



**RIPARIAN CORRIDOR
VEGETATION MANAGEMENT PLAN**

**2 MACPHERSON STREET
WARRIEWOOD**

**AUGUST 2019
REF: 9094V6**



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VERSION 6**

Conacher Consulting Pty Ltd

Environmental and Land Management Consultants

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PREFACE

This 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.

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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.

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 plant nursery)

1.2 PROPOSED DEVELOPMENT

The subject site is located within the Warriewood Valley Urban Release Area. The proposed development is for a community title subdivision and associated infrastructure. The civil works required have been assessed and approved under a separate previous development application. Detailed plans of the proposed development 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 Department of Industry Natural Resource Access Regulator Guidelines for Controlled Activities / DPI Office of Water

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. Warriewood Valley Landscape Masterplan and Design Guidelines (Northern Beaches Council 2018)

This document provides landscape plan and sectional guidelines for the design and landscape treatment of creekline corridor within the Warriewood Urban Release Area and was considered in the preparation of this VMP.

iii. Flora and Fauna Assessment Report V4 (Conacher Consulting 2019)

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

iv. Site Inspection

A site inspection was undertaken on 8 June 2017 and 4 December 2018 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 intersects the northern and eastern sections of the subject site. The document, Guidelines for Riparian Corridors on Waterfront Land (DPI Office of Water 2012) identify that this watercourse is a second order watercourse requiring a total riparian corridor width of 40m plus channel width. This includes a 20m setback on each side of the watercourse.

Under the current proposal a 50m setback consisting of a 25 metre wide Outer Riparian Corridor and a 25m private buffer is proposed from Narrabeen Creek. The proposed riparian corridor will exceed the 20m setback required by the NSW DPI Office of Water for second order watercourses.

This report has been prepared specifically for the 25 metre Outer Riparian Corridor Area of the site. Requirements for the Private Buffer Area are addressed separately to this Report.

1.5 EXISTING VEGETATION CHARACTERISTICS

The vegetation within the site consists of:

- Plant Community Type 1232 Swamp Oak Floodplain Swamp Forest, Sydney Basin Bioregion & South East Corner Bioregion; and
- Cleared Land / Exotic Vegetation.

The following descriptions are provided for these vegetation types.

PCT 1232 SWAMP OAK FLOODPLAIN SWAMP FOREST, SYDNEY BASIN BIOREGION AND SOUTH EAST CORNER BIOREGION (SOFF EEC)

Structure:

Upper Stratum: To 3-20 metres high, with 30-70% Projected Foliage Cover (PFC).

Mid Stratum: To 6 metres high, with 30% PFC.

Lower Stratum: To 1 metre high, with 50% PFC.

Floristics:

(Characteristic Species)

Upper Stratum: *Casuarina glauca*, *Eucalyptus robusta*, *Melaleuca quinquenervia*, *Melaleuca linearifolia*.

Mid Stratum: *Casuarina glauca* (regrowth), *Lantana camara*, *Erythrina crista-galli* and *Cestrum parqui*.

Lower Stratum: *Arundo donax*, *Ageratina adenophora*, *Ludwigia peruviana* and *Ipomoea indica*.

Exotics: *Ficus* spp., *Lantana camara*, *Monstera deliciosa*, *Arundo donax*, *Ageratina adenophora*, *Senna pendula* var. *glabrata*, *Ipomoea indica*, *Erythrina crista-galli* and *Ludwigia peruviana*.

Variation:

Within the site this plant community predominantly consists of highly disturbed areas of land which contain remnant native trees interspersed with exotic vegetation. The distribution of the dominant native species is variable.

Disturbance:

Within the site this plant community predominantly occurs in drainage line areas and consists of highly disturbed land which contains remnant native trees interspersed with exotic vegetation. High levels of weed invasion, historical soil modification and historical clearing have occurred.

Location and Distribution:

Disturbed Swamp Oak Forest occurs around the perimeter of the site in small patches. This vegetation type occupies approximately 0.17 hectares of the subject site.

Classification:

It is considered that this vegetation corresponds to a highly disturbed / regrowth variant of the Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions endangered ecological community (EEC).



Photo 1. PCT 1232 Swamp Oak Floodplain Swamp Forest, Sydney Basin Bioregion and South East Corner Bioregion.

CLEARED LAND / EXOTIC VEGETATION

Areas of Cleared Land / Exotic Vegetation are composed of exotic flora species including *Ficus benjamina*, *Ficus elastica*, *Erythrina x sykesii* and *Salix babylonica*, *Lantana camara*, *Erythrina cristagalli*, *Senna pendula* var. *glabrata*, *Arundo donax*, *Cestrum parqui*, *Arundo donax*, *Modiola caroliniana*, *Conyza bonariensis*, *Phytolacca octandra*, *Sida rhombifolia*, *Verbena bonariensis*, *Rumex obtusifolius*, *Cyperus eragrostis*, *Ageratina adenophora* and *Ipomoea indica*. These areas occupy approximately 1.86 hectares of the site.



Photo 2. Cleared Land / Exotic Vegetation.

1.6 COMPLIANCE WITH GUIDELINES FOR VEGETATION MANAGEMENT PLANS 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 proposed riparian corridor with is appropriate and exceeds the NSW DPI Office of Water requirements.
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.

TABLE 1.2 NSW OFFICE OF WATER GUIDELINES FOR VEGETATION MANAGEMENT PLANS CRITERIA ASSESSMENT	
Criteria	Where Addressed in this Report
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.	Encroachments will be managed with tree plantings flanking the proposed new road.
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.
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.

TABLE 1.2 NSW OFFICE OF WATER GUIDELINES FOR VEGETATION MANAGEMENT PLANS CRITERIA ASSESSMENT	
Criteria	Where Addressed in this Report
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 & 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 be the following:

- Removal of exotic vegetation, introduced materials and reshaping of the riparian corridor area to emulate natural topographical conditions,
- Re-grading and stabilisation works including rock armouring and installation of jute matting.
- 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. Any imported soil material should be free from invasive weeds and invasive plant pathogens. Following civil works vegetation replanting is to occur.

2.2.2 Weed Management & 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 vegetation planting works.

i. 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;

- 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.

ii. Primary Weed Control & 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. Where excavation or lopping of non-endemic vegetation is likely to result in substantial damage and/or the removal of native trees to be retained, other methods may be utilised.

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. Physical control methods are to be the initial preferred option, with herbicides to be used to target weeds during any secondary weed control works. Further detailed descriptions of herbicide control techniques are provided in Appendix 2.

Target Weed Species

Table 2.1 contains a list of exotic flora species which are to be prioritised for 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	
<i>Scientific Name</i>	<i>Common Name</i>
Trees	
<i>Erythrina crista-galli</i> *	Cockspur Coral Tree
<i>Erythrina x sykesii</i> *	Coral Tree
<i>Ficus benjamina</i>	Weeping Fig
<i>Ficus elastica</i> *	Rubber Fig
<i>Salix babylonica</i> *	Weeping Willow
Shrubs	
<i>Ricinus communis</i> *	Castor Oil Plant
<i>Senna pendula</i> var. <i>glabrata</i> *	
<i>Ligustrum lucidum</i> *	Large-leaved Privet
<i>Ligustrum sinense</i> *	Small-leaved Privet
<i>Ludwigia peruviana</i> *	
<i>Arundo donax</i> *	Giant Reed
<i>Lantana camara</i> *	Lantana
<i>Monstera deliciosa</i> *	Fruit Salad Plant
<i>Phyllostachys</i> sp.	Bamboo
<i>Xanthosoma violaceum</i> *	Chinese Taro

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

iii. Secondary Weed Control

Secondary weed control should be undertaken following revegetation works within the Riparian Corridor. 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 jute matting is to be installed where additional stabilisation is necessary. 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.

The replanting works are to be undertaken in accordance with the Landscape Plan prepared by Meriton (2019). The list of flora species for replanting should be compliant with the Warriewood Valley Landscape Masterplan & Design Guidelines reproduced in Appendix 3.

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 or as specified by Council. Revegetation of other areas outside of the Riparian Corridor will be undertaken in accordance with the site landscaping requirements.

2.2.4 Vegetation Protection & Access Management

i. Vegetation Protection and Access Management

The Biodiversity Values Map / Coastal Wetlands Area is to be protected and retained during works. Some remnant trees within the private buffer area are also to be retained.

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 or as identified by the Project Arborist.
- 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.

2.2.5 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.

2.2.6 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 Outer Riparian Corridor area.

2.4 SOIL EROSION & 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 within 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 & 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.

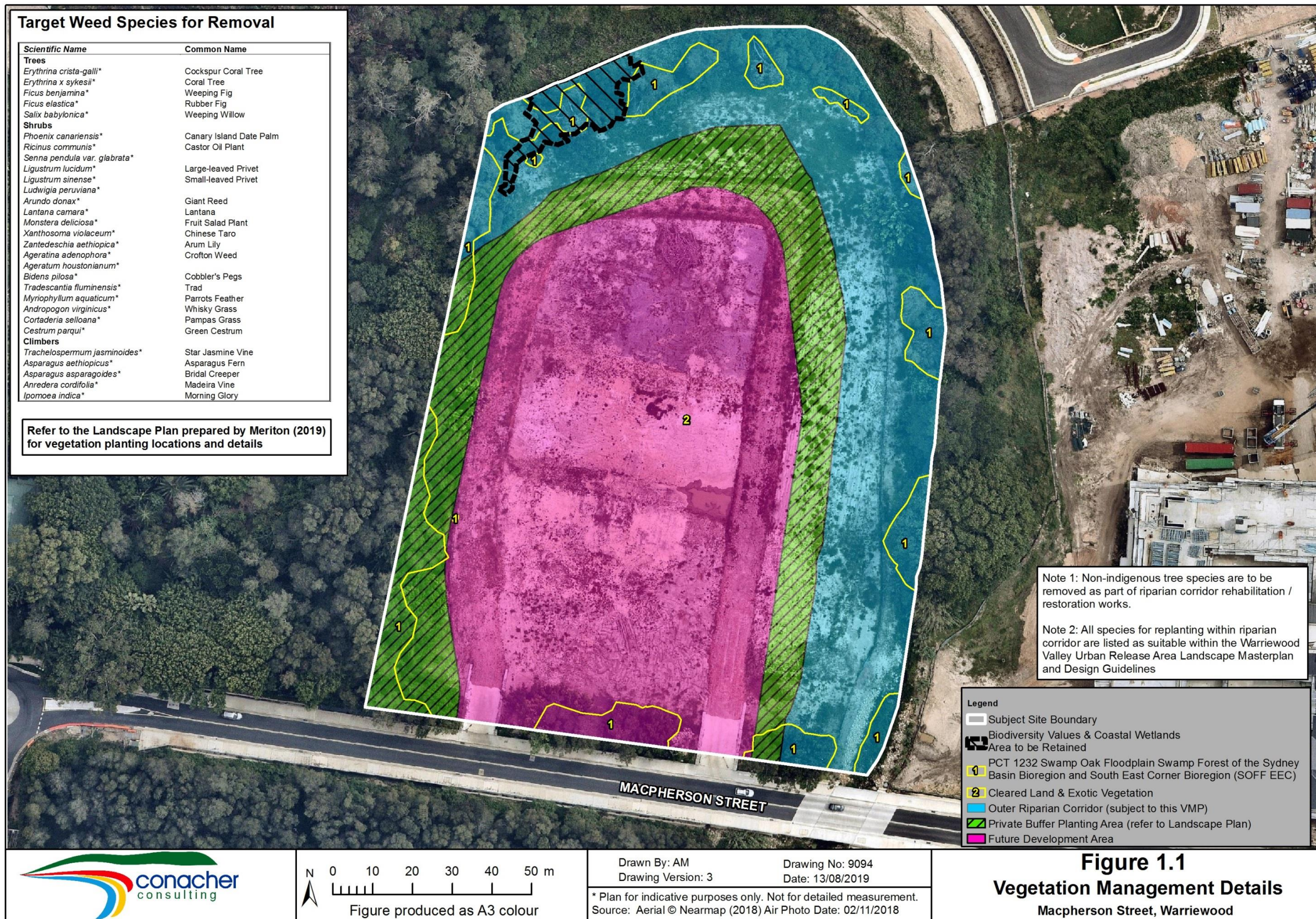
SECTION 3

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-Civil Works	Civil Works	First Month Post Civil Works	1 Month to end of Year 1	Year 1 to end of Year 2	
Collection of seed / plant propagation						Bushland regenerator / Landscape Contractor
Identify and install protective fencing for retained vegetation						Contractor and project Arborist / 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	Quarterly	Bushland regenerator / Landscape contractor
Monitoring and Reporting Inspections				Biannually	Biannually	Ecologist



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APPENDIX 1

SITE PHOTOGRAPHS



Photo 1. Photograph showing typical weedy condition of Riparian Corridor Vegetation.



Photo 2. Typical condition of cleared areas adjoining the Riparian Corridor.

APPENDIX 2

WEED MANAGEMENT AND REVEGETATION TECHNIQUES

PART 1 REVEGETATION METHODS

1. SITE PREPARATION

Site preparation activities for all planting sites will include preliminary weed control and where necessary rubbish removal and soil remediation. 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.

2. PLANT MATERIAL

Plant material used for revegetation within the project area shall be sourced only from the catchment management area or a directly adjoining catchment management area. The planting contractor is responsible for obtaining all necessary permits and licenses for any plant propagation works if material is sourced from local bushland areas. 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 planting contractor 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.

3. PLANTING GUIDELINES

3.1 Planting Densities and Niche species

The landscape contractor shall be responsible for planting according site landscape plan prepared in consultation with the Proponent. This Plan will detail the required species and their distribution across the planting area. The landscape contractor shall be responsible for ensuring planting densities and appropriate niche species.

Only locally indigenous plants will be used, in accordance with the species planting requirements provided within this Plan. 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 density once established.

3.2 Planting Methods

Planting holes shall be excavated to an appropriate depth depending on the size of the stock, this will generally be twice the size of the existing plant container. Slow release native plant fertiliser (low phosphorous formulated native plant fertiliser tablet/granules) shall be placed into the planting hole. In poorly structured soils, 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 an irrigation system may be set up to water plants on a weekly basis.

3.3 Plant Protection

The landscape contractor shall be responsible for adequately protecting plant material from frost, wind, sun, vermin and animals. Plant guards (including 2 stakes) shall be around each plant and maintained throughout the maintenance period of up to 2 years. The use of Jute mats (mulch mats) is recommended where weed regrowth or soil erosion is expected.

3.4 Mulching

After planting, the exposed ground directly around each plant should be mulched with low-nutrient mulch such as weed free chipped eucalyptus recycled from the site clearing area. No exotic plant material is to be used. Pine bark is considered not to be a suitable mulch material. The provenance of all mulch material must be known and free from known pathogens. 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 plant stems to prevent rotting. Alternately, a light sowing of a suitable nurse crop 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 landscape contractor.

3.5 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 landscape contractor.

Site maintenance shall consist of the following tasks:

- Weeding throughout the planting area;
- Watering plantings;
- Replacing dead plants (as required);
- Removing wind-blown or other rubbish from the planting area; and
- Adjusting plant guards.

PART 2 WEED MANAGEMENT TECHNIQUES

1. BACKGROUND INFORMATION

Primary weed removal is to be undertaken during civil works and regrading of the site.

Secondary weed removal should be undertaken following revegetation using hand tools such as trowels, spades, rakes, mattocks, garden forks, knives and saws to reduce soil disturbance and minimise damage to nearby native plants. In addition to hand removal of weeds in some situations where weeds are abundant or too large to remove, 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 a sharp blade, secateurs or a bush saw;
- 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 target tree or shrub 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 for disposal;
- 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
- Ensure that any reproductive parts are collected and bagged for disposal.

Considerations:

- Leave weeds so roots are not in contact with the soil or remove from site.

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, 2009), specifically those that kill on contact (contact herbicides), and those that must move through the tissue of the plant (translocated herbicides). Other herbicides include those that are non-selective and those that are selective. There are also residual herbicides that remain active in the soil and give ongoing weed control for a few weeks to a few years (Buchanan, 2009). The most commonly used biodegradable herbicides by bush regenerators are those containing glyphosate.

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 waterbodies.

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.

Herbicides should particularly 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 or are too large 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.

APPENDIX 3

SPECIES FOR REPLANTING IN RIPARIAN CORRIDOR

Plant species for landscape development

STREET CORRIDORS

LARGE CANOPY TREES

ANGOPHORA COSTATA
ANGOPHORA FLORIBUNDA
EUCALYPTUS PUNCTATA
LOPHOSTEMON CONFERTUS
SYNCARPIA GLOMULIFERA
SYZYGIUM PANICULATUM
WATERHOUSIA FLORIBUNDA

MEDIUM CANOPY TREES

BANKSIA INTEGRIFOLIA
CALLISTEMON 'HANNAH RAY'
CORYMBIA FICIFOLIA
EUCALYPTUS HAEMASTOMA
SYZYGIUM LEUHMANNII
MELALEUCA STYPHELOIDES
TRISTANIOPSIS LAURINA
XANTHOSTEMON CHRYSANTHUS

SMALL CANOPY TREES

ACMENA SMITHII 'CULTIVARS'
BACKHOUSIA MYRTIFOLIA
BUCKINGHAMIANA CELSISSIMA
CALLISTEMON 'ENDEAVOUR'
CALLITRIS RHOMBOIDEA
CERATOPETALUM GUMMIFERUM
ELAEOCARPUS RETICULATUS
HYMENOSPORUM FLAVUM
LEPTOSPERMUM PETERSONII
MELALEUCA LINARIIFOLIA
METROSIDEROS EXCELSA
SYZYGIUM PANICULATUM 'SMALL CULTIVARS'
TRISTANIA LAURINA
* ACER PALMATUM
* LAGERSTROEMIA 'CULTIVARS'
* MURRAYA PANICULATA (not hedged)
* PHOTINIA 'CULTIVARS'
* VIBURNUM TINUS (not hedged)

* Selected exotic small trees to be used for small lots less than 6m wide and front setback of 3m only.

PALM TREES

LIVISTONIA AUSTRALIS

SHRUBS

CALLISTEMON 'SMALL CULTIVARS' to 1m
CORREA ALBA
WESTRINGIA 'SMALL CULTIVARS' to 1m

GROUNDCOVERS

DIANELLA SP.
LOMANDRA 'SMALL CULTIVARS'

CREEKLINE CORRIDORS

(CENTRAL 50M PUBLIC CORRIDOR)

AQUATIC PLANTS (0.0 TO 0.3M WATER DEPTH)

ALISMA PLANTAGO-AQUATICA
BAUMEA ARTICULATA
BAUMEA JUNCEA
BAUMEA RIBIGNOSA
BOLBOSCHOENUS FLUVIATILIS
BOLBOSCHOENUS CADWELLII
ELEOCHARIS SPHACELATA
PHILYDRUM LANGUINOSUM
PHRAGMITES AUSTRALIA
SCHENOPECTUS VALIDUS
TRIGLOCHIN PROCERA

LITTORIAL PLANTS FREQUENTLY INUNDATED

CAREX APPRESSA
JUNCUS KRAUSSII
JUNCUS USITATUS
CYPERUS BREVIFOLIUS
ISCAHNE GLOBOSA
PHILYDRUM LANGUINOSUM

GRASSES INFREQUENTLY INUNDATED

CAREX APPRESSA
DIANELLA CAERULEA
GAHNSIA SIEBERANA
ISOLEPIS NODOSA
LOMANDRA LONGIFOLIA
JUNCUS USITATUS
PLUS LOCALLY NATIVE GRASSES

SHRUBS

ACACIA ELONGATA
ACACIA LONGIFOLIA
ACACIA SUAVEOLENS
ACACIA IMPLEXA
ACACIA DECURRENS
CALLISTEMON CITRINUS
CALLISTEMON LINEARIS
GOODENIA PANICULATA
LEPTOSPERMUM JUNIPERINUM
KUNZEA AMBIGUA
MELALEUCA ERICIFOLIA
PULTANAEA VILLOSA
PITTOSPORUM REVOLUTUM

TREES

ACMENA SMITHII
ANGOPHORA COSTATA (ON SAND RIDGES)
ANGOPHORA FLORIBUNDA
BACKHOUSIA MYRTIFOLIA

CALLITRIS RHOMBOIDEA
CASUARINA GLAUCA
CERATOPETALUM APETALUM
CERATOPETALUM GUMMIFERUM
EUCALYPTUS ROBUSTA
EUCALYPTUS BOTRYOIDES
GIOCHIDION FERDINAND
SYNCARPIA GLOMULIFERA
LIVISTONIA AUSTRALIS

CREEKLINE CORRIDORS

(25M PRIVATE CREEKLINE BUFFER STRIP)

CANOPY TREES

SWAMP MAHOGANY
PORT JACKSON FIG
SANDERPAPER FIG
WATER GUM
SMOOTH BARKED APPLE
ROUGH BARKED APPLE
SWAMP SHE-OAK
SNOW-IN-SUMMER
SWAMP PAPERBARK
CABBAGE TREE PALM
COAST BANKSIA
TURPENTINE
GREY GUM
BANGALAY
LILLY PILLY
CHEESE TREE
PAPAREBARK
COACHWOOD
ROUGH TREE FERN

EUCALYPTUS ROBUSTA
FICUS RUBIGINOSA
FICUS CORONATA
TRISTANIOPSIS LAURINA
ANGOPHORA COSTATA
ANGOPHORA FLORIBUNDA
CASUARINA GLAUCA
MELALEUCA LINEARIFOLIA
MELALEUCA ERICIFOLIA
LIVISTONIA AUSTRALIS
BANKSIA INTEGRIFLORA
SYNCARPIA GLOMULIFERA
EUCALYPTUS PUNCTATA
EUCALYPTUS BOTRYOIDES
ACMENA SMITHII
GIOCHIDION FERDINANDI
MELALEUCA QUINQUENERVIA
CERATOPETALUM APETALUM
CYATHEA AUSTRALIS

NARRABEEN CREEK

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FERN CREEK

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MULLET CREEK

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UNDERSTOREY/SHRUBS

ROUGH TREE FERN
SWEET WATTLE
HONEY SUCKLE BANKSIA
COAST BANKSIA
NSW CHRISTMAS BUSH
PINK SPIDER FLOWER
CYCAD
RED FLOWERING PAPERBARK
BLACK WATTLE
GOLDEN GUINEA FLOWER
GRASS TREE
DOG ROSE
KANGAROO GRASS
WATER VINE
RUSH
WATER SEDGE
MAT RUSH
WEEPING GRASS

CYATHEA AUSTRALIS
ACACIA SUAVEOLENS
BANKSIA SPINULOSA
BANKSIA INTEGRIFOLIA
CERATOPETALUM GUMMIFERUM
GREVILLEA SERICEA
MACROZAMIA COMMUNIS
MELALEUCA HYPERICIFOLIA
CALLICOMA SERRATIFOLIA
HIBBERTIA SCANDENS
XANTHORRHOEA SPP
BAUERA RUBROIDES
THEMEDA AUSTRALIS
CISSUS HYPOGLAUCA
JUNCUS SPP
GAHNSIA SIEBERANA
LOMANDRA LONGIFOLIA
MICROLAENA STIPOIDES

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RECREATION OPEN SPACES

FERN CREEK DISTRICT PARK
APOLLO RESERVE WETLAND
SECTOR 1 N'HOOD PARK
SECTOR 8 N'BOURHD PARK
SECTOR 10 N'BOURHD PARK
BOONDAH RD SPORTSFIELDS

REFER CREEKLINE CORRIDOR PLANTING - FERN
REFER CREEKLINE CORRIDOR PLANTING - NARRABEEN
REFER CREEKLINE CORRIDOR PLANTING - NARRABEEN
REFER CREEKLINE CORRIDOR PLANTING - FERN
REFER CREEKLINE CORRIDOR PLANTING - MULLET
REFER CREEKLINE CORRIDOR PLANTING - NARRABEEN

BUFFER PLANTINGS

SECTOR ONE
SECTOR THREE
WARRIEWOOD WETLAND

REFER CREEKLINE CORRIDOR PLANTING - NARRABEEN
REFER CREEKLINE CORRIDOR PLANTING - FERN
REFER CREEKLINE CORRIDOR PLANTING - MULLET

2.0

2018

Plant Species

NORTHERN BEACHES
COUNCIL

Warriewood Valley Release Area
MASTERPLAN AND DESIGN GUIDELINES