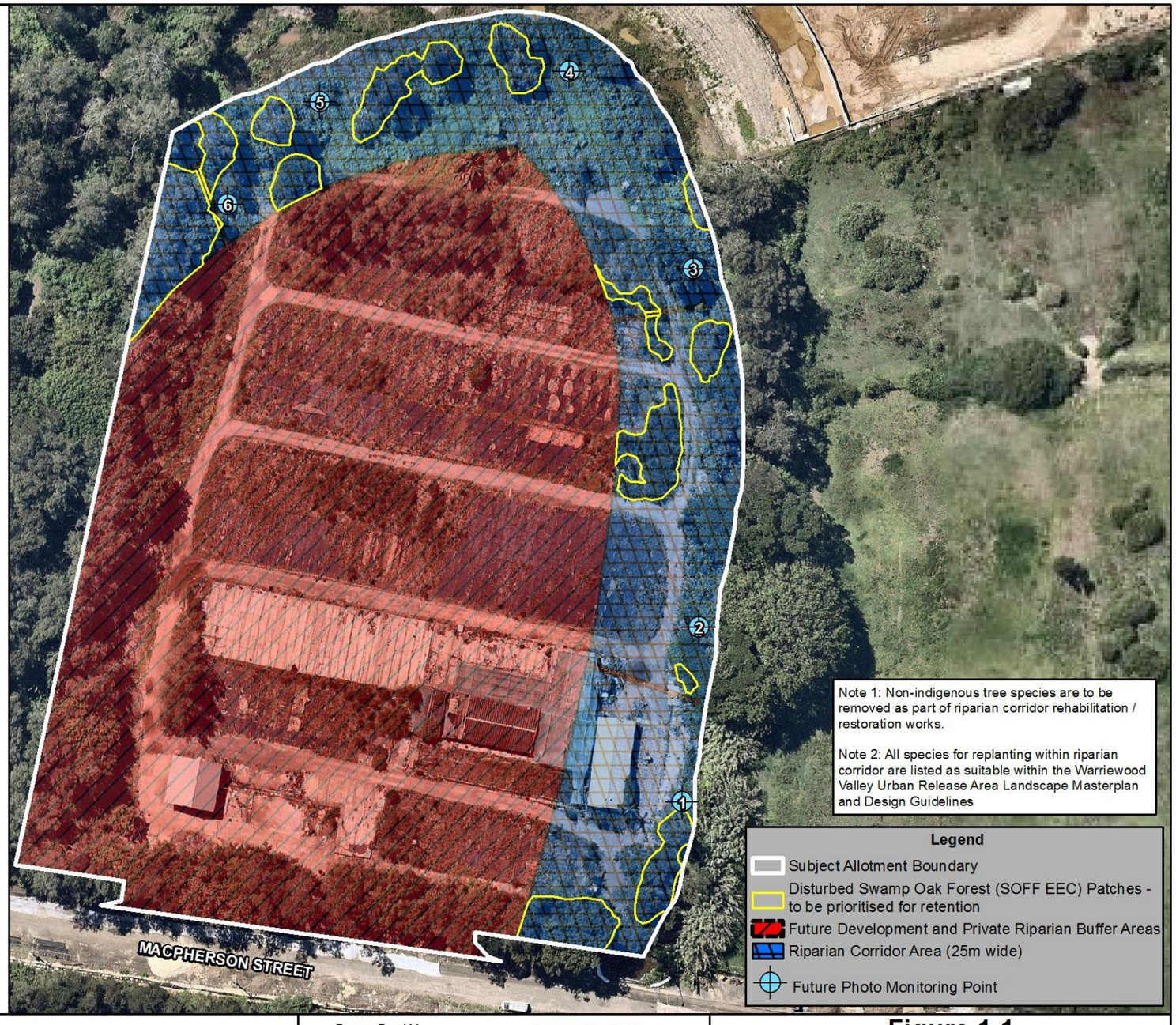
Target Weed & Replanting Species

EXOTIC FLORA SPECIES TARGETED FOR ERADICATION	
Scientific Name	**Common Name**
Trees	
*Erythrina crista-galli**	Cockspur Coral Tree
*Erythrina x sykesii**	Coral Tree
*Ficus benjamina**	Weeping Fig
*Ficus elastica**	Rubber Fig
*Salix babylonica**	Weeping Willow
Shrubs	
*Phoenix canariensis**	Canary Island Date Palm
*Ricinus communis**	Castor Oil Plant
*Senna pendula var. glabrata**	
*Ligustrum lucidum**	Large-leaved Privet
*Ligustrum sinense**	Small-leaved Privet
*Ludwigia peruviana**	
*Arundo donax**	Giant Reed
*Lantana camara**	Lantana
*Monstera deliciosa**	Fruit Salad Plant
*Xanthosoma violaceum**	Chinese Taro
*Zantedeschia aethiopica**	Arum Lily
*Ageratina adenophora**	Crofton Weed
*Ageratum houstonianum**	
*Bidens pilosa**	Cobbler's Pegs
*Tradescantia fluminensis**	Trad
*Myriophyllum aquaticum**	Parrots Feather
*Andropogon virginicus**	Whisky Grass
*Cortaderia selloana**	Pampas Grass
*Cestrum parqui**	Green Cestrum
Climbers	
*Trachelospermum jasminoides**	Star Jasmine Vine
*Asparagus aethiopicus**	Asparagus Fern
*Asparagus asparagoides**	Bridal Creeper
*Anredera cordifolia**	Madeira Vine
*Ipomoea indica**	Morning Glory

RECOMMENDED SPECIES FOR REPLANTING WITHIN RIPARIAN CORRIDOR		
Planting Area	**Recommended Species**	**Planting Density**
Canopy Trees	*Eucalyptus robusta* *Ficus coronata* *Tristaniopsis laurina* *Casuarina glauca* *Melaleuca ericifolia* *Livistona australis* *Banksia integrifolia* *Eucalyptus punctata* *Eucalyptus botryoides* *Acmena smithii* *Glochidion ferdinandi* *Schizomeria ovata* *Ceratopetalum apetalum* *Cyathea australis*	1 plant / m²
Understorey Shrubs	*Cyathea australis* *Acacia suaveolens* *Banksia spinulosa* *Banksia integrifolia* *Ceratopetalum gummifera* *Grevillea sericea* *Macrozamia communis* *Melaleuca hypericifolia* *Callicoma serratifolia* *Hibbertia scandens*	3 plants / m²
Native Grasses and Aquatics	*Xanthorrhoea spp.* *Cissus hypoglauca* *Juncus spp.* *Gahnia sieberana* *Lomandra longifolia* *Microlaena stipoides*	4 plants / m²

Riparian Planting Cross Section





conacher consulting

N 0 10 20 30 40 50 m

Figure produced as A3 colour

Drawn By: AM
Drawing Version: 1
Drawing No: 7038
Date: 16/08/2017

* Plan for indicative purposes only. Not for detailed measurement.
Source: Aerial © Nearmap (2017) Air Photo Date: 23/02/2017

Figure 1.1
Vegetation Management Details
Macpherson Street, Warriewood

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APPENDIX 1

SITE PHOTOGRAPHS

Photo 1. Dense exotic understorey vegetation within the northern section of the site.

Photo 2. Typical regrowth native vegetation present within the site.

Photo 3. Exotic and native canopy vegetation within the northern section of the site.

APPENDIX 2

WEED MANAGEMENT AND REVEGETATION TECHNIQUES

PART 1
REVEGETATION METHODS

1. TIMETABLE OF WORK

The Bushland Regenerator shall provide a preliminary planting schedule which incorporates a draft timetable of works for the planting activities. This shall be submitted at the time of tendering. A final planting schedule shall be prepared in consultation with the Proponent. This schedule should be designed to minimise the time the sites are exposed and take into account seasonal factors, availability of tubestock plants, and timing of construction works.

2. SITE PREPARATION

Site preparation activities for all planting sites will include preliminary weed control, rubbish removal and (where necessary) minor earthworks (levelling, ripping). Bare soil areas are to be sown with a native grass mix nurse crop to provide temporary soil stabilisation, and (where applicable) soil erosion control measures installed.

3. PLANT MATERIAL

Plant material used for revegetation within the project area shall be sourced only from local bushland areas. The Bushland Regenerator is responsible for obtaining all necessary permits and licenses. All plants are to be provided in a healthy condition. They must have good root development and a sturdy shoot system. Plant with an elongated or yellowed shoot system shall not be accepted. Planting shall be undertaken immediately after delivery. If this is not possible, the Bushland Regenerator shall be required to provide appropriate storage to keep the plants in good condition on the site, adequately protected from frost, wind, sun and vermin, and secured from vandals.

4. PLANTING GUIDELINES

4.1 Planting Densities and Niche species

The Bushland Regenerator shall be responsible for planting according to the Site Planting Plan prepared by in consultation with the Proponent. This Plan will detail the required species and their distribution across the planting area. The Bushland Regenerator shall be responsible for ensuring planting densities and appropriate niche species.

Only locally indigenous plants will be used. Niche preferences shall be considered in planting, with plants being placed in the correct position with regard to soil type, moisture, aspect and slope. Plantings should be at a density which will result in a near natural canopy density at all structural levels (strata).

4.2 Planting Methods

Planting holes shall be excavated to a depth of 150 mm and a diameter of 200 mm. Slow release native plant fertiliser (low phosphorous formulated native plant fertilizer tablet/granules) shall be placed into the planting hole. In poorly structured soils, approximately 200 cubic centimetres of native plant soil mix is to be placed and incorporated into the planting hole with fertiliser and water storing granules. Plants must be placed into moistened soil preferably by soaking 1-2 litres of water into each hole. After planting the soil shall be replaced and carefully firmed, leaving a slight depression around each plant to allow for water collection. Soil is to be replaced in the hole so that the base of the stem is level with the soil surface, not set below the soil, or sitting above.

All plants are to be thoroughly watered before planting and again after planting. If the weather is hot, a third watering shall be carried out within two (2) days or a t-tape or drip irrigation system set up to water plants on a weekly basis.

4.3 Plant Protection

The Bushland Regenerator shall be responsible for adequately protecting plant material from frost, wind, sun, vermin and animals. Two (2) Litre cardboard guards (including 2 stakes) shall be around each plant and maintained throughout the maintenance period of up to 3 years. The use of Jute mats (mulch mats) is recommended where annual or grass regrowth is expected.

4.4 Mulching

After planting, the exposed ground should be thickly mulched with low-nutrient mulch such as chipped eucalyptus. A depth of approximately 75 mm and a diameter of 400 mm around each plant are recommended. No exotic plant material is to be used. Pine bark is not considered to be a suitable mulch material. The provenance of all mulch material must be known and approved by the Bushland Regenerator. Mulch is not to be used in sand dunes ecosystems or bushfire inner protection areas. Care should be taken to keep mulch material away from the stems of the newly planted tubestock. Alternately, a light sowing of a suitable nurse crop (Rye Corn or Japanese Millet) can be made between plantings to provide a protective microclimate. Sowing rates to be used are those recommended by the supplier and agreed with the Bushland Regenerator.

4.5 Maintenance and Weed Control

Plantings must be suitably maintained (watering and weeding). During the maintenance phase any plant losses in excess of 20% of the total number planted must be replaced at the expense of the Bushland Regenerator.

Site maintenance shall consist of the following tasks:

- Weeding throughout the planting area;
- Watering tubestock;
- Replacing lost plants (as required); and
- Removing wind-blown or other rubbish from the planting area.

The Bushland Regenerator shall provide a preliminary maintenance schedule which incorporates a timetable of works for each of the activities listed above.

PART 2
WEED MANAGEMENT TECHNIQUES

1. BACKGROUND INFORMATION

Weed removal should be undertaken using small tools such as spades, mattocks, garden forks and saws to reduce soil disturbance and minimise damage to nearby plants. In addition to hand removal of weeds in some situations where weeds are abundant, such as for many of the grass species and when native plants will not be affected by spray drift, the use of Glyphosate herbicide is recommended in accordance with the manufacturers specifications.

Herbicides should not be applied prior to rain occurring as this reduces the herbicides' effectiveness and increases the potential to enter creeks and drainage lines in runoff.

2. WEED REMOVAL TECHNIQUES

Weeds are to be removed in accordance with the following techniques recommended by the National Trust, NSW National Parks and Wildlife Service, Australian Association of Bush Regenerators and Buchanan (2009).

2.1 Weed removal techniques for woody plants

Cut and Paint (Woody weeds to 10 cm basal diameter)
- Make a horizontal cut close to the ground using secateurs, loppers or a bush saw; and
- Immediately apply herbicide to the exposed flat stump surface.

Considerations:
- Cuts should be horizontal to prevent herbicide from running off the stump, sharp angle cuts are hazardous;
- Herbicide must be applied immediately before the plant cells close (within 30 seconds) and translocation of herbicide ceases;
- If plants resprout cut and paint the shoots after sufficient regrowth has occurred; and
- Stem scraping can be more effective on some woody weeds.

Stem Injection
- At the base of the tree drill holes at a 45 degree angle into the sapwood;
- Fill each hole with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Frilling or Chipping
- At the base of the tree make a cut into the sapwood with a chisel or axe;
- Fill each cut with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Considerations:
- Plants should be actively growing and in good health;
- Deciduous plants should be treated in spring and autumn when leaves are fully formed;
- For multi-stemmed plants, inject or chip below the lowest branch or treat each stem individually; and
- Herbicides must be injected immediately before plant cells close (within 30 seconds) and translocation of herbicide ceases.

2.2 Weed removal techniques for small hand-pullable plants

Hand Removal
- Remove any seeds or fruits and carefully place into a bag;
- Grasp stem at ground level, rock plant backwards and forwards to loosen roots and pull out; and
- Tap the roots to dislodge any soil, replace disturbed soil and pat down.

Considerations:

- Leave weeds so roots are not in contact with the soil eg. hang in a tree, remove from site or leave on a rock.

2.3 Weed removal techniques for vines and scramblers

Hand Removal

- Take hold of one runner and pull towards yourself;
- Check points of resistance where fibrous roots grow from the nodes;
- Cut roots with a knife or dig out with a trowel and continue to follow the runner;
- The major root systems need to be removed manually or scrape/cut and painted with herbicide; and
- Any reproductive parts need to be bagged.

Stem Scraping

- Scrape 15 to 30 cm of the stem with a knife to reach the layer below the bark/outer layer; and
- Immediately apply herbicide along the length of the scrape.

Considerations:

- A maximum of half the stem diameter should be scraped. Do not ringbark;
- Larger stems should have two scrapes opposite each other; and
- Vines can be left hanging in trees after treatment.

2.4 Weed removal techniques for plants with underground reproductive structures

Hand Removal of Plants with a Taproot

- Remove and bag seeds or fruits;
- Push a narrow trowel or knife into the ground beside the tap root, carefully loosen the soil and repeat this step around the taproot;
- Grasp the stem at ground level, rock plant backwards and forwards and gently pull removing the plant; and
- Tap the roots to dislodge soil, replace disturbed soil and pat down.

Crowning

- Remove and bag stems with seed or fruit;
- Grasp the leaves or stems together so the base of the plant is visible;
- Insert the knife or lever at an angle close to the crown;
- Cut through all the roots around the crown; and
- Remove and bag the crown.

Herbicide Treatment – Stem Swiping

- Remove any seed or fruit and bag; and
- Using a herbicide applicator, swipe the stems/leaves.

Considerations:

- Further digging may be required for plants with more than one tuber;
- Some bulbs may have small bulbils attached or present in the soil around them which need to be removed;
- It may be quicker and more effective to dig out the weed;
- Protect native plants and seedlings; and
- For bulb and corm species the most effective time to apply herbicide is after flowering and before fruit is set.

Exotic vegetation should be removed and stockpiled in a clear area away from adjoining bushland. This stockpile should be removed from the site at a convenient time. As part of the regular maintenance of the restored area any regrowth of exotic plant species should be removed and disposed of appropriately.

3. USE OF HERBICIDES

There are various categories of herbicides currently used (Buchanan, 1989), specifically those that kill on contact (contact herbicides), and those that must move through the tissue of the plant (systematic herbicides). Other herbicides include those that are non-selective and those that are selective. There are also those herbicides that kill all existing plants and those that prevent germination (Buchanan, 1989). The most commonly used biodegradable herbicides by bush regenerators are those containing glyphosate (ZERO ®, Glyphosate 340 ® and Roundup ®).

An advantage of herbicide use is the relatively reduced amount of time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds. Another advantage is that the dead weeds may provide some measure of soil stabilisation for a short period of time.

Herbicides should not be applied prior to rain occurring. This reduces the herbicides effectiveness as well as being transported in runoff to creek lines and waterways.

An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds.

Buchanan (1989), recommends that the use of herbicides should be considered when:

- There are small areas of dense weeds with few or no native plants to protect;
- There are large areas of weeds;
- The weeds are growing too rapidly for physical removal; and
- The weeds are located in areas with a high potential for erosion if vegetation is removed.

The spraying of weeds must only be undertaken by experienced and qualified persons. The success of each treatment must be evaluated by the operator after a set period of time according to the labelled effectiveness for each herbicide. Care must be taken when applying herbicides near drainage lines to avoid excess use due to the sensitivity of the wetlands and waterways into which runoff will eventually flow.

PART 3
BUSHLAND REGENERATOR CONTRACTOR
COMPETENCY REQUIREMENTS

A suitably qualified and experienced professional bush regeneration contractor or landscape contractor is to be engaged to carry out any weed control, revegetation planting, restoration and maintenance works, in accordance with Council's requirements. The minimum qualifications and experience required for the bush regeneration site supervisor are TAFE Certificate IV in Conservation and Land Management (or equivalent), three years demonstrated experience.