43, 45-49 Warriewood Road, Warriewood

Biodiversity Management Plan

Creative Planning Solutions

13 December 2023

Final

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Report No. 21097RP3

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or commendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

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Position:	Director
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Date:	19/12/2023

Table of Contents

Table of Tables

Table of Photographs

Table of Appendices

Table of Figures

Glossary

Term / Abbreviation	Definition
AHD	Australian Height Datum
APZ	Asset Protection Zone
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	NSW *Biosecurity Act 2015*
BMP	Biodiversity Management Plan
BMP Area	The land which is the subject of this BMP (see **Figure 1**)
DA	Development Application
DPIE	Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GDE	Groundwater Dependant Ecosystem
GIS	Geographic Information System
ha	Hectares
LEP	Pittwater Local Environmental Plan 2014
LGA	Local Government Area
NSW	New South Wales
PCT	Plant Community Type
Study Area	The property comprising Lot 1 and Lot 2 DP 349085 (see **Figure 1**)
Subject Land	The land proposed as a development site (see **Figure 1**)
SSF	Swamp Sclerophyll Forest
TEC	Threatened Ecological Community
WoNS	Weed of National Significance

1. Introduction

Cumberland Ecology has been commissioned by Creative Planning Solutions to prepare a Biodiversity Management Plan (BMP) for 43, 45-49 Warriewood Road, Warriewood (the 'Study Area'). The study area comprises Lot 1 and Lot 2 DP 349085 and is approximately 2.18 ha in area. It is located within the Northern Beaches Local Government Area (LGA) and is zoned R3 Medium Density Residential under the *Pittwater Local Environmental Plan 2014* (LEP). The study area is shown in **Figure 1**.

The purpose of the BMP is to guide the restoration of areas of the native vegetation within the retained areas of the study area. The vegetation conforms to the Threatened Ecological Community (TEC) Swamp Sclerophyll Forest (SSF) on Coastal Floodplains, which is listed as an Endangered Ecological Community (EEC) under the NSW *Biodiversity Conservation Act 2016* (BC Act). The BMP is also prepared to direct the control and removal of weed species and oversee the subsequent planting of locally indigenous species within the study area.

The BMP is to accompany a Development Application lodged for a proposed redevelopment of the study area. The vegetation to be restored occurs in the southwest of the study area, and the specific area subject to management under the guidance of this BMP is hereafter referred to as the 'BMP Area' (shown in **Figure 1**). The BMP Area will be secured in perpetuity using a caveat on the study area.

The proposed redevelopment is for a eleven (11) lot residential subdivision, civil works and construction of integrated residential development including two (2) residential flat buildings containing thirty-four (34) apartments (the 'project').

It is noted that a previous Development Application (DA2020/1517) for the site was submitted to Northern Beaches Council in March 2021 and subsequently withdrawn. A BMP was prepared by Lesryk Environmental (2021) to accompany the DA that intended to mitigate the impacts of the project on the biodiversity values of the site, prepared using the Biodiversity Assessment Method 2017 (NSW Government 2017). Council provided a suite of comments on review of this BMP to be addressed prior to re-submission. Cumberland Ecology understands that the current DA to be submitted is separate to DA2020/1517 and therefore, this BMP has been prepared to replace any management actions proposed by the previous BMP. Nevertheless, this BMP still seeks to address the comments made by council on 5 March 2021 for DA2020/1517.

This BMP has been prepared in collaboration with the Biodiversity Development Assessment Report, also prepared by Cumberland Ecology (2023).

I have been given a copy of Division 2 "Provisions applicable to expert evidence generally" of Part 31 of the Uniform Civil Procedure Rules (2005) and have read, understood and adopt this document and its Schedule 7, 'Expert witness code of conduct'. I understand that I have an overriding duty to assist the Court impartially on matters relevant to my area of expertise, and that my paramount duty is to the Court and not to the retaining company. The evidence provided to the Court – both written and oral - will be in compliance with this Code of Conduct, and I am bound by that Code of Conduct. Notwithstanding that I have had some assistance in the preparation of this report, the opinions and conclusions are my own. I have ensured that my staff who have assisted me are also aware of the expert code and the need for impartiality and independence, and I am satisfied that they have appropriately discharged that duty.

1.1. Location and Description of the Study Area and BMP Area

The study area is located at 43, 45-49 Warriewood Road, Warriewood, comprising Lot 1 and Lot 2 DP 349085. The study area is bounded to the west by Pheasant Place, to the south by Narrabeen Creek and to the east by a neighbouring lot and to the north by Warriewood Road. The study area occurs within the Greater Sydney Local Land Services region.

Vegetation within the study area includes planted trees and cleared grassland areas around the dwellings located in the north of the study area. Planted woody vegetation around the dwelling comprise exotic trees such as *Liquidambar styraciflua* (American Sweetgum) and *Araucaria heterophylla* (Norfolk Island Pine). The southern areas of the study area are forested wetlands found adjacent to Narrabeen Creek that runs along the southwestern boundary of the study area. The forested wetland canopy includes the native tree species *Eucalyptus robusta* (Swamp Mahogany) and *Casuarina glauca* (Swamp Oak), although the exotic trees *Erythrina x sykesii* (Coral Tree) and *Erythrina crista-galli* (Cockspur Coral Tree) are common.

The vegetation within the BMP Area is a Groundwater Dependant Ecosystem (GDE). Typically, GDEs are fully or partially dependent on groundwater, which may be permanently *in situ* or episodically present due to tidal forces or stream flows. Such ecosystems can exist wherever the water table is within the root zone of the plants. GDEs vary in terms of the degree of dependence on groundwater. The vegetation on site receives water from rainfall and overland flows as well as groundwater. For this reason it is not solely groundwater dependent for survival.

The subject land is currently residential land containing two vacant dwellings that uniformly slopes in a south-westerly direction from approximately 12 m above sea level to 4 m asl in the south-west along Narrabeen Creek.

The BMP Area, which is approximately 0.87 ha in size, is the area to the southwest of the development footprint ('subject land') that will be managed and rehabilitated for conservation as part of the project. The forested wetlands and existing cleared areas that occur in the BMP Area are to be retained and restored.

This BMP provides guidelines for the revegetation, regeneration, and management of vegetation to be conserved within the BMP Area.

1.2. Aims

The purpose of the BMP is to guide the revegetation of a native vegetation buffer ('the BMP Area') between a proposed development within the study area and the rear of the study area. The BMP specifies the management activities to be conducted within the BMP Area to maintain and improve its biodiversity values in the long term. This BMP includes measures for:

- Protection of the existing biodiversity values of the BMP area during clearing (**Chapter 5**);
- Weed management to enhance the biodiversity values of the BMP area (**Chapter 6**);
- Revegetation in appropriate areas of the BMP Area with native vegetation that is broadly representative of the original plant community, comprising all three strata (ground, shrub and canopy) (**Chapter 7**); and

- Provisions for ongoing monitoring to maintain the ecological values of the BMP Area in the long term (**Chapter 9**).

1.3. Relevant Legislation

Legislation relevant to this BMP includes:

- The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act);
- The NSW *Biodiversity Conservation Act 2016* (BC Act);
- The NSW *Biosecurity Act 2015* (Biosecurity Act);
- The NSW *Pesticides Act 1999;* and
- The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.4. Implementation

This BMP is to be implemented from the date of release of the Construction Certificate. In reference of the council comments received on 5 March 2021 for DA2020/1517, In accordance with the Warriewood Water Management Specification (2001), a 25 m inner riparian corridor and 25 m riparian buffer is required, for a 50m riparian corridor in total to be managed under this BMP. The 25 m riparian corridor has to be measured from the property boundary is marked on the final plans, and is shown on **Figure 1**. This 25 m inner creekline corridor is to be dedicated to Council. Prior to dedication of land, the land will be fully rehabilitated by removal of weeds, removal of fill and subsequent native revegetation. The area outside of the 25 m dedication will also be subject to the BMP, and will be managed in perpetuity.

2. Methodology

2.1. Literature Review and Database Analysis

The preparation of this BMP involved a literature review to determine the most up to date methods of weed control for exotic species that are present in the BMP area. The literature review involved a variety of sources including government fact sheets and websites. Cumberland Ecology staff with expertise in bushland maintenance were also consulted regarding current best practice weed control methods and techniques, as well as determining suitable native plant species for planting, as required for revegetation.

Previously prepared reports by Lesryk Environmental and Land Eco Consulting were also reviewed to evaluate the flora and fauna values associated with the BMP area.

Key documents reviewed for this BMP included:

- Biodiversity Development Assessment Report: 45-49 Warriewood Road by Lesryk Environmental Pty Ltd (2020).
- Biodiversity Management Plan by Land Eco Consulting (2020).
- Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions Final Determination (NSW Scientific Committee 2011);
- Coastal swamp sclerophyll forests of south-eastern Australia nomination and assessment (DAWE 2017); and
- Richardson S, et al (2011) Australian groundwater-dependent ecosystem toolbox part 1: assessment framework, Waterlines report, National Water Commission, Canberra

2.2. Field Surveys

Field surveys undertaken by Cumberland Ecology were undertaken for the purposes of verification of vegetation mapping of the study area, including the Plant Community Types (PCTs) present, for a Biodiversity Development Assessment Report for the study area and to inform this BMP. The survey consisted of taking notes, photographs, and accompanying waypoints with a handheld Global Positioning Service (GPS) device. Features such as significant occurrences of weeds and areas where revegetation is required were also noted.

Vegetation integrity assessments within the study area were undertaken in accordance with the Biodiversity Assessment Method (BAM) on 10 June 2021, to collect data on the species composition and condition of the vegetation present in the site. Surveys included establishment of 20 x 50 m plots, with an internal 20 x 20 m floristic plot. The following data was collected within each of the plots:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within the 20 m x 20 m floristic plot;
- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within the 20 m x 20 m floristic plot;
- Cover of 'High Threat Exotic' weed species within the 20 m x 20 m floristic plot;

- Assessment of function attributes within the 20 m x 50 m plot, including:
    - Count of number of large trees;
    - Tree stem size classes, measured as 'diameter at breast height over bark' (DBH);
    - Regeneration based on the presence of living trees with stems <5 cm DBH;
    - The total length in metres of fallen logs over 10 cm in diameter;
- Assessment of litter cover within five 1 m x 1 m plots evenly spread within each 20 m x 50 m plot; and
- Number of trees with hollows that are visible from the ground within each 20 m x 50 m plot.

3. Existing Biodiversity Values

3.1. Vegetation Communities within the BMP Area

A single PCT is present within the BMP Area, in three condition classes as detailed below. A vegetation map of the study area is shown on **Figure 2**.

3.1.1. PCT 4006 Northern Paperbark-Swamp Mahogany Saw-sedge Forest

Vegetation Formation: Forested Wetlands

Vegetation Class: Coastal Swamp Forests

Percent Cleared Value: 23

3.1.1.1. Condition Class 1 – Moderate

BC Act Status: Endangered Ecological Community (EEC) - Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

EPBC Act Status: Not listed

This community occurs throughout the southern half of the study area (**Photograph 1**). The community is consistent with the Northern Paperbark-Swamp Mahogany Saw-sedge Forest community described by the formally named OEH (2016).

Although this community represents the highest quality native vegetation within the study area the occurrence of the community is highly degraded, with exotic species forming significant components of the canopy, sub-canopy, and shrub and ground layers, and are sub-dominant to dominant in some strata in some areas. Dominant native species in the canopy are *Casuarina glauca* (Swamp Oak) and *Eucalyptus robusta* (Swamp Mahogany), and *Livistona australis* (Cabbage Palm) occurs to a lesser extent. Native species in the sub-canopy include younger individuals of the canopy species, as well as *Melaleuca linariifolia* (Flax-leaved Tea-tree). Exotic species common to sub-dominant in the canopy and sub-canopy are *Erythrina x sykesii* (Coral Tree) and *Erythrina crista-galli* (Cockspur Coral Tree), which are profuse throughout the southern half of the study area, and there are occurrences of *Arundo donax* (Giant Reed) in the sub-canopy in the south-western areas of the community.

With the exception of sparsely occurring juvenile individuals of the canopy species, a native shrub layer is absent, although tall herbaceous species such as *Alocasia brisbanensis* (Cunjevoi), *Phragmites australis* (Common Reed), and *Gahnia clarkei* (Tall Saw-sedge) are present, though sparsely distributed throughout the community. Exotic species such as *Lantana camara* (Lantana), *Ludwigia peruviana* (Ludwigia), and *Solanum mauritianum* (Wild Tobacco Bush), are present and dominate the layer in some areas, along with taller herbaceous species such as *Zantedeschia aethiopica* (Arum Lily) and *Cyperus papyrus* (Paper Reed).

Native species are generally scattered in the ground layer, due to dense shading from the upper strata. Species present include the forbs *Persicaria decipiens* (Slender Knotweed) and *Alternanthera denticulata* (Lesser Joyweed), the sedge *Carex appressa* (Tall Sedge), and the ferns *Hypolepis muelleri* (Harsh Ground Fern) and *Telmatoblechnum indicum* (Swamp Water Fern). Exotic species are common in the layer, and dominant in some areas, particularly *Tradescantia fluminensis* (Wandering Trad). Other species present include the grasses

Paspalum urvillei (Vasey Grass) and *Stenotaphrum secundatum* (Buffalo Grass), the sedge *Cyperus albostriatus,* the forbs *Ageratina adenophora* (Crofton Weed) and *Rumex crispus* (Curled Dock), and the vines *Anredera cordifolia* (Madeira Vine) and *Lonicera japonica* (Japanese Honeysuckle).

Photograph 1 PCT4006 – Moderate within the study area

3.1.1.2. Condition Class 2 - Low

BC Act Status: EEC - Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

EPBC Act Status: Not listed

This community occurs as scattered patches within the north (**Photograph 2**) and the south (**Photograph 3**) of the study area. It consists of canopy trees only from PCT 4006 occurring over a nearly entirely exotic understorey or an understorey cleared back to bare earth, such as some areas in the south-west of the site where an access track occurs. The community is consistent with the Northern Paperbark-Swamp Mahogany Saw-sedge Forest community described by the formally named OEH (2016).

Canopy species present in the community are *Eucalyptus robusta* and *Casuarina glauca.* A native shrub layer is absent from the community. In areas without a cleared understorey exotic shrub species occur sparsely and include *Rhaphiolepis indica* (Indian Hawthorn), *Ricinus communis* (Castor Oil Plant), and *Cestrum parqui* (Green Cestrum).

The ground layer in areas without a cleared understorey is dominated by exotic grasses including *Paspalum urvillei, Cenchrus clandestinus* (Kikuyu), and *Stenotaphrum secundatum*. Exotic forbs are common and include *Sonchus asper* (Prickly Sowthistle), *Conyza sumatrensis* (Tall Fleabane), and *Modiola caroliniana* (Red-flowered Mallow).

Photograph 2 PCT4006 – Low in the north of the study area

Photograph 3 PCT4006 - low in south of study area

3.1.1.3. Condition Class 3 - Revegetation

BC Act Status: Not listed

EPBC Act Status: Not listed

This zone consists of an area in the south-east of the study area, which was formerly cleared and has recently been revegetated (**Photograph 4**). The species composition indicates the revegetation is intended to recreate PCT 4006. As this area does not contain any remnant native vegetation it is not considered to conform to the Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC.

The plantings are dominated by the native sedge *Juncus kraussii* (Salt Marsh Rush), with the lily *Dianella caerulea* (Blue Flax-lily) also occurring, along with scattered plantings of the small tree species *Melaleuca linariifolia*, though these are currently in a juvenile state and shorter in stature than the surrounding sedges.

Exotic species have colonised the revegetation area, with species including the grass *Paspalum urvillei*, forb *Bidens pilosa* (Cobbler's Pegs), and vine *Ipomoea indica* (Morning Glory).

Photograph 4 PCT4006 – Revegetation within the study area

3.1.1.4. Justification for PCT Selection

The SVTM maps Swamp Mahogany Forest immediately to the north-west of the subject land and study area. Within the subject land and study area, the vegetation consists largely of degraded condition classes. However, there are sufficient native species present including canopy trees and midstorey/ground layer species to confidently assign PCT 4006 to the vegetation. The location on a floodplain near Narrabeen Creek in Warriewood is also consistent with the description of this PCT (OEH 2016).

The two BAM plots that were completed within the area mapped as PCT 4006 contained a total of 13 key diagnostic species listed in the description of Swamp Mahogany Forest (DPE 2023), substantially more than theminimum of 8 species required to positively diagnose this PCT at the 95% confidence interval within BAM plot. These included the typical canopy tree species *Eucalyptus robusta*, and the mid story species *Casuarina glauca* and *Melaleuca linariifolia*.

The vegetation is also consistent with the description of PCT 4006 within the Bionet Vegetation Classification, containing the canopy species *Eucalyptus robusta*, three midlayer species (*Casuarina glauca, Acacia longifolia* and *Melaleuca linariifolia*) and seven ground layer species (*Alternanthera denticulate, Centella asiatica, Commelina cyanea, Entolasia marginate, Gahnia clarkei, Hypolepis muelleri* and *Oplismenus aemulus*) listed in the description.

3.1.1.5. Threatened Ecological Community Status

The PCT 4006 corresponds with the EEC Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions listed under the BC Act. The Final Determination for the

TEC (OEH 2017) describes the EEC as being associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Structurally, this TEC typically occurs as open forests with partial clearing occasionally resulting in reduced canopy to scattered trees, and in extreme cases; resembling scrubland. It tends to display an open to dense tree layer of eucalypts and paperbarks, which may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality (OEH 2017).

Within the study area, two of the three conditions states of PCT 4006 have been described as conforming to the BC Act listing for the TEC. Specifically, the Moderate and Low condition states display the relevant structural layers and species composition consistent with the final determination (OEH 2017). The area described as regeneration however does not conform to the TEC listing. This area has been recently cleared and is currently undergoing attempted replanting measures. This area does not display the structural layers to be consistent with the final determination for the TEC and therefore has not been considered to conform to the BC Act listing of Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions.

3.1.2. Exotic Vegetation

BC Act Status: Not listed

EPBC Act Status: Not listed

This community consists of areas dominated nearly exclusively by exotic species. In the northern half of the study area this includes scattered exotic trees such as *Liquidambar styraciflua* (American Sweetgum) and *Araucaria heterophylla* (Norfolk Island Pine) (**Photograph 5**) and large wasteland areas dominated by exotic shrubs and grasses (**Photograph 6**) which formerly comprised the yards of residential dwellings within the Subject Land. In the south, with the exception of one small area dominated by exotic grasses and forbs (**Photograph 7**), which appear to have grown over a formerly cleared area, probably a track, the community consists of dense occurrences of the exotic trees *Erythrina x sykesii* and *Erythrina crista-galli* (**Photograph 8**), with a scattered layer of exotic shrubs such as *Senna pendula* var. *glabrata* and *Ligustrum sinense* (Small-leaved Privet), and a ground layer where present generally dominated by *Tradescantia fluminensis*.

Photograph 5 Exotic trees in the north of the study area

Photograph 6 Exotic shrubs and herbaceous species in the north of the study area

Photograph 7 Exotic herbaceous species in the south of the study area

Photograph 8 *Erythrina* spp. dominated area in the south of the study area

3.2. Flora Species

3.2.1. General Flora

Full details of the flora species recorded within the study area are provided in **Appendix A.** A list of weeds recorded within the study area and weed control methods is provided in **Appendix B**. Of the 140 flora species recorded, 36 (26%) species were native and 104 (74%) were exotic.

3.2.2. Threatened Flora Species

No threatened flora species were detected within the study area during the site survey.

3.3. Fauna

3.3.1. Habitat Values

Habitat features recorded within the study area and the BMP Area include:

- Hollow-bearing trees;
- Human-made structures;
- Log piles;
- Minor rock features; and
- Watercourse (Narrabeen Creek).

4. Vegetation Management Zones

The BMP Area comprises areas of PCT 4006 – Northern Paperbark-Swamp Mahogany Saw-sedge Forest in three condition states; (moderate, low and revegetation). This chapter outlines the vegetation management zones proposed for the BMP Area, and the objectives for each zone. For the purposes of this BMP, the areas of Northern Paperbark-Swamp Mahogany Saw-sedge Forest (Low) is to be grouped within the Landscaped Areas Management Zone, as this condition state is of such a small area and poor condition to justify a separate management zone. Furthermore, as mentioned previously, the BMP area contains areas that include the riparian corridor and a 25m inner creek line corridor that the applicant is to dedicate to Council following an initial five year management period.

Five management zones have been identified for the BMP Area, comprising the following:

- Zone 1 – Northern Paperbark-Swamp Mahogany Saw-sedge Forest;
- Zone 2 – Northern Paperbark-Swamp Mahogany Saw-sedge Forest (Revegetation);
- Zone 3 – Exotic Vegetation and Cleared Land;
- Zone 4 – Infiltration Basin; and,
- Zone 5 – Landscaped Areas.

The location of each management zone is shown in **Figure 3**. The management objectives of each management zone are summarised below. It should be noted that Zone 3 provides management actions for the exotic vegetation and cleared land within the BMP area. Native species suitable for planting are provided in **Appendix C**.

4.1. Zone 1: Northern Paperbark-Swamp Mahogany Saw-sedge Forest

Zone 1 comprises remnant vegetation of the Northern Paperbark-Swamp Mahogany Saw-sedge Forest community with an existing canopy of remnant trees and covers 0.52 ha.

The objectives for Zone 1 include:

- Protection of existing remnant native canopy trees and understorey vegetation;
- Removal of exotic species to facilitate natural regeneration of native species;
- Re-establishment planting of native trees, shrubs, and ground layers;
- Utilising locally indigenous Northern Paperbark-Swamp Mahogany Saw-sedge Forest species of local provenance for plantings;
- Protection from inadvertent impacts through the implementation of fencing, demarcation of clearing limits, and erosion and sediment control; and
- Enhance habitat for fauna species.

4.2. Zone 2: Northern Paperbark-Swamp Mahogany Saw-sedge Forest (Revegetation)

Zone 2 is approximately 0.05 ha in area and comprises no remnant vegetation of the Northern Paperbark-Swamp Mahogany Saw-sedge Forest community. It was formerly cleared and has recently been revegetated.

The objectives for Zone 2 include:

- Removal of exotic species to facilitate natural regeneration of native species;
- Re-establishment planting of native trees, shrubs, and ground layers;
- Utilising locally indigenous Northern Paperbark-Swamp Mahogany Saw-sedge Forest species of local provenance for plantings;
- Protection from inadvertent impacts through the implementation of fencing, demarcation of clearing limits, and erosion and sediment control; and
- Enhance habitat for fauna species.

4.3. Zone 3: Exotic Vegetation and Cleared Land

Zone 3 comprises no remnant vegetation of the Northern Paperbark-Swamp Mahogany Saw-sedge Forest community and covers 0.15 ha. The majority of this management zone is an infestation of *Erythrina x sykesii* (Coral Tree) and *Erythrina crista-galli* (Cockspur Coral Tree).

The objectives for Zone 3 include:

- Removal of exotic species to facilitate natural regeneration of native species;
- Re-establishment planting of native trees, shrubs, and ground layers;
- Utilising locally indigenous Northern Paperbark-Swamp Mahogany Saw-sedge Forest species of local provenance for plantings;
- Protection from inadvertent impacts through the implementation of fencing, demarcation of clearing limits, and erosion and sediment control; and
- Enhance habitat for fauna species.

4.4. Zone 4: Infiltration Basin

Zone 4 is approximately 0.09 ha in area and comprises no remnant vegetation of the Northern Paperbark-Swamp Mahogany Saw-sedge Forest community. It was formerly cleared and has since then been colonised by woody exotic vegetation.

The objectives for Zone 4 include:

- Removal of exotic species to facilitate natural regeneration of native species;

- Re-establishment planting of suitable aquatic species and other inundation tolerant ground cover species;
- Utilising locally indigenous Northern Paperbark-Swamp Mahogany Saw-sedge Forest aquatic species of local provenance for plantings within the basin;
- Protection from inadvertent impacts through the implementation of fencing, demarcation of clearing limits, and erosion and sediment control; and
- Enhance habitat for fauna species.

4.5. Zone 5: Landscaped Areas

Zone 5 is approximately 0.06 ha in area and has previously been cleared. It includes a very small area (0.003 ha) of the Northern Paperbark-Swamp Mahogany Saw-sedge Forest community in a low condition state that is represented only as a canopy over a nearly entirely exotic understorey or an understorey cleared back to bare earth.

The objectives for Zone 5 include:

- Protection of existing remnant native canopy trees and understorey vegetation;
- Removal of exotic species to facilitate cultivation of suitable native species;
- Re-establishment planting of native trees, shrubs, and ground layers;
- Utilising locally indigenous Northern Paperbark-Swamp Mahogany Saw-sedge Forest species of local provenance for plantings;
- Protection from inadvertent impacts through the implementation of fencing, demarcation of clearing limits, and erosion and sediment control; and
- Enhance habitat for fauna species.

5. Vegetation Clearing Plan

This chapter provides protocols for vegetation clearing and other site works associated with the proposed development bordering the BMP Area, and for the broader Subject Land, to avoid impacts to retained native vegetation in the BMP Area. Other specific BMP works such as weed control and revegetation are detailed in later chapters.

5.1. Hygiene Protocols

To avoid the spread of *Phytophthora cinnamomi* and other soil borne pathogens, appropriate hygiene procedures and guidelines described in the following two documents will be followed:

- Best Practice Management Guidelines for *Phytophthora cinnamomi* within the Sydney Metropolitan Catchment Management Authority Area (SMCMA); and
- Hygiene guidelines: Protocols to protect priority biodiversity areas in NSW from *Phytophthora cinnamomi*, Myrtle Rust (*Puccinia psidii),* amphibian chytrid fungus (*Batrachochytrium dendrobatidis),* and invasive plants (Botanic Gardens Trust 2008, DPIE 2020).

This will involve all machinery, clothing (such as boots and gloves), and tools, which will have contact with soil to be disinfected with a spray prior to entering and leaving the BMP Area.

Recommended disinfectant products include:

- Non-corrosive disinfectants including Coolacide®, Phytoclean®, or Biogram® which can be for cleaning footwear, tools, tyres, machinery and other items in contact with soil;
- 70% Methylated spirits solution in a spray bottle which is suitable for personal use (clothing); and
- Sodium Hypochlorite 1%, which is effective, but can damage clothing and degrades rapidly in light.

5.2. Environmental Inductions

Inductions will be undertaken for all personnel who will work within the BMP Area prior to the commencement of any works. The induction will specify in detail which areas of vegetation are approved to be removed and the importance of not damaging retained vegetation, as all native vegetation comprises an occurrence of an EEC. The induction will specify that unauthorised personnel are not permitted to enter retained vegetation areas, and that no machinery or stockpiling of materials is permitted within the BMP Area.

5.3. Protection of Vegetation during Construction Phase

Where vegetation clearing is proposed to occur adjacent to areas of vegetation to be retained, appropriate measures are needed to protect retained native vegetation. Prior to clearing being undertaken, the boundaries of clearing are to be clearly delineated. Clearing limits must be marked with appropriate signage. To avoid unnecessary damage to vegetation or inadvertent habitat removal, disturbance is to be restricted to the delineated area. No stockpiling of equipment, soils, or machinery is to take place beyond delineated boundaries within areas of the BMP Area.

In addition, to ensure the retained plants are not impacted by the proposed development, these retained trees must be identified prior to clearing activities commencing. Appropriate fencing should be installed around the retained trees to ensure that they are not impacted during clearing activities. Fencing should be of a metal construction fencing that physically protects trees from inadvertent damage.

Sediment control measures will be installed to prevent run-off of soil, weed propagules, excess nutrients, and pollutants into adjacent vegetated areas. Sediment fencing should be installed along the entire perimeter of the lowest boundary of clearing areas in order to protect all retained vegetation.

5.4. Clearing Supervision

An inspection of all vegetation to be removed will be undertaken on each morning of clearing works prior to clearing commencing. The inspection will be undertaken by a qualified ecologist in order to determine that no fauna species are present within vegetation to be cleared or nearby vegetation.

The attending ecologist must also supervise the removal of all vegetation required to be removed. If clearing is undertaken in two separate sections, one ecologist is required to supervise the removal of vegetation within each section.

5.5. Salvage of Habitat Items

Where present, fauna habitat features including hollow-bearing trees, hollow-bearing logs, other woody material and bushrock will be salvaged from the subject land during clearing and stockpiled for future use in restoration of the BMP Area. The placement of salvaged items will increase habitat complexity as such items are used by a variety of invertebrate and vertebrate species as microhabitat areas.

Habitat features are to be stored until such time as restoration of the BMP Area commences. Storage must be undertaken within designated stockpile areas, with onsite contractors made aware material is to be retained, to prevent loss of stored habitat features prior to utilisation. Placement of stored habitat features within the BMP Area will be undertaken in co-ordination with an ecologist.

Trees and stags containing hollows felled during the clearing process will be relocated within the BMP Area. These will be used for habitat reconstruction within the BMP Area. Hollows will be trimmed by a tree removal specialist and will be relocated to trees within the BMP Area. When the relocation of a hollow is not possible, a nest box will be placed in a tree in the BMP Area to ensure that all lost arboreal habitat is either relocated or replaced.

Hollows to be translocated will be those that are structurally sound to the extent that they survive the tree felling and subsequent translocation. The suitability of each hollow is to be determined during pre-clearance surveys by an ecologist, as outlined in the BDAR (Cumberland Ecology 2021).

5.6. Weed Management During Clearing

Numerous weed species have been recorded from all three condition states of the vegetation in the BMP Area, and if left uncontrolled these may threaten the objectives of each management zone. In addition, disturbance during development works can create opportunities for weed invasion, and therefore appropriate weed control

activities will be undertaken during clearing in order to minimise additional weed establishment. The amount of bare soil exposed at any one time will be minimised, and sediment fencing will be installed along the lower boundary of any areas proposed to be cleared, and downslope of any activities involving earthworks to prevent the spread of weeds into the area from clearing works.

Prior to clearing, all plant equipment entering the site will be inspected and recommended for wash down (in designated wash down areas) as required to ensure weed material from off-site locations do not establish or spread into native vegetation within the BMP Area. Any weed materials will need to be carefully removed off site in a manner appropriate to the species, to prevent the spread of propagules to uncleared areas of native vegetation, both on and off site. More detailed weed control measures for implementation in the BMP Area are presented in **Chapter 6**.

5.7. Erosion and Sediment Control

Potential impacts to flora and fauna occurring in the construction phase that can be managed include run-off, sedimentation, erosion and pollution. To reduce sedimentation of the BMP Area, erosion control measures should be implemented according to standard guidelines for construction outlined in the 'Blue Book' (Landcom 2004). This includes minimising the amount of exposed soils on the site at any given time. All soil stockpiles should be adequately covered when not in use to prevent erosion from heavy rainfall. Sediment fences should be established around the perimeter of the subject land to prevent the impacts of sedimentation on the adjoining vegetation. During development, precautions should be taken to ensure that no pollution, such as petrochemical substances or water containing suspended solids, escapes the construction site. Pollution traps and efficient removal of pollution to an off-site location would help to minimise pollution impacts.

Clearing should not take place during periods of heavy rain in order to minimise erosion and sediment run-off.

6. Weed Management Plan

6.1. Introduction

6.1.1. Objectives

The study area contains several weeds, including 30 Priority Weed species or "other weeds of regional concern", as listed in the Greater Sydney Regional Strategic Weed Management Plan (NSW Local Land Services 2022) (see **Section 6.1.2** and **Table 1** below). In addition, future development on the Subject Land has the potential to contribute to the spread of exotic species, including garden escapees into the BMP Area. The objectives of weed management in the BMP Area are to control the existing weeds that occur in order to facilitate the recovery of the native vegetation present, and to prevent the establishment of any additional weed species through ongoing maintenance.

6.1.2. Relevant Legislation

Under the NSW *Biosecurity Act 2015* (Biosecurity Act) all weeds are required to be controlled by all persons under a "General Biosecurity Duty". The General Biosecurity Duty means that all public and private land owners or managers and all other people who deal with weed species (biosecurity matters) must use the most appropriate approach to prevent, eliminate, or minimise the negative impact (biosecurity risk) of those weeds (DPI 2017). The power for enforcement of penalties relating to compliance with the legislation is given to Local Control Authorities (i.e. Local Governments).

State-wide management of weeds under the Biosecurity Act is directed by the NSW Invasive Species Plan (NSW Local Land Services 2022). Weed responses are assigned to four categories:

- Prevention of new weeds establishing;
- Eradication of small and localised infestations where feasible;
- Containment of larger infestation to stop wider spread; and
- Protection of key assets, such as threatened plants and agricultural land, to prevent their damage or degradation by weed invasion.

Under the Biosecurity Act some weed species have been prioritised for management by specific regulations and controls under the Act. These are known as State Level Priority Weeds. Specific legal requirements exist for how these weeds are managed.

All land within the BMP Area is within the Greater Sydney Local Land Services region, and weed management within the region is be undertaken under the direction of the Greater Sydney Regional Strategic Weed Management Plan (NSW Local Land Services 2022). Appendix 1 of the plan outlines the State Listed Priority Weeds and Regional Priority Weeds, and Appendix 2 outlines other weeds of concern in the region.

Of the exotic species recorded within the study area four species - *Anredera cordifolia* (Madeira Vine), *Asparagus aethiopicus* (Asparagus Weed), *Lantana camara* (Lantana) and *Senecio madagascariensis* (Fireweed) - are listed as both State Priority Weeds within the Greater Sydney Regional Strategic Weed Management Plan 2023 – 2027 (NSW Local Land Services 2022) and as Weeds of National Significance (WoNS) under the National Weeds Strategy. State-listed Priority weeds have specific legal requirements for management and have higher

management priorities. These weeds are required to be controlled in every management zone that they occur in.

Priority Weeds recorded within the study area are detailed in **Table 1**.

Table 1 Priority Weeds identified within the study area

Scientific name	Common Name	Status	WoNS
Acetosa sagittata	Turkey rhubarb	Other Weed of Regional Concern	No
Ageratina adenophora	Crofton weed	Other Weed of Regional Concern	No
Ageratina riparia	Mistflower	Other Weed of Regional Concern	No
Anredera cordifolia	Madeira vine	State Priority - Asset Protection	Yes
Araujia sericifera	Moth vine, Moth plant	Other Weed of Regional Concern	No
Asparagus aethiopicus	Asparagus weed	State Priority - Asset Protection	Yes
Cardiospermum grandiflorum	Balloon vine	Other Weed of Regional Concern	No
Cenchrus clandestinus	Kikuyu	Other Weed of Regional Concern	No
Cestrum parqui	Green cestrum	Regional Priority	No
Chloris gayana	Rhodes grass	Other Weed of Regional Concern	No
Cinnamomum camphora	Camphor laurel	Other Weed of Regional Concern	No
Eragrostis curvula	African lovegrass	Other Weed of Regional Concern	No
Erythrina crista-galli	Cockspur coral tree	Other Weed of Regional Concern	No
Erythrina x sykesii	Coral tree, Common coral tree	Other Weed of Regional Concern	No
Gymnocoronis spilanthoides	Senegal tea	Regional Priority	No
Hedychium gardnerianum	Ginger lily	Other Weed of Regional Concern	No
Ipomoea indica	Blue morning glory	Other Weed of Regional Concern	No
Lantana camara	Lantana	State Priority - Asset Protection	Yes
Ligustrum lucidum	Large-leaved Privet	Other Weed of Regional Concern	No
Ligustrum sinense	Small-leaved Privet	Other Weed of Regional Concern	No
Lonicera japonica	Japanese honeysuckle	Other Weed of Regional Concern	No
Ludwigia peruviana	Ludwigia	Regional Priority	No
Ochna serrulata	Ochna	Other Weed of Regional Concern	No
Parietaria judaica	Pellitory, Asthma weed	Other Weed of Regional Concern	No
Rhaphiolepis indica	Indian hawthorn	Other Weed of Regional Concern	No
Senecio madagascariensis	Fireweed	State Priority - Asset Protection	Yes
Senna pendula var. glabrata	Cassia, Senna	Other Weed of Regional Concern	No
Solanum mauritianum	Wild tobacco bush	Other Weed of Regional Concern	No
Tradescantia fluminensis	Trad	Other Weed of Regional Concern	No

Scientific name	Common Name	Status	WoNS
Zantedeschia aethiopica	Arum lily	Other Weed of Regional Concern	No

Table Key: *SP = State Priority Weed, RP = Regional Priority Weed, OWRC = Other Weeds of Regional Concern, WoNS = Weed of National Significance.*

6.2. Best Management Practice

Contractors for weed removal within the BMP area will have to be mindful with regard to the following, to minimise impacts upon existing vegetation and habitats:

- The main principles of the Bradley Method of bush regeneration, i.e. not over-clearing (remove only targeted species), employment of minimal disturbance techniques to avoid soil and surrounding vegetation disturbance, and replacement of disturbed mulch/leaf-litter;
- Removal of fruiting/seeding parts of weeds carefully, to minimise spread of plant propagules;
- Use of chemicals and sprays only during suitable weather conditions (i.e. not during wet or windy conditions), and only during appropriate seasons;
- All equipment should be thoroughly cleaned prior to entering the site to minimise contamination;
- Proximity to watercourses and swampy areas; and
- Presence of native fauna or nesting/breeding sites.

6.3. Weed Control Methods

All weed removal works in the BMP Area should be approached using the strategies outlined below. Specific weed control methods for all species recorded within the study area are provided in **Appendix B**.

6.3.1. Primary Weeding

6.3.1.1. Senegal Tea (*Gymnocoronis spilanthoides*)

Gymnocoronis spilanthoides (Senegal Tea) is present within the BMP Area. The species poses a significant biosecurity risk, and the control of this weed is a reasonably practical objective. The species is listed as a Regional Priority weed listed in the Greater Sydney Regional Strategic Weed Management Plan (NSW Local Land Services 2022). It originates from South and Central America and grows in damp floodplain soils, on the margins of creeks and dams, in wetlands and in still or slow-flowing fresh water.

The species poses a significant risk to biosecurity due to being hardy species and having a rapid growth rate that can quickly congest waterways and interfere with ecosystem function. There are major concerns associated

with the control of the species that include disposal of the removed plant material, soil and the risk of spreading stem fragments.

Recommended removal techniques for these species include:

- Mechanical and manual removal can be carried out in small accessible infestations;
- Infestations should be treated with Glyphosate 360 g/L herbicide prior to removing plant material to reduce the risk of spreading viable stem fragments; and,
- Plant material should be dried and burnt wherever possible, as any plant material and soil that remains damp has the ability to spread viable plant fragments and seeds.

6.3.1.2. Coral Tree (*Erythrina* spp.)

Erythrina crista-galli (Cockspur Coral Tree) and *Erythrina x sykesii* (Coral Tree) are present within the BMP Area. The species are listed as Other Weed of Regional Concern in the Greater Sydney Regional Strategic Weed Management Plan (NSW Local Land Services 2022). *Erythrina crista-galli* originates from South America and *Erythrina x sykesii* is a hybrid of horticultural origin, that was probably developed in Australia or New Zealand. They grow in damp floodplain soils, waterways and in other moist habitats such as swamps and wetlands.

Both species pose a significant risk to biosecurity and can form dense thickets that can rapidly displace native communities, congest riparian vegetation and interfere with ecosystem function. There are major concerns associated with the control of the species that include disposal of the removed plant material and the risk of spreading propagules.

Recommended removal techniques for these species include:

- Requires an arborist to section and remove large trees;
- Cut and paint stumps with undiluted Glyphosate;
- Inject stem/stumps with undiluted Glyphosate;
- All vegetative material from removed individuals needs to be contained and disposed of carefully (burnt or taken to landfill) - the species will regrow vegetatively from twigs, branches, logs, and on occasion, woodchipped material; and,
- Follow-up six months after tree removal. Hand weed and spot spray (< 1.4m high plants) with Glyphosate prior to removal and disposal (burnt or taken to landfill).

6.3.2. Manual Weed Removal

Manual removal, or hand weeding, is an effective form of weed control when all viable parts of the plant are removed from the soil (roots, fruiting material and rhizomes) and site. All weeds removed by hand will be handled according to best practice bush regeneration techniques to prevent subsequent seed set from the removed weeds, and the unviable plant material will be retained on site to provide mulch and natural leaf litter to protect the soil surface.

6.3.3. Woody Weed Removal

Large woody weed species are present within the BMP Area. Recommended removal techniques for these species include:

- The selective spraying of woody weed regrowth, with selective and non-selective herbicides;
- Cutting/scraping and painting deep rooted woody weeds and climbers with hand tools, chainsaws and brush cutters and painting cut stumps with herbicides containing Glyphosate or Picloram; and
- Target drilling and injecting certain large tree weeds with herbicides such as Glyphosate and a Garlon/diesel mix.

6.3.4. Use of Herbicides

All herbicides should be used according to recommendations on the herbicide label. Appropriate Personal Protective Equipment (PPE) should be worn and consideration given to time of day, likelihood of rainfall, wind direction and likely impact on native species as per guidelines on the label. Use of Glyphosate will be appropriate for most species. Glyphosate is the preferred herbicide for use in environmentally sensitive areas as it is rapidly broken down by microbes in the soil so residue is short lived and will not affect remnant and planted native individuals in the long-term following application. In areas near water courses, an appropriate form of the herbicide should be used to minimise impact to aquatic life and amphibians. Herbicide use should be avoided within 2 m of the riparian edges. Examples of appropriate herbicide forms are Roundup Biactive and Clearup Bio 360 which have surfactants that are formulated to minimise harm to amphibians. As runoff is a likely way for herbicide residue to enter watercourses, chemical treatment should be avoided prior to or directly after rains.

It is important to note that there can be legal restrictions and permit requirements for use of specific herbicides for specific plants, and chemical labels and permit requirements always need to be researched prior to herbicide application. The relevant permit numbers are PER9907, and PER11916. These permits need to be obtained from the Federal Government body, the Australian Pesticides and Veterinary Management Authority.

Manual removal will be an appropriate form of control for some species, and all chemical treatment should be carried out according to best practice guidelines. Planting should not occur within 10 days of herbicide application.

6.3.5. Use of Weed Suppression Materials

Use of weed suppression materials such as jute matting or mulch is appropriate to use within the BMP Area. Although erosion risks following weed removal are likely to be minimal, and presence of native species suggests these materials may suppress native regeneration as well as weed germination.

6.4. Weed Management in the BMP Area

6.4.1. Initial Weed Control

After installation of sediment fencing has been completed, initial weed treatment in the BMP Area will commence. Initial weeding will involve treatment/removal of all woody weed species, and Priority Weeds and Other Weed of Regional Concern, and spraying of all large infestations of herbaceous weeds with herbicide where off target impact to native species will be minimal.

Herbicide application will consist of spraying with Glyphosate 360g/L at a concentration of 10 mL herbicide to 1 L of water. This strength is commonly used in bushland regeneration works as it will effectively kill most herbaceous weed species. A marker dye should be used in the herbicide solution to ensure no areas are missed. Knapsack sprayers with a spray cone to direct the spray towards the ground are recommended to be used to prevent herbicide drift into adjacent vegetated areas. Spraying should be adjusted based on on-ground conditions and should target areas with weed infestations.

Following the initial spraying, the site should be left for three weeks to allow time for any treated weeds to die back. After this period, the treated areas should be resprayed with Glyphosate again, with a focus made on treating any exotic plant species that still have green colouring left in foliage, and any juvenile germinated exotic grasses.

6.4.2. Ongoing Weed Maintenance

The most cost and time effective method of controlling weed regrowth will be by spraying a non-selective Glyphosate herbicide. This is only to be used for large infestations. If targeting individual weeds, then wick wiping/direct press techniques are advisable.

Ongoing maintenance of the BMP Area should occur for a five-year period by the contracted bushland regeneration company, and the BMP Area be covered in its entirety once every month, to diminish the soil seed bank of exotic weed species present on site. In order to eliminate the occurrence of these species they need to be controlled before they have a chance to set seed, otherwise progress on the site will not be made.

Tree guards should remain around all native planted trees and shrubs, for at least 18 months to protect them from herbivory. Rabbits can devastate revegetation areas soon after planting if tree guards are not used. Tree guards will also allow herbicide to be used for control of the majority of regrowth weeds, without damage to native plants by herbicide drift.

The following sequential steps are recommended to manage each area of the Subject Site effectively for each site visit:

- Initially the bushland regeneration team visiting the site should sweep from one end of each area to the other. During this sweep weeds occurring within each tree guard alongside native plants should be removed by hand and any weed occurring within a patch of dominant native plants (such as a patch of grasses).

- A member of the team should then sweep the entire area, spraying all regrowth weeds between native plantings/remnant natives in open areas with herbicide, and spot spraying where possible in regeneration areas.

It is important during site visits for ongoing weed maintenance that as many weed species as possible are controlled. This will minimise maturity and set seed of weeds between site visits. Some weed species are prolific seeders, and many exotic plants can have seed that remains viable in the soil for long periods of time. In order to effectively diminish the soil seed bank occurrences of exotic species it is important that individuals are not allowed to set seed.

During site visits for weed control, Priority Weeds and Weeds of National Significance (WONS) must be prioritised for control. Individual plants of these species on site should not be allowed to achieve a reproductive stage in their life cycles.

7. Revegetation Plan

7.1. Introduction

7.1.1. Objectives

This chapter provides details for the restoration of the native vegetation within the BMP Area.

The objectives of this revegetation plan are to provide details of the measures that will be implemented to restore the degraded patches of Northern Paperbark-Swamp Mahogany Saw-sedge Forest within the BMP Area back to high quality occurrences of Northern Paperbark-Swamp Mahogany Saw-sedge Forest that will remain in the long term.

7.2. Revegetation Preparation

Preparation for revegetation of the BMP area will require the treatment of soils, and the installation of protective plant fencing. Recommended revegetation strategies include:

- Initial and ongoing control of competing weeds using bushland regeneration techniques and conventional best practice chemical and physical strategies as outlined in **Chapter 6**;
- Treatment of soils within each planted tube stock plant hole with a plant establishment aid that contains a mix of materials such as slow and quick release fertilisers, water holding crystals, rooting hormones and wetting agents, (i.e. products such as Terra Cottem by TC Advantage Pty Ltd or Sure Start by Barmac). These agents assist in establishing newly installed plants and can reduce establishment watering resources by up to 50%;
- Stabilising soils and suppressing weeds around individual plantings where required using products, such as 40 cm square jute fibre mats or woodchip leaf mulch to a 50 cm diameter and 75 mm depth; and
- Protecting individual tree and shrub plantings with a tree guard from feral animal grazing, frost and maintenance herbicide spraying overspray. Bamboo stakes 3 x 10-12 mm x 750 mm and 1 x 350 mm x 450 mm plastic tree guards are suitable for this purpose.

7.3. Recommended Revegetation Techniques

7.3.1. Species Selection

Appropriate plant species for Northern Paperbark-Swamp Mahogany Saw-sedge Forest are provided in **Appendix C** and are to be used for revegetation of the BMP Area. Plants will be sourced from local provenance stock and may be sourced from seed collections or cuttings from within the existing remnant vegetation within the BMP Area or from commercially sourced tube stock.

It is recommended that a mix of local native trees, shrubs, and ground layer plants are replanted at the specified densities outlined below. All plants must be disease and pest-free, hardened off and well-watered at the time

of planting. All plants are to be provided in a healthy condition. They must have good root development and a sturdy shoot system.

Final species selection will be based upon:

- Availability of seed material;
- Exclusion of plants likely to naturally regenerate on the site; and
- Previous experience with species re-vegetation performance.

As many species as are able to be sourced should be planted to maximise the species richness within the BMP Area. The minimum numbers of species to be used in the initial establishment phase of the revegetation are:

- Two canopy tree species;
- Five subcanopy or shrub layer species; and
- Ten groundcover species.

The above minimum number of species represents 50% of benchmark as detailed in BioNET vegetation classification database (NSW Government 2020).

7.3.2. Planting Densities

Differential cover of shrubs provides a greater diversity of fauna habitat, particularly for some small, woodland birds which forage in grassy areas and shelter in shrub thickets. Trees and shrubs should be planted unevenly in patches to mimic natural distribution.

Planting of trees should be avoided in close proximity (<5m) to existing (retained) canopy. In areas of Zones 1 and 2 in which retained locally native canopy trees occur, planting of understorey and ground layer species will be required along with canopy species where the existing canopy is sparse or where removal of weed species has created gaps in the canopy.

7.3.2.1. Zone 1

Zone 1 has an intact native canopy of Northern Paperbark-Swamp Mahogany Saw-sedge Forest trees and as such planting of tree species is only required where the canopy is sparse or where removal of weed species has created gaps in the canopy, along with the required planting of shrubs and ground layer species at the densities specified below.

The required planting specifications for Northern Paperbark-Swamp Mahogany Saw-sedge Forest in Zone 1 of the BMP Area are:

- Canopy @ 1 unit / 4 m^2 only in areas without existing native canopy;
- Shrubs @ 4 units / 1 m^2 (can be differentially spaced across the BMP Area in thickets); and
- Groundcovers @ 4 units / 1 m^2 planted in clumps/thickets or singly.

Due regard will be given to existing native species in each stratum and plantings are only required in areas with less than the above required planting densities, following initial weed control.

Recommended planting species are provided in **Appendix C**.

7.3.2.2. Zone 2

Zone 2 comprises no remnant vegetation of the Northern Paperbark-Swamp Mahogany Saw-sedge Forest community. It was formerly cleared and has recently been revegetated. As such revegetation will be required of all strata. The recent revegetation present in the zone will have to be factored in when achieving the required planting densities specified below.

The required planting specifications for Northern Paperbark-Swamp Mahogany Saw-sedge Forest in Zone 3 of the BMP Area are:

- Canopy @ 1 unit / 4 m^2;
- Shrubs @ 4 units / 1 m^2 (can be differentially spaced across the BMP Area in thickets); and
- Groundcovers @ 4 units / 1 m^2 planted in clumps/thickets or singly.

Due regard will be given to existing plantings and additional plantings are only required in areas with less than the above required planting densities, following initial weed control.

Recommended planting species are provided in **Appendix C**.

7.3.2.3. Zone 3

Zone 3 is primarily exotic woody vegetation so following weed removal, this zone will be open and significant gaps will have been created in the canopy and as such significant revegetation will be required of all strata.

The recommended planting specifications for Northern Paperbark-Swamp Mahogany Saw-sedge Forest in Zone 4 of the BMP Area are:

- Canopy @ 1 unit / 4 m^2;
- Shrubs @ 4 units / 1 m^2 (can be differentially spaced across the BMP Area in thickets); and
- Groundcovers @ 4 units / 1 m^2 planted in clumps/thickets or singly.

Recommended planting species are provided in **Appendix C**.

7.3.2.4. Zone 4

Zone 4 will be managed as an infiltration basin. It is primarily exotic woody vegetation so following weed removal this zone will only have the ground stratum revegetated with suitable aquatic species and other ground cover species that are tolerant to periodic inundation around the periphery of the basin.

The recommended planting specifications for Northern Paperbark-Swamp Mahogany Saw-sedge Forest in Zone 4 of the BMP Area are:

- Groundcovers @ 4 units / 1 m^2 planted in clumps/thickets or singly.

Recommended aquatic planting species are provided in **Table 7** in **Appendix C**.

7.3.2.5. Zone 5

Zone 5 will be managed as a Landscaping Area. For the most part, it is devoid of a native understorey and the few Northern Paperbark-Swamp Mahogany Saw-sedge Forest trees reside over a largely exotic understorey or bare ground. As such, planting of tree species is as required in the landscaping plan and revegetation will be required of all strata.

The required planting specifications for Northern Paperbark-Swamp Mahogany Saw-sedge Forest in Zone 5 of the BMP Area are:

- Canopy @ 1 unit / 4 m^2
- Shrubs @ 4 units / 1 m^2 (can be differentially spaced across the BMP Area in thickets)
- Groundcovers @ 4 units / 1 m^2 planted in clumps/thickets or singly.

Due regard will be given to existing native species in each stratum and plantings are only required in areas with less than the above required planting densities, following initial weed control.

Recommended planting species are provided in **Appendix C**.

7.3.3. Species Richness of Plantings

The goal of revegetation should be to match the species richness benchmark for PCT 4006. The benchmark for PCT 4006 is four tree species, nine shrub species, seven grasses/graminoids, six forb species, two ferns, and five other species (i.e. vines and twiners). It is recognised that the ability to match benchmark species richness will be dependent on stock able to be obtained from local nurseries. As such, specific performance criteria against the benchmark are provided in **Table 2**.

7.3.4. Relative Abundance of Tree Species Plantings

With regards to meeting 50% of the benchmark species richness of four canopy species (NSW Government 2020), the main tree species planted will be of the species *Eucalyptus robusta*, *Eucalyptus botryoides* and/or *Casuarina glauca*. Two canopy species are required as a minimum.

7.3.5. Characteristic Planting Units

Species should be planted in characteristic planting units to correspond with the topology, aspect, soil type and proximity to water.

Trees, smaller trees and shrubs should be planted unevenly in patches to mimic natural distribution. It should be noted Swamp Sclerophyll Forest in its natural state has a varied open to closed canopy with a distinct sub-canopy. Grasses may be planted in clumps of three or more (spaced 15–20 cm apart within clumps) to generate physical / structural support for each other and microclimates. Wind pollinated grasses such as *Entolasia*

marginata may be particularly planted in clumps to aid fertilisation and to create a natural understorey within the restoration areas.

7.3.6. Plant Supply

Any tube stock will be purchased of local provenance native plants identified in **Appendix C**. In the event that the required quantities of tube stock are not available, it may be necessary to collect or source suitable quantities of local native seed for propagation.

Seeds and vegetative propagules should be of local provenance from within the Pittwater LGA, preferably from within 10 km of the study area. Material should be propagated in a local commercial or community nursery, with well-established plants used for revegetation, for trees and shrub species particularly. It may be necessary to get the required amounts of seed and vegetative material contract-collected and grown-n by specialist nurseries. Local native plants should be grown in "Hiko" tube, maxi cell or viro-tube, or Forestry Tube-type containers.

7.4. Maintenance

After planting works have been completed, treated areas in each zone should be maintained by appropriately qualified personnel, selectively spot spraying and hand weeding around native plants, watering plants and replacing dead plants as needed.

Provision should be made to irrigate areas, as required, in the first three months after installation, (on at least four to five occasions, depending on rainfall conditions, more watering if required, particularly over summer months).

Re-growing environmental weeds such as vines, woody trees and shrubs, broadleaf annuals and naturalised grasses should be closely monitored and controlled using ecologically sensitive bushland regeneration hand weeding and spot-spraying methods, to ensure adequate weed control and native plant establishment (refer to **Chapter 6**). Weeding inside each planting bag by hand or selective herbicides will be required, as well as in an approximate 50 cm radius around the outside of each plant and tree guard.

Plants that have died due to drought or pest and disease damage should be replaced as required. Plants that are observed to have died should be replaced by the bushland maintenance team with a planting of the same form.

7.5. Rubbish Removal

Rubbish should be removed at commencement of works under the BMP, but should be undertaken after placement of habitat items such as logs in the BMP Area has been completed. This is because rubbish can form sheltering habitat for fauna.

7.6. Signage

To educate residents of the locality of the BMP Area, signs will be installed on the fence of the BMP Area. The aim of the signs will be to provide information of the conservation significance of the vegetation within the BMP Area and to state that restoration works are being undertaken.

8. Groundwater Dependant Ecosystems

8.1. Introduction and Identification of the GDE

Ground water Dependant Ecosystems are typically dependent on subsurface presence of groundwater either permanently *in situ*, or episodically from tidal forces or creek line flows. However, not all GDEs draw on groundwater directly and not all are solely reliant on groundwater (Geoscience Australia 2023). These types of ecosystems can exist wherever the water table is within the root zone of the plants. Six types of GDEs have been identified in Australia, including:

- Terrestrial vegetation that relies on the availability of shallow groundwater
- Wetlands;
- River baseflow systems where groundwater discharge provides a significant baseflow component to the river;
- Aquifer and cave ecosystems where life exists independent of sunlight;
- Terrestrial fauna that rely on groundwater as a source of drinking water; and
- Estuarine and near-shore marine systems.

The vegetation within the BMP Area is a GDE consistent with types one and two as listed above; terrestrial vegetation and wetlands. However, it is unlikely that the GDE is solely groundwater dependent as it also receives water in the form of direct rainfall and overland flows. While it does receive some groundwater and overland flows from within the study area, it also receives floodwaters from upstream areas.

According to the Richardson et al. (2011), existing investigative projects are trying to understand the response of GDEs to changes in water quality and groundwater levels. These investigations largely rely on long term ongoing monitoring projects that collect and rely on an appropriate amount of baseline data to determine if recorded changes can be attributed to natural variability. Therefore, it is also important to rely on expert opinion (Richardson et al. 2011) especially in the case of the project as there is an absence of localised baseline data.

8.2. Identification of Threats to the GDE

According to Richardson et al. (2011), there are two categories of impacts that can impact on groundwater.

- Physical – water quantity, location, timing, frequency, duration of supply; and
- Chemical – water quality (salinity, nutrients), temperature.

It is important to anticipate both as part of the management following the implementation of the project. In particular, the project will alter the overland flow from areas within the study area with an increased amount hardstand. Additionally, the project proposes a stormwater retention basin that will act to localise and moderate the flow of water into the BMP Area.

As mentioned previously, the wetland vegetation within the BMP Area is not solely groundwater dependent as it also can rely on water in the form of overland flows for survival. While the wetland vegetation within the

BMP Area does receive some groundwater and overland flows uphill areas of the study area, it also receives such waters from other land in the locality, particularly from upstream areas where the project will have no influence.

No substantial changes to groundwater are predicted as a result of the project and no significant impacts upon the wetland vegetation as a result of altered overland flows are likely to occur.

8.3. Monitoring

To verify that there are no significant impacts upon the wetland vegetation, this BMP includes groundwater monitoring in conjunction with vegetation monitoring. Examination of data collected will be used to check the condition of the GDE and, if necessary, to change management of downslope areas to maintain vegetation condition. The wetland will be monitored as set out in **Chapter 9**.

8.4. Limitations

Change in ecosystem state due to changing groundwater conditions has been a problematic concept in the sense there has been a perception that neat and predictable relationships exist, which is not always the case. According to Richardson et al. (2011) where data is limited to determine GDE responses to altered groundwater conditions, expert opinion must be relied on (Richardson et al. 2011). In particular, the management practises and monitoring proposed as part of this BMP has been prepared using expert opinion in the absence of localised baseline data.

9. Monitoring, Reporting

This chapter outlines the requirements for monitoring biodiversity across the BMP Area and for checking the progress of various management measures intended to improve biodiversity.

9.1. Monitoring Practises

It is noted that the wetland vegetation within the BMP Area is a GDE. As such, a multidisciplinary approach is proposed to ensure the BMP Area is sufficiently protected and improved. This monitoring program proposes to monitor the following environmental conditions as part of a holistic approach:

- Water table depth monitoring; and
- Vegetation Monitoring.

In light of the potential threats defined in **Chapter 8**, the monitoring objectives are set to determine whether changes to groundwater levels have an influence on the supply of fresh water or nutrients to the wetland vegetation within the BMP Area. Alterations in the water table would lead to decreases in the supply of fresh groundwater to the BMP Area, with impacts on nutrient supply and salinity regimes.

The above listed monitoring practises are described in further detail in the sections below.

9.1.1. Water Table Depth Monitoring

It will be very important to monitor the depth of the water table due to the likely influence on the condition of the wetland vegetation. The monitoring objectives for monitoring the water table include the establishment of the existing conditions by starting prior to construction and to maintain existing conditions throughout and following construction.

An array of piezometers traversing the BMP Area are proposed to monitor the depth of the water table and will be implemented and monitored by a suitably qualified hydrologist. As previously mentioned, the measurements are proposed to be undertaken prior to construction to establish some baseline data. The piezometers would be sampled monthly, with care taken to ensure that any tidal influences are taken into account, either around the time of sampling or via post-collection data treatment.

9.1.2. Vegetation Monitoring

It is important to collection monitoring data for the wetland vegetation within the BMP Area as this will assist in determining whether changes to the water table depth or quality have an effect on the overlying vegetation. Vegetation monitoring will be undertaken within the BMP Area to include:

- Qualitative of the BMP Area to ensure that any plantings survive and that weeds are kept in check; and
- Long term quantitative monitoring focussed on the condition of the wetland vegetation.

The objective of the vegetation monitoring is to ensure that no reduction in vegetation integrity within the BMP Area occurs as a result of changes in water table depth or quality. Additionally, the management practises outlined in this BMP work towards an improvement in vegetation integrity towards the benchmark scores of PCT 4006.

9.1.2.1. Qualitative Monitoring

The qualitative monitoring program will be carried out for the duration of the BMP but will be intensive in the first 24 months of the life of this plan to ensure that recent plantings survive and prosper and that weeds are kept to a minimum.

All areas that are subject to planting will be inspected and checked quarterly for the first 24 months and notes made about survivorship of plantings and occurrences of weeds. Plantings will be checked at least annually thereafter for the remainder of the five-year management period of the BMP.

During each inspection the following will be recorded:

- Estimates of the success rate of plantings and any recruitment, and assessment of plant replacement requirements (to maintain densities proposed in **Section 7.3.3**);
- Notes about weed occurrences and estimates of weed cover in each planting area; and
- Recommendations for corrective measures and/or vegetation management.

Where plantings fail and weeds require control, corrective action will be undertaken to maintain the integrity of plantings. It is intended that planted vegetation will, in time become self-sustaining and that natural regeneration will occur. Where and when such regeneration occurs, it will obviate the need for further planting. However, if monitoring detects dieback of plantings and a failure to naturally recruit new plants, further plantings will be undertaken as required to fill gaps in plantings.

9.1.2.2. Quantitative Monitoring

Under the BAM (2020), vegetation and fauna habitat data can be collected and compared with data held about each PCT known to occur in NSW by the BioNet database. BAM plots are proposed therefore to be used as a surrogate for monitoring to determine changes in vegetation integrity. As such, BAM plots are hereafter referred to as 'monitoring plots.'

Prior to the commencement of construction, baseline data will be collected from monitoring plots focussed on the wetland vegetation to establish the existing condition. Monitoring plots will be undertaken quarterly thereafter to allow for seasonal variability for the duration of this BMP. Each monitoring plot consists of a 20 x 50 m plot within which the following data will be collected, plus additional information about tree and shrub height classes in each plot:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within a 20 m x 20 m plot;
- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within a 20 m x 50m plot;
- Cover of 'High Threat Exotic' weed species;
- Assessment of function attributes within a 20 m x 50 m plot, including:
    - Count of number of large trees;

- Tree stem size classes, measured as 'diameter at breast height over bark' (DBH);
- Tree and shrub height classes;
- Regeneration based on the presence of living trees with stems <5 cm DBH;
- The total length in metres of fallen logs over 10 cm in diameter;

- Assessment of litter cover within five 1 m x 1 m plots evenly spread within the 20 m x 50 m plot; and
- Number of trees with hollows that are visible from the ground within the 20 m x 50 m plot.

BAM plot data collection and analysis will be done by suitably qualified ecologists accredited to conduct BAM assessments. Photo reference points should also be established in the BMP Area at one corner of each monitoring plot and a photograph shall be taken at each photo reference point facing north, east, south, and west, and one diagonally across the monitoring plot, for a visual assessment of site progress.

Monitoring plots are located sequentially with the first plot placed nearest the clearing boundary, with subsequent parallel plots placed adjacent downslope, Specific locations of monitoring plots are shown on **Figure 4**.

9.1.3. Performance Indicators

As mentioned previously, the objectives of this monitoring plan is to ensure that the project will not have any significant ongoing impact to the wetland vegetation in the BMP Area. As the response to significant change in groundwater will be indicated by the condition of the vegetation, this monitoring plan uses performance indicators that are based on the benchmark values of the wetland vegetation PCT 4006.

Northern Paperbark-Swamp Mahogany Saw-sedge Forest, PCT 4006 is a naturally occurring forested wetland/swamp community that occurs on poorly drained coastal alluvium. The community likely occurred on site originally across much of the study area. The community will be monitored and compared to the benchmark values associated with this PCT type (EHG 2022). The performance indicators to be reached at the end of this BMP are summarised in **Table 2**.

It is noted that an objective for this monitoring plan is to also maintain the existing characteristics of the groundwater within the BMP Area in an effort to maintain conditions currently utilised by the overlying vegetation. Should significant change in groundwater conditions be recorded during the monitoring period, the stormwater retention basin outflow will be reviewed.

Table 2

Performance Indicator	Benchmark*	Performance Criteria					Notes
		Year 1	Year 2	Year 3	Year 4	Year 5	
Tree Richness	4	4	4	4	4	4	It is noted that any planted trees will take time to mature. Richness values are expected to meet benchmark following initial planting and should be maintained.
Shrub Richness	9	9	9	9	9	9	Richness values are expected to meet benchmark following initial planting and should be maintained.
Grass and Grass like Richness	8	8	8	8	8	8	Richness values are expected to meet benchmark following initial planting and should be maintained.
Forb Richness	7	7	7	7	7	7	Richness values are expected to meet benchmark following initial planting and should be maintained.
Fern Richness	2	2	2	2	2	2	Richness values are expected to meet benchmark following initial planting and should be maintained.
Other Richness	4	4	4	4	4	4	Richness values are expected to meet benchmark following initial planting and should be maintained.
Tree Cover	26%	>26%	>26%	>26%	>26%	>26%	Cover value based on tree cover of current plot data collected for P3 in the BDAR (Ref. 21097RP4) – This plot was conducted in the BMP Area and is used as indicative of the current condition of the vegetation within the BMP Area. It is noted that any tree plantings will take time to mature and likely will not contribute to tree cover percentage during this BMP.

Performance Indicator	Benchmark*	Performance Criteria					Notes
		Year 1	Year 2	Year 3	Year 4	Year 5	
Shrub Cover	19%	19%	19%	19%	19%	19%	Shrub cover should meet benchmark immediately following the initial planting at the beginning of this BMP and maintained.
Grass and Grass like species Cover	52%	52%	52%	52%	52%	52%	Grass cover should meet benchmark immediately following the initial planting at the beginning of this BMP and maintained.
Forb Cover	3%	3%	3%	3%	3%	3%	Forb cover should meet benchmark immediately following the initial planting at the beginning of this BMP and maintained.
Fern Cover	2%	2%	2%	2%	2%	2%	Fern cover should meet benchmark immediately following the initial planting at the beginning of this BMP and maintained.
Other Cover	3%	3%	3%	3%	3%	3%	Other cover should meet benchmark immediately following the initial planting at the beginning of this BMP and maintained.
Log length	44	>44 m	>44 m	>44 m	>44 m	>44 m	Log length value based on current plot data collected for P3 in the BDAR (Ref. 21097RP4) – This plot was conducted in the BMP Area and is used as indicative of the current condition of the vegetation within the BMP Area. Log length already exceeds benchmark and will be maintained during this BMP.
Litter Cover	44%	>44%	>44%	>44%	>44%	>44%	Litter cover value based on current plot data collected for P3 in the BDAR (Ref. 21097RP4) – This plot was conducted in the BMP Area and is used as indicative of the current condition of the vegetation within the BMP Area. Litter cover already exceeds benchmark and will be maintained during this BMP.

Performance Indicator	Benchmark*	Performance Criteria					Notes
		Year 1	Year 2	Year 3	Year 4	Year 5	
Number of large trees	5	1	1	1	1	1	Tree value based on tree cover of current plot data collected for P3 in the BDAR (Ref. 21097RP4) – This plot was conducted in the BMP Area and is used as indicative of the current condition of the vegetation within the BMP Area. It is noted that any tree plantings will take time to mature and likely will not contribute to tree cover percentage during this BMP. It is therefore unlikely that the number of large trees will change during this BMP.
Weed Density	0	<10%	<10%	<10%	<10%	<10%	It is unlikely that weeds will be avoided entirely however, should be maintained at less than 10% for the duration of this BMP.
Vegetation Integrity Score (Composition, Structure, Function Scores)	VI: 100 C: 100, S: 100, F: 100	VI: 100 C: 100, S: 100, F: 100	VI: 100 C: 100, S: 100, F: 100	VI: 100 C: 100, S: 100, F: 100	VI: 100 C: 100, S: 100, F: 100	VI: 100 C: 100, S: 100, F: 100	

**Benchmark values based on an average rainfall year as per benchmarks listed in VIS database for PCT 4006*

9.2. Monitoring Responsibilities

It is recommended that a project manager/supervisor with a suitably qualified BAM accredited ecologist be assigned to coordinate, supervise, and manage all works and correspondence with respect to the management of the BMP Area. The consultant will be responsible for ensuring the measures outlined in this BMP are implemented and that plant stock is replaced, as needed. The project manager will become familiar with the BMP Area and surrounds, and progress of all aspects of works undertaken.

The project manager will be responsible for allocation of monitoring and maintenance tasks to personnel in response to ongoing monitoring results as well as reporting. Regular monitoring and feedback from personnel will assist in the allocation of labour relative to available funds.

9.3. Adaptive Management

In situations where there is a good degree of controllability but high uncertainty, adaptive management is the favoured approach. Specifically, since there is an absence of baseline data, a Trigger Action Response Plan (TARP) has been prepared to guide corrective action and is presented in **Table 3.** The TARP covers triggers for corrective action for the BMP Area.

Where the proposed management actions are inadequate to meet proposed, remedial actions will be undertaken. Responses to concerns raised by monitoring results will be varied according to the significance of issues detected, as follows:

- **Level 1** – measured variables are within a reasonable range and consistent with expected progress of the BMP Area. No response needed.
- **Level 2** – measured variables are close to, but not within a reasonable range and consistent with expected progress of the BMP Area. A response will be made.
- **Level 3** – measured variables are clearly outside a reasonable range and inconsistent with expected progress of the BMP Area. An urgent response will be made as a high priority.

Table 3 Trigger Action Response Plan for the BMP Area

Feature	Management of Planted Vegetation		
	Trigger	**Action**	**Response**
Reduction in vegetation integrity of the BMP Area following the commencement of construction	**Level 1**		
	• Monitoring indicates vegetation parameters, including vegetation integrity scores as identified in **Table 2** are met,	• Continue monitoring as per monitoring program.	• No response required.
	Level 2		
	• Monitoring indicates vegetation parameters, including vegetation integrity scores as identified in **Table 2** are met, are within 10% of the relevant target.	• Continue monitoring as per monitoring program. If only one plot is failing to meet the target parameters, then further action may not be required until subsequent monitoring periods. If multiple plots are not meeting target parameters, then actions to be taken managing ecologist and discussion is to occur with Council on most appropriate action • Determine if VIS is within 10% of target or if only one or more variables of the VIS are failing to be met. • Review and confirm monitoring data, cross check water table depth monitoring data against other related environmental data (e.g. control sites and benchmark data) to identify the potential trigger.	As defined by managing ecologist. • Consider appropriate action such as replanting selected species or areas, controlling weeds or feral animals; • Consider increasing monitoring frequency or additional monitoring for impacted areas where relevant; • Analyse and report on results. Determine further action to rectify situation as required; • Review of stormwater outlet to increase/decrease discharge in to the BMP Area

Feature	Management of Planted Vegetation		
	Trigger	**Action**	**Response**
	Level 3		
	• Monitoring indicates vegetation parameters, including vegetation integrity scores as identified in **Table 2** are met are more than 20% below targets.	• Continue monitoring as per monitoring program. • If only one plot is failing to meet the target parameters, then further action may not be required until subsequent monitoring periods. If multiple plots are not meeting target parameters, then actions to be taken by the managing ecologist and discussion is to occur with Council on most appropriate action • Where inconsistencies between plot data is widespread, determine if the VIS is 20% below the target or if only individual attributes are and if the poorly performing attributes can be easily resolved (e.g. planting more plants). • Convene civil engineer to review potential cause from stormwater discharge, and response. • Review and confirm monitoring data, cross check biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) upon identification of the potential trigger.	• Urgently investigate and implement any additional management measures as recommended by managing ecologist. • Urgent review of stormwater outlet to increase/decrease discharge in to the BMP Area

9.4. Reporting

A brief and concise report will be prepared annually based on the findings of the monitoring visits. The report will be prepared by the suitably qualified ecologist and forwarded to Council for approval at the end of each yearly period for the duration of this BMP.

Each annual report will:

- Describe the revegetation works undertaken;
- Provide an assessment of works against performance indicators;
- State the findings of the monitoring surveys;
- Discuss any problems encountered in implementing the BMP; and
- Recommend any adaptations or additions to the BMP.

The report will contain site photographs, as well as a short description of weeds in each management zone and a short comparison to the photographs to the previous years. Any other notable occurrences of weeds will also be reported. The report will also recommend and prioritise areas where additional weed control should be targeted for the following maintenance period.

10. Timing and Responsibilities

10.1. Timing and Responsibilities

This BMP covers work to be carried out on site over a five-year period. The BMP Area is to be managed in a series of phases as follows:

- Phase 1 – Site establishment;
- Phase 2 – Revegetation and primary weeding;
- Phase 3 – Maintenance; and
- Phase 4 – Monitoring and Reporting

Timing and responsibilities at each phase of management within the BMP Area are shown within **Table 4** along with performance criteria. This table assigns each activity within each phase to those responsible.

Table 4 Timing, responsibilities, and performance criteria

Management Area	Action	Responsibility	Performance Criteria	Timing
Phase 1: Collect Baseline Data				
BMP Area	Place piezometers and collect initial readings	Hydrologist	Ensure they are operational. Marking using GPS and high visibility flagging tape	Immediately following formal approval of this BMP. Repeat monthly to collect maximal baseline data until project clearing commences
BMP Area	Establish monitoring plots and collect baseline data	Ecologist	Monitoring data prior to initial site preparation works. GPS establish two monitoring sites that can be used for photograph points, comparison, measuring weeds and plant retention.	Immediately following formal approval of this BMP
Phase 1: Site Preparation				
Edge of Construction Area	Delineation of clearing boundary	Property Owner or Construction Subcontractor	Marking using GPS and high visibility flagging tape and boundary markers.	Before construction works commence

Management Area	Action	Responsibility	Performance Criteria	Timing
Development footprint	Vegetation Clearance	Construction Contractor	Planned vegetation clearing completed	During Construction Works
BMP Area	Habitat Feature Salvage	Construction Contractor	Salvaged logs have been placed within the BMP Area.	During Construction Works
Edge of Construction Area	Tree Protection	Construction Contractor	Establishing a physical barrier to protect the trees to be retained	Before construction works commence
Phase 2: Restoration Works Commence				
BMP Area	Fixed Point vegetation Monitoring	Ecologist	Photographs of fixed monitoring sites before initial weeding.	Prior to commencement of restoration works for each area.
BMP Area	Carry out primary weeding.	Bush Regeneration Contractor	Main weed infestations removed, including Priority Weeds - Reproductively mature plants absent from site.	First two months of restoration works for each Zone.
BMP Area	Fixed Point vegetation Monitoring	Ecologist	Photographs of fixed monitoring sites prior to weeding each month.	Quarterly for duration of BMP restoration works
Management Zone 1	Revegetate with canopy, shrubs and ground cover species if required	Bush Regeneration Contractor	Native plants have been planted (species from **Appendix C**) in shrub and ground layers.	Upon completion of Initial Weeding.
Management Zone 2	Revegetate with canopy, shrubs and ground cover species	Bush Regeneration Contractor	Native plants have been planted (species from **Appendix C**) in all vegetation strata.	Upon completion of Initial Weeding.
Management Zone 3	Revegetate with canopy, shrubs and ground cover species	Bush Regeneration Contractor	Native plants have been planted (species from **Appendix C**) in	Upon completion of Initial Weeding.

Management Area	Action	Responsibility	Performance Criteria	Timing
			shrub and ground layers.	
Management Zone 4	Revegetate with aquatic and inundation tolerant ground cover species	Bush Regeneration Contractor	Native plants have been planted (species from **Table 7** in **Appendix C**) in shrub and ground layers.	Upon completion of Initial Weeding.
Management Zone 5	Revegetate with canopy (as required), shrubs and ground cover species	Landscape architect	Native plants have been planted (species from **Appendix C**) in shrub and ground layers.	Upon completion of Initial Weeding.
BMP Area	Carry out secondary weeding.	Bush Regeneration Contractor	Weed regrowth following primary weeding removed. Work has commenced on control of annual weed species. Weed coverage should be < 50% at end of first year, < 40% at end of second year, < 30% at end of third year, < 20% at end of fourth year, < 10% at end of fifth year. Coverage of Priority Weeds at end of first year should be <10%, <5% at end of second and third year, and at <2% at end of fourth and fifth year.	Following primary weeding, site visits monthly.
Phase 3: Maintenance				

Management Area	Action	Responsibility	Performance Criteria	Timing
BMP Area	Carry out maintenance weeding throughout management zones	Bush Regeneration Contractor	Existing weed growth minimised or controlled.	Monthly for each zone for duration of 5-year maintenance period under BMP
			Regrowth following secondary weeding controlled.	
			No new weed species or infestations.	
Management Zones 1-5.	Maintenance of plantings (if required)	Bush Regeneration Contractor	Any dead plantings replaced.	Monthly duration of 5-year maintenance period under BMP
			Plants watered when drought stressed.	
			Additional plantings where required due to observed gaps in any strata.	
			At end of first six months species richness should Meet benchmark data as provided in **Table 2**.	
Phase 4: Monitoring and reporting				
BMP Area	Collection of piezometer data	Hydrologist	Data recorded on predefined proforma	Monthly following phase 1 initial collection of baseline data
BMP Area	Quarterly qualitative monitoring	Ecologist	Site inspection completed as outlined in Chapter 9.	Quarterly for duration of this BMP
BMP Area	Quarterly quantitative monitoring	Ecologist	Site inspection completed as outlined in Chapter 9.	Quarterly for duration of this BMP
BMP Area	Progress report preparation	Ecologist	Annual Report prepared on progress of restoration works.	Once a year for the 5-year maintenance period of BMP

Management Area	Action	Responsibility	Performance Criteria	Timing
			Also outlines any management actions undertaken if required.	
BMP Area	Final Inspection of Site.	Ecologist	Final inspection carried out at completion of BMP. Also outlines any management actions undertaken if required.	After 5 years of maintenance under BMP
BMP Area	Final Report.	Ecologist	Final report detailing success of restoration or outlining further works needed. Also outlines any management actions undertaken if required.	After 5 years of maintenance under BMP

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APPENDIX A :
Flora Species List

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Table 5 Flora Species List

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Tetragonia tetragonioides		New Zealand Spinach	Aizoaceae	Alive in NSW, Native		Forb (FG)	0.1	1					
Nothoscordum borbonicum	*	Onion Weed	Alliaceae	Introduced			0.1	10	0.1	20			
Alstroemeria pulchella	*	Parrot Alstroemeria	Alstroemeriaceae	Introduced									x
Alternanthera denticulata		Lesser Joyweed	Amaranthaceae	Alive in NSW, Native		Forb (FG)					0.1	10	
Clivia miniata	*		Amaryllidaceae	Introduced									x
Chlorophytum comosum	*	Spider Plant	Anthericaceae	Introduced									x
Centella asiatica		Indian Pennywort	Apiaceae	Alive in NSW, Native		Forb (FG)					0.1	5	
Cyclospermum leptophyllum	*	Slender Celery	Apiaceae	Introduced			0.1	5					
Hydrocotyle bonariensis	*		Apiaceae	Introduced			0.1	10	0.2	50			

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Araujia sericifera	*	Moth Vine	Apocynaceae	Introduced			0.2	5	0.2	5			
Gomphocarpus fruticosus	*	Narrow-leaved Cotton Bush	Apocynaceae	Introduced					0.2	1			
Parsonsia straminea		Common Silkpod	Apocynaceae	Alive in NSW, Native		Other (OG)							x
Alocasia brisbanensis		Cunjevoi	Araceae	Alive in NSW, Native		Forb (FG)							x
Zantedeschia aethiopica	*	Arum Lily	Araceae	Introduced			0.2	2			0.75	7	
Hedera helix	*	English Ivy	Araliaceae	Introduced	YES		0.5	10					
Araucaria heterophylla	*	Norfolk Island Pine	Araucariaceae	Introduced									x
Livistona australis		Cabbage Palm	Arecaceae	Alive in NSW, Native		Other (OG)					4	2	
Asparagus aethiopicus	*	Asparagus Fern	Asparagaceae	Introduced	YES		0.3	20					
Ageratina adenophora	*	Crofton Weed	Asteraceae	Introduced	YES		0.1	10					x

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Ageratina riparia	*	Mistflower	Asteraceae	Introduced	YES								x
Arctotheca calendula	*	Capeweed	Asteraceae	Introduced					0.1	2			
Bidens pilosa	*	Cobbler's Pegs	Asteraceae	Introduced	YES		1	200	0.2	50			x
Cirsium vulgare	*	Spear Thistle	Asteraceae	Introduced			1	100	0.4	20			
Conyza sumatrensis	*	Tall fleabane	Asteraceae	Introduced			0.5	200	0.25	30	0.1	10	
Crassocephalum crepidioides	*	Thickhead	Asteraceae	Introduced			0.2	3	0.1	3			
Gamochaeta americana	*	Purple Cudweed	Asteraceae	Introduced					0.1	2			
Gymnocoronis spilanthoides	*	Senegal Tea	Asteraceae	Introduced	YES								x
Hypochaeris radicata	*	Catsear	Asteraceae	Introduced			0.1	10					
Lactuca saligna	*	Willow-leaved Lettuce	Asteraceae	Introduced							0.1	3	
Senecio madagascariensis	*	Fireweed	Asteraceae	Introduced			0.1	4					x
Sonchus asper	*	Prickly Sowthistle	Asteraceae	Introduced			0.3	100					

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Sonchus oleraceus	*	Common Sowthistle	Asteraceae	Introduced			0.1	5	0.1	5			
Tagetes minuta	*	Stinking Roger	Asteraceae	Introduced									x
Taraxacum officinale	*	Dandelion	Asteraceae	Introduced					0.1	5			
Anredera cordifolia	*	Madeira Vine	Basellaceae	Introduced	YES								x
Telmatoblechnum indicum		Swamp Water Fern	Blechnaceae	Alive in NSW, Native		Fern (EG)							x
Brassica rapa	*	Turnip	Brassicaceae	Introduced			0.1	2					
Cardamine hirsuta	*	Common Bittercress	Brassicaceae	Introduced					0.1	10			
Lepidium didymum	*	Lesser Swinecress	Brassicaceae	Introduced			0.1	10	0.1	5			
Callitriche stagnalis	*	Common Starwort	Callitrichaceae	Introduced							0.2	500	
Lonicera japonica	*	Japanese Honeysuckle	Caprifoliaceae	Introduced	YES								x
Cerastium glomeratum	*	Mouse-ear Chickweed	Caryophyllaceae	Introduced			0.1	30					

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Stellaria media	*	Common Chickweed	Caryophyllaceae	Introduced			0.1	10	0.1	100			
Casuarina glauca		Swamp Oak	Casuarinaceae	Alive in NSW, Native		Tree (TG)					25	15	
Commelina cyanea		Native Wandering Jew	Commelinaceae	Alive in NSW, Native		Forb (FG)	0.1	3	0.1	2			
Tradescantia fluminensis	*	Wandering Jew	Commelinaceae	Introduced	YES						1	100	
Ipomoea indica	*	Morning Glory	Convolvulaceae	Introduced	YES		1	10	5	50			
Cupressus sp.	*		Cupressaceae	Introduced									x
Cyathea cooperi		Straw Treefern	Cyatheaceae	Alive in NSW, Native		Other (OG)					0.5	1	
Carex appressa		Tall Sedge	Cyperaceae	Alive in NSW, Native		Grass & grasslike (GG)					5	200	
Cyperus albostriatus	*		Cyperaceae	Introduced									x
Cyperus brevifolius	*		Cyperaceae	Introduced			0.1	5	0.25	500			
Cyperus congestus	*		Cyperaceae	Introduced			0.1	2	0.2	20			

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Cyperus eragrostis	*	Umbrella Sedge	Cyperaceae	Introduced	YES		0.1	5	0.25	20			
Cyperus gracilis		Slender Flat-sedge	Cyperaceae	Alive in NSW, Native		Grass & grasslike (GG)			0.1	5			
Cyperus papyrus	*		Cyperaceae	Introduced									x
Cyperus rotundus	*	Nutgrass	Cyperaceae	Introduced			0.2	20					
Gahnia clarkei		Tall Saw-sedge	Cyperaceae	Alive in NSW, Native		Grass & grasslike (GG)					25	300	
Hypolepis muelleri		Harsh Ground Fern	Dennstaedtiaceae	Alive in NSW, Native		Fern (EG)					1	20	
Calochlaena dubia		Rainbow Fern	Dicksoniaceae	Alive in NSW, Native		Other (OG)					0.5	3	
Euphorbia peplus	*	Petty Spurge	Euphorbiaceae	Introduced			0.1	50					
Ricinus communis	*	Castor Oil Plant	Euphorbiaceae	Introduced			0.2	2					
Senna pendula var. glabrata	*		Fabaceae (Caesalpinioideae)	Introduced							0.3	3	

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Erythrina crista-galli	*	Cockspur Coral Tree	Fabaceae (Faboideae)	Introduced							15	20	
Erythrina x sykesii	*	Coral tree	Fabaceae (Faboideae)	Introduced							15	8	
Medicago minima	*	Woolly Burr Medic	Fabaceae (Faboideae)	Introduced					0.1	10			
Medicago polymorpha	*	Burr Medic	Fabaceae (Faboideae)	Introduced			0.5	500	1	300			
Trifolium repens	*	White Clover	Fabaceae (Faboideae)	Introduced									x
Vicia sativa	*	Common vetch	Fabaceae (Faboideae)	Introduced			2	100					
Acacia longifolia var. longifolia		Sydney Golden Wattle	Fabaceae (Mimosoideae)	Alive in NSW, Native		Shrub (SG)							x
Fumaria muralis	*	Wall Fumitory	Fumariaceae	Introduced			0.2	50					
Geranium homeanum			Geraniaceae	Alive in NSW, Native		Forb (FG)							x
Myriophyllum aquaticum	*	Parrots Feather	Haloragaceae	Introduced									x

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Liquidambar styraciflua	*	Sweetgum	Hamamelidaceae	Introduced					10	1			
Dietes grandiflora	*		Iridaceae	Introduced									x
Gladiolus undulatus	*	Wild Gladiolus	Iridaceae	Introduced			0.2	50					
Sisyrinchium rosulatum	*	Scourweed	Iridaceae	Introduced			0.1	10	0.1	10			
Juncus kraussii		Sea Rush	Juncaceae	Alive in NSW, Native		Grass & grasslike (GG)							x
Cinnamomum camphora	*	Camphor Laurel	Lauraceae	Introduced									x
Lomandra longifolia		Spiny-headed Mat-rush	Lomandraceae	Alive in NSW, Native		Grass & grasslike (GG)							x
Geitonoplesium cymosum		Scrambling Lily	Luzuriagaceae	Alive in NSW, Native		Other (OG)							x
Rhaphiolepis indica	*	Indian Hawthorn	Malaceae	Introduced			0.2	1					
Modiola caroliniana	*	Red-flowered Mallow	Malvaceae	Introduced			0.2	30	0.2	20			

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Sida rhombifolia	*	Paddy's Lucerne	Malvaceae	Introduced			0.1	20	0.5	200			
Melia azedarach		White Cedar	Meliaceae	Alive in NSW, Native		Tree (TG)	0.1	2					
Ficus coronata		Creek Sandpaper Fig	Moraceae	Alive in NSW, Native		Shrub (SG)							x
Morus alba	*	White Mulberry	Moraceae	Introduced			0.2	1					
Musa sp.	*	Banana	Musaceae	Introduced			0.75	7	0.2	1			x
Eucalyptus robusta		Swamp Mahogany	Myrtaceae	Alive in NSW, Native		Tree (TG)	15	1			10	3	
Melaleuca linariifolia		Flax-leaved Paperbark	Myrtaceae	Alive in NSW, Native		Shrub (SG)					2	2	
Ochna serrulata	*	Mickey Mouse Plant	Ochnaceae	Introduced	YES								x
Ligustrum lucidum	*	Large-leaved Privet	Oleaceae	Introduced	YES		0.5	4	0.3	3			

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Ligustrum sinense	*	Small-leaved Privet	Oleaceae	Introduced	YES						1	10	
Ludwigia peruviana	*		Onagraceae	Introduced	YES						3	40	
Oxalis corniculata	*	Creeping Oxalis	Oxalidaceae	Introduced					0.1	2			
Passiflora edulis	*	Common Passionfruit	Passifloraceae	Introduced									x
Dianella caerulea var. producta			Phormiaceae	Alive in NSW, Native		Forb (FG)							x
Phytolacca octandra	*	Inkweed	Phytolaccaceae	Introduced			0.3	20	0.2	10			
Plantago lanceolata	*	Lamb's Tongues	Plantaginaceae	Introduced			0.5	200					
Axonopus fissifolius	*	Narrow-leafed Carpet Grass	Poaceae	Introduced	YES				0.3	50			
Briza maxima	*	Quaking Grass	Poaceae	Introduced			0.2	20					
Bromus catharticus	*	Praire Grass	Poaceae	Introduced					1	3			
Cenchrus clandestinus	*	Kikuyu Grass	Poaceae	Introduced			45	4000	70	700			
Chloris gayana	*	Rhodes Grass	Poaceae	Introduced	YES		1	50					

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Cynodon dactylon		Common Couch	Poaceae	Alive in NSW, Native		Grass & grasslike (GG)	5	500					
Digitaria sanguinalis	*	Crab Grass	Poaceae	Introduced			0.2	30	0.2	30			
Echinochloa crus-galli	*	Barnyard Grass	Poaceae	Introduced			0.1	5					
Ehrharta erecta	*	Panic Veldtgrass	Poaceae	Introduced	YES		0.1	10	0.25	40			
Eleusine tristachya	*	Goose Grass	Poaceae	Introduced			0.1	10					
Entolasia marginata		Bordered Panic	Poaceae	Alive in NSW, Native		Grass & grasslike (GG)							x
Eragrostis curvula	*	African Lovegrass	Poaceae	Introduced	YES				0.1	2			
Eragrostis tenuifolia	*	Elastic Grass	Poaceae	Introduced			0.1	5					
Lolium perenne	*	Perennial Ryegrass	Poaceae	Introduced			0.1	10					
Microlaena stipoides var. stipoides		Weeping Grass	Poaceae	Alive in NSW, Native		Grass & grasslike (GG)			0.1	20			

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Oplismenus aemulus			Poaceae	Alive in NSW, Native		Grass & grasslike (GG)			0.1	10			
Paspalum dilatatum	*	Paspalum	Poaceae	Introduced	YES		1	100	1	100			
Paspalum urvillei	*	Vasey Grass	Poaceae	Introduced			10	500	10	500			x
Phragmites australis		Common Reed	Poaceae	Alive in NSW, Native		Grass & grasslike (GG)					1	30	
Poa annua	*	Winter Grass	Poaceae	Introduced			0.1	5	0.1	20			
Setaria parviflora	*		Poaceae	Introduced			1	100					
Stenotaphrum secundatum	*	Buffalo Grass	Poaceae	Introduced			15	1500	5	500			x
Acetosa sagittata	*	Rambling Dock	Polygonaceae	Introduced	YES								x
Persicaria decipiens		Slender Knotweed	Polygonaceae	Alive in NSW, Native		Forb (FG)					0.4	200	
Persicaria lapathifolia		Pale Knotweed	Polygonaceae	Alive in NSW, Native		Forb (FG)							x

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Persicaria strigosa			Polygonaceae	Alive in NSW, Native		Forb (FG)							x
Rumex crispus	*	Curled Dock	Polygonaceae	Introduced									x
Lysimachia arvensis	*	Scarlet Pimpernel	Primulaceae	Introduced			0.1	50	0.2	200			
Grevillea robusta		Silky Oak	Proteaceae	Alive in NSW, Native		Tree (TG)	0.25	1					
Potentilla indica	*	Indian Strawberry	Rosaceae	Introduced					0.1	2			
Cardiospermum grandiflorum	*	Balloon Vine	Sapindaceae	Introduced	YES								x
Cestrum parqui	*	Green Cestrum	Solanaceae	Introduced	YES		0.5	2					
Solanum mauritianum	*	Wild Tobacco Bush	Solanaceae	Introduced									x
Solanum nigrum	*	Black-berry Nightshade	Solanaceae	Introduced			1	50	0.5	30	0.1	2	
Typha orientalis		Broad-leaved Cumbungi	Typhaceae	Alive in NSW, Native		Grass & grasslike (GG)							x

Scientific Name	Exotic	Common Name	Family	Establish. Means	High Threat	BAM Growth Form Group	1 Cov	1 Abu	2 Cov	2 Abu	3 Cov	3 Abu	RMS 1
Parietaria judaica	*	Pellitory	Urticaceae	Introduced									x
Urtica urens	*	Small Nettle	Urticaceae	Introduced			0.1	3					
Lantana camara	*	Lantana	Verbenaceae	Introduced							5	20	
Verbena bonariensis	*	Purpletop	Verbenaceae	Introduced			0.5	100	0.2	10			
Viola banksii			Violaceae	Alive in NSW, Native		Forb (FG)							x
Hedychium gardnerianum	*	Ginger Lily	Zingiberaceae	Introduced									x

Table Key: *BAM = Biodiversity Assessment Method, Cov = Cover, Abu = Abundance, RMS = Random Meander Survey*

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APPENDIX B :

Weeds Recorded within the study area and Weed Control Methods

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Table 6 Weeds Recorded within the study area and Weed Control Methods

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
Acetosa sagittata	Turkey rhubarb	Polygonaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Bag and remove seed present on mature plants - Cut vines close to the ground and dig out as much as of root system and tubers as possible - Juvenile plants growing from seed can be dug out or hand pulled - Tuber at base of plant needs to be removed - On individuals with deep and difficult to remove tubers, stems can be scraped on one side with a blade for a length of 45cm and scraped area painted with undiluted Glyphosate - This treatment may need to be repeated on subsequent site visits - On plants with difficult and deep to remove tubers the tubers close to the surface can also be scraped and painted with undiluted Glyphosate
Ageratina adenophora	Crofton weed	Asteraceae	Other Weed of Regional Concern	No	Greater Sydney & Hunter Management Plans 2017-2022	- Hand Weed - Spot Spray with Glyphosate 5mL/1L - Slash large individuals with brushcutter and spray regrowth foliage with Glyphosate 5mL/1L
Ageratina riparia	Mistflower	Asteraceae	Other Weed of	No	Greater Sydney Management Plan 2017-2022	- Hand Weed - Spot Spray with Glyphosate 5mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
			Regional Concern			- Slash large individuals with brushcutter and spray regrowth foliage with Glyphosate 5mL/1L
Alstroemeria pulchella	Peruvian lily	Alstroemeriaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Remove the entire plant including the roots. Cut individual stems near ground and paint with full strength herbicide. Follow up required.
Anredera cordifolia	Madeira vine	Basellaceae	State Priority - Asset Protection	Yes	Greater Sydney & Hunter Management Plans 2017-2022	- Hand pull juvenile vines, or remove with hand tools taking care to remove roots and tubers - Skirting vines is not recommended as plant can remain alive for up to 2 years without roots - Pulling vines down from canopy is similarly not recommended as it will result in fall of aerial tubers and bulbils which will sprout new plants - Scrape and paint stems with undiluted glyphosphate, scrape both sides of stem and scrape from ground to as high as can be reached, taking care not to completely ringbark stem which will stop herbicide dispersal through plant - Spray seedlings with glyphosphate 10 mL/1L + surfactant - When removing vines all bulbils and aerial tubers should be bagged and removed from

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
						site, and fallen tubers collected and removed from the ground beneath mature vines
Araucaria heterophylla	Norfolk Island Pine	Araucariaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand weed seedlings - Spray seedlings and coppice regrowth with Glyphosate 10mL/1L - Drill and inject stem with, or chisel and apply, undiluted Glyphosate - Cut and paint stump with undiluted Glyphosate (will require an arborist for large trees) - Cut and grind stump of large trees (arborist)
Araujia sericifera	Moth vine, Moth plant	Apocynaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Hand Weed Juveniles - Spray juveniles with Glyphosate 10mL/1L - Skirt mature vines (cut through plant close to root) and then pull root manually or apply undiluted Glyphosate to cut surface - Scrape and paint vine with undiluted Glyphosate
Arctotheca calendula	Cape Weed	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
Asparagus aethiopicus	Asparagus weed	Asparagaceae	State Priority - Asset Protection	Yes	Greater Sydney & Hunter Management Plans 2017-2022	- Any branches profuse with fruit should be cut with secateurs and bagged to prevent further spread of species by birds - Juvenile plants can be eased out of soil with a trowel or knife - care should be taken to remove below ground plant material - For large, mature plants the woody crown at the base can be cut around with a sharp knife, or hacked out with a mattock or peter lever and removed - it is easiest to cut all branches off near the base with secateurs prior to removing crown - plant will not resprout from water storing tubers or roots below ground so these can be left to rot to reduce soil disturbance. - Spray mature and juvenile plants with metsulfuron methyl 6g/100mL + surfactant
Axonopus fissifolius	Carpet Grass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Bidens pilosa	Cobbler's Pegs	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans	
Brassica rapa	Field Mustard	Brassicaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Briza maxima	Quaking Grass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Bromus catharticus	Brome Grass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Callitriche stagnalis	Common Starwort	Plantaginaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter	- Dense growths of starwort are often a conspicuous feature in drains and can impede waterflow. Can be sprayed or mechanically removed from flowing water channels.

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans	
Cardamine hirsuta	Common Bittercress	Brassicaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Cardiospermum grandiflorum	Balloon vine	Sapindaceae	Other Weed of Regional Concern	No	Greater Sydney & Hunter Management Plans 2017-2022	- Hand weed juveniles or spray with Glyphosate 10mL/1L - Hand pull roots of mature vines - Vines growing over trees, shrubs, or other objects should be skirted with shears as close to the ground as possible - Spray remaining ground coverage with Glyphosate 10mL/1L, or treat cut stems with undiluted Glyphosate - Bag and remove seed cases where possible
Cenchrus clandestinus	Kikuyu	Poaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Cerastium glomeratum	Mouse-ear Chickweed	Caryophyllaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans	
Cestrum parqui	Green cestrum	Solanaceae	Regional Priority	No	Hunter Management Plan 2017-2022	- Hand weed juveniles - Scrape stem and paint with undiluted Glyphosate - Cut all above ground suckering individuals with loppers or saw and paint stumps with undiluted Glyphosate - Spray regrowth foliage with Glyphosate 10mL/1L
Chloris gayana	Rhodes grass	Poaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Hand weed juveniles - Remove carefully with secateurs and bag seed plumes of mature plants - Dig mature plants out of the ground with a mattock; or - Brushcut mature plants to near ground level and spray with Glyphosate 10mL/1L - During subsequent site visits spray regrowth foliage with Glyphosate 10mL/1L
Chlorophytum comosum	Spider plant	Asparagaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter	- Spot Spray with Glyphosate 10mL/1L. Do not dump garden waste. This plant is unlikely to spread into native vegetation without such assistance. Plants can be dug and burnt or deeply buried to prevent them re-sprouting.

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans	
Cinnamomum camphora	Camphor laurel	Lauraceae	Other Weed of Regional Concern	No	Greater Sydney & Hunter Management Plans 2017-2022	- Hand weed seedlings - Spray seedlings and coppice regrowth with Glyphosate 10mL/1L - Drill and inject stem with, or chisel and apply, undiluted Glyphosate - Cut and paint stump with undiluted Glyphosate (will require an arborist for large trees) - Cut and grind stump of large trees (arborist)
Cirsium vulgare	Spear Thistle	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed using gloves - Spot Spray - Glyphosate 10mL/1L - Appropriate pasture and grazing management - Mechanical removal
Clivia miniata	Clivia	Amaryllidaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	-Hand Weed - Spot Spray suckers - Glyphosate 10mL/1L - Controlling feral pig populations limits the spread of this weed

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
Conyza sumatrensis	Tall Fleabane	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L - On-going grubbing (all year)
Crassocephalum crepidioides	Thickhead	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Cupressus spp.		Cupressaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand weed seedlings - Spray seedlings and coppice regrowth with Glyphosate 10mL/1L - Drill and inject stem with, or chisel and apply, undiluted Glyphosate - Cut and paint stump with undiluted Glyphosate (will require an arborist for large trees) - Cut and grind stump of large trees (arborist)
Cyclospermum leptophyllum	Slender Celery	Apiaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans	
Cyperus albostriatus		Cyperaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Cyperus brevifolius	Mullumbimby Couch	Cyperaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Cyperus congestus		Cyperaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Cyperus eragrostis	Umbrella Sedge	Cyperaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans	
Cyperus papyrus	Paper Sedge	Cyperaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Cyperus rotundus	Nut Grass	Cyperaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Difficult Weed to control manually as it an has extensive underground root network with tubers from which it will resprout - if manual methods need entirety of underground mass needs to be dug up, bagged, and removed from site - Weed is resistant to most herbicides which will kill foliage though not tubers from which it will resprout - Use of Glyphosate 10 mL/1L will kill tubers eventually if foliage and resprouting foliage is sprayed repeatedly during each site visit - Spraying should occur monthly until no resprouting material is present, and area should be monitored following this for new foliage in the months after
Dietes grandiflora	Wild Iris	Iridaceae	No Status	No	Not Mentioned in Greater Sydney or	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Hunter Managaement Plans	
Digitaria sanguinalis	Summer Grass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- This species is present above ground generally only during the warmer months of the year when it grows densely, in large abundances, after seedlings germinate from soil seed. It seeds profusely and it is important to prevent seed from being deposited in the soil to prevent dense infestations the following year. It is important to control juveniles before they are able to produce and set seed. On any plant that is seeding the seed head needs to be cut off and bagged, with secateurs for individual plants, or use of shears in areas with large amounts of the grass seeding. - The most effective control methods is to spray all patches of juvenile plants with Glyphosate 10mL/1L before they reach maturity. This needs to be repeated during every site visit during the warmer months as germination of new plants will occur throughout this period.
Echinochloa crus-galli	Barnyard Grass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans	
Ehrharta erecta	Panic Veldtgrass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Eleusine tristachya	Crab Grass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Eragrostis curvula	African lovegrass	Poaceae	Other Weed of Regional Concern	No	Greater Sydney & Hunter Management Plans 2017-2022	- Any seed heads present on mature individuals should be cut from plants with secateurs and bagged and removed from site - Dig large individuals out with a mattock - Juvenile individuals can be dug out using hand tools or spot sprayed using Glyphosate 10mL/1L - Spot spraying with Glyphosate 10mL/1L is effective during the growth period during Spring and Summer - During this period large individuals can be mown or brushcut to the ground level and regrowth foliage sprayed with Glyphosate

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
						- Spot spraying the herbicide Fluproponate (745g/L formulation) at 3mL/1L concentration (as per label) is effective at eradicating African Lovegrass and will kill any seedling regrowth for up to 4 years as the herbicide may remain active in the soil for this time period. This time period exceeds the length of time African Love Grass seed remains viable in the soil so will eradicate the grass in areas where it is sprayed. The herbicide is taken up through the roots of the plants following rain and it may take up to 3 months for plants to yellow, and 18 months for them to die back. As the herbicide will inhibit regrowth of native grasses for up to 4 years and may harm other native plants through ground water movement it is not recommended for use in bushland remnant or revegetation areas, though is the most effective herbicide for controlling African Love Grass in nearby flat areas from which the weed may spread into bushland areas. Many native grasses such as Microlaena stipoides and Themeda australis are extremely sensitive to this herbicide. If applied before heavy rain the herbicide may be removed from the area of soil around the root zone of targeted weeds before uptake through plant roots, and may harm nearby native grasses. This

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
						herbicide should not be used on slopes (> than 10 degrees) as it is transported through groundwater and may accumulate at the base of slopes. It should not be used in close proximity to water bodies of any kind. The herbicide remains in clay soils such as the shale soils on the Cumberland Plain for longer time periods than in well-drained soils (for a period of up to 800 mm of accumulated rain fall).
Eragrostis tenuifolia	Elastic Grass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Erythrina crista-galli	Cockspur coral tree	Fabaceae (Faboideae)	Other Weed of Regional Concern	No	Greater Sydney & Hunter Management Plans 2017-2022	- Requires an arborist to section and remove large trees - Cut and paint stumps with undiluted Glyphosate - Inject stem/stumps with undiluted Glyphosate - All vegetative material from removed tree/shrub needs to be contained and disposed of carefully (burnt or taken to landfill) - The species will regrow vegetatively from twigs, branches, logs, and on occasion, woodchipped material

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
						- Follow-up six months after tree removal. Hand weed and spot spray with Glyphosate prior to removal and disposal (burnt or taken to landfill).
Erythrina x sykesii	Coral tree, Common coral tree	Fabaceae (Faboideae)	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Requires an arborist to section and remove large trees - Cut and paint stumps with undiluted Glyphosate - Inject stem/stumps with undiluted Glyphosate - All vegetative material from removed tree/shrub needs to be contained and disposed of carefully (burnt or taken to landfill) - The species will regrow vegetatively from twigs, branches, logs, and on occasion, woodchipped material - Follow-up six months after tree removal. Hand weed and spot spray with Glyphosate prior to removal and disposal (burnt or taken to landfill).
Euphorbia peplus	Petty Spurge	Euphorbiaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Fumaria muralis	Wall Fumitory	Fumariaceae	No Status	No	Not Mentioned in Greater	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Sydney or Hunter Management Plans	
Gamochaeta americana	Cudweed	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Gladiolus undulatus	Wild Gladiolus	Iridaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Dig out with hand tools - Care needs to be taken to removal all small cornels present under the main corm - May require bagging and removal of soil around the main corm to remove all cornels - Spray regrowth seedlings with Glyphosate 10mL/1L
Gomphocarpus fruticosus	Narrow-leaved Cotton Bush	Apocynaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed Juveniles - Spot Spray Glyphosate 15mL/1L - Cut and Paint Glyphosate 50mL/100mL
Gymnocoronis spilanthoides	Senegal tea	Asteraceae	Regional Priority	No	Greater Sydney & Hunter	- Mechanical and manual removal can be carried out in small accessible infestations

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans 2017-2022	- Infestations should be treated with Glyphosate 360 g/L herbicide prior to removing plant material to reduce the risk of spreading viable stem fragments - Plant material should be dried and incinerated wherever possible as any plant material and soil that remains damp has the ability to spread viable plant fragments and seeds.
Hedera helix	English Ivy	Araliaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Weeding plants by hand - Do not leave the plants on the ground, they can respout - Bag and Remove
Hedychium gardnerianum	Ginger lily	Zingiberaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Cut, bag, and remove mature seed heads from plants - Dig up with mattock or hand pull mature plants, taking care to remove all fleshy rhizomes - Rhizomes need to be removed from site, or crushed and piled on site to rot (monitor for regrowth) - Cut plant as close to rhizome as possible and treat with undiluted metsulfuron methyl at 6g -1 L (winter) or 1g -1 L (summer)
Hydrocotyle bonariensis	Pennywort	Apiaceae	No Status	No	Not Mentioned in Greater	- Mechanical - Using a shovel or mattock dig up underground rhizomes - Extremely time

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Sydney or Hunter Management Plans	consuming and impractical - Use a wick/wand to apply undiluted Glyphosate to leaf surface
Hypochaeris radicata	Catsear	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Ipomoea indica	Blue morning glory	Convolvulaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Hand pull taking care to remove root system and stem - plant will resprout from stem segments not removed from site - Cut vine at 1m or less above ground height and pull remaining plant out of the ground at the roots - Spray any ground hugging vines with Glyphosate 10mL/1L (will require follow up spraying of regrowth over several months as plant will resprout)
Lactuca saligna	Willow-leaved Lettuce	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
Lantana camara	Lantana	Verbenaceae	State Priority - Asset Protection	Yes	Greater Sydney & Hunter Management Plans 2017-2022	- Hand weed juveniles and regrowth from small pieces - Spot spray with Glyphosate 10mL/1L - Slash using brushcutter, or hand cut with loppers, and spray regrowth foliage with Glyphosate 10mL/1L - Cut near ground level and paint with undiluted Glyphosate - Some individuals will have stumps which will still regrow foliage, spray regrowth foliage with Glyphosate 10mL/1L
Lepidium didymum	Lesser Swinecress	Brassicaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Ligustrum lucidum	Large-leaved Privet	Oleaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Hand weed juveniles - Drill holes with power drill with thick drill bit into mature trees, around base of trunk and fill holes with undiluted Glyphosate. Once Glyphosate has been absorbed refill holes with undiluted Glyphosate several times. - Cut shrub and mature individuals as close to ground as possible with loppers or hand saw (or chainsaw) and treat stump with undiluted Glyphosate

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
						- Spray juveniles and regrowth foliage of cut and painted individuals with Glyphosate 10mL/1L
Ligustrum sinense	Small-leaved Privet	Oleaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Hand weed juveniles - Drill holes with power drill with thick drill bit into mature trees, around base of trunk and fill holes with undiluted Glyphosate. Once Glyphosate has been absorbed refill holes with undiluted Glyphosate several times. - Cut shrub and mature individuals as close to ground as possible with loppers or hand saw (or chainsaw) and treat stump with undiluted Glyphosate - Spray juveniles and regrowth foliage of cut and painted individuals with Glyphosate 10mL/1L
Liquidambar styraciflua	American sweetgum	Altingiaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Remove tree or Hand Weed - Spot Spray suckers - Glyphosate 10mL/1L
Lolium perenne	Perennial Ryegrass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans	
Lonicera japonica	Japanese honeysuckle	Caprifoliaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Cut and scrape vine stems with undiluted Glyphosate - Hand weed seedlings - Spray low lying foliage, regrowth foliage, and seedlings with 20mL/1L Glyphosate & metsulfuron methyl(e.g. Brush-Off) 10.5g/10L + non ionic surfactant - Roots of plant can be dug up with mattock or shovel
Ludwigia peruviana	Ludwigia	Onagraceae	Regional Priority	No	Hunter Management Plan 2017-2022	- Hand weed juveniles - Carefully remove and bag seeding material - Hand pull, or dig mature individuals out with tools, taking care not to remove all root material - Spray foliage of large infestations with 10mL/1L Glyphosate (using a formula with an environmentally friendly surfactant near waterways)
Lysimachia arvensis	Scarlet Pimpernel	Primulaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
Medicago minima	Woolly Burr Medic	Fabaceae (Faboideae)	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Medicago polymorpha	Burr Medic	Fabaceae (Faboideae)	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Modiola caroliniana	Red-flowered Mallow	Malvaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Morus alba	White Mulberry	Moraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand weed seedlings or spray with Glyphosate 10mL/1L - Cut larger individuals/trees to ground level with hand saw or chainsaw and apply undiluted Glyphosate to cut stump

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
Musa spp.	Banana	Musaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Saw trunk back to ground level and apply undiluted Glyphosate - Cut any regrowth foliage off in subsequent months with loppers and apply undiluted Glyphosate - Bag and remove vegetative material from site to prevent resprouting from trunk segments
Myriophyllum aquaticum	Parrots Feather	Haloragaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Remove from water and apply herbicide
Nothoscordum borbonicum	Onion Weed	Alliaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Can be extremely difficult to control due to numerous bulbils sprouting from main bulb which break off underground and form new plants - The plant can be dug out carefully with hand tools; an effort must be made to carefully remove and bag all bulbils formed around the main bulb. - Follow up hand weeding for many months is required to remove juvenile plants; control is easier if juvenile plants are carefully dug out, taking care to bag and remove bulbs, before bulbils have formed

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
						- Spray with 10mL/1L Glyphosate every month; adult plants may take several months to die back. Repeat monthly to control sprouting juvenile plants. - Wipe leaves of plants with undiluted Glyphosate monthly, without missing juvenile sprouting plants. This can be nearly as time consuming as hand digging plants out - Any flowering stem should be cut and bagged, along with any head with seed.
Ochna serrulata	Ochna	Ochnaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Stems of all juvenile and mature plants should be scraped and painted with undiluted Glyphosate - follow up treatment may be needed on regrowth stems around base of plant in following monthly site visits - Mature fruits on plants should be bagged and removed from site
Oxalis corniculata	Yellow Wood Sorrel	Oxalidaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Parietaria judaica	Pellitory, Asthma weed	Urticaceae	Other Weed of	No	Greater Sydney Management Plan 2017-2022	- Spray large areas of weed with Glyphosate 10ml/L and follow up by removing or spraying any seedlings for several months at least.

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
			Regional Concern			
Paspalum dilatatum	Dallisgrass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Paspalum urvillei	Vasey Grass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Passiflora edulis	Passionfruit	Passifloraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand weed Juveniles - Dig roots out of ground for larger individuals or use secateurs to cut the vine near the base and treat cut surface with undiluted Glyphosate
Phytolacca octandra	Inkweed	Phytolaccaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans	
Plantago lanceolata	Lamb's Tongues	Plantaginaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Poa annua	Winter Grass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Potentilla indica	Indian Strawberry	Rosaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Rhaphiolepis indica	Indian hawthorn	Rosaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Hand weed or if not possible cut-back to stump and paint stem with undiluted Glyphosate

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
Ricinus communis	Castor Oil Plant	Euphorbiaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- PPE should be worn as all parts of plant toxic to humans - Hand pull juveniles - Spray juveniles with glyphosate 10mL/1L - Cut larger shrub at base and paint cut stump with undiluted Glyphosate
Rumex crispus	Curled Dock	Polygonaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Senecio madagascariensis	Fireweed	Asteraceae	State Priority - Asset Protection	Yes	Greater Sydney & Hunter Management Plans 2017-2022	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Senna pendula var. glabrata	Cassia, Senna	Fabaceae (Caesalpinioideae)	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Hand Weed or use Glyphosate 75% v/v for stem injections. Undiluted for cut stump treatments.
Setaria parviflora	Pigeon Grass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans	
Sida rhombifolia	Paddy's Lucerne	Malvaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand weed - Spray with Glyphosate 10mL/1L - Cut large, firmly rooted individuals at the base with secateurs and paint with undiluted Glyphosate
Sisyrinchium rosulatum	Scourweed	Iridaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Solanum mauritianum	Wild tobacco bush	Solanaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- When working with this plant additional PPE may be required as some individuals are sensitive to the shedding fine hairs of the species - Recommended PPE is a dustmask, long sleeve shirt and pants + gloves - Hand weed juveniles - Mature individuals can be cut and painted with Glyphosate 10mL/1L - Remove all fruit and seeds

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
Solanum nigrum	Blackberry Nightshade	Solanaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L - Remove all fruit and seeds
Sonchus asper	Sow Thistle	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Sonchus oleraceus	Milk Thistle	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Stellaria media	Common Chickweed	Caryophyllaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
Stenotaphrum secundatum	Buffalo Grass	Poaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Tagetes minuta	Stinking Roger	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Taraxacum officinale	Dandelion	Asteraceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Tradescantia fluminensis	Trad	Commelinaceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Small infestations can be removed by hand weeding - Care needs to be taken not to leave behind any plant material which will resprout. - Large infestations can be controlled by spraying with Glyphosate 10mL/1L, and the use of a surfactant will increase the efficacy of herbicide. Spraying needs to be repeated during every site visit. It can take several months before

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
						the mature plants appear to be affected but a sudden die off will occur after several months of treatment. Any regrowth material following die off of mature plants needs to be sprayed or removed by hand. - Large infestations can be raked up and bagged and removed from site. This is time consuming and labour intensive due to the large mass and weight of heavy infestations of healthy plants. - Large infestations can be covered with black plastic sheets for several months. The plants will die eventually due to lack of required sunlight. This method is not recommended for bushland regeneration as it also inhibits regrowth form seed of native plant species.
Trifolium repens	White Clover	Fabaceae (Faboideae)	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Urtica urens	Small Nettle	Urticaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter	- Hand Weed - Spot Spray - Glyphosate 10mL/1L

Scientific Name	Common Name	Family	Status	WoNS	Management Plan	Control Method
					Management Plans	
Verbena bonariensis	Purple Top	Verbenaceae	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Vicia sativa	Common Vetch	Fabaceae (Faboideae)	No Status	No	Not Mentioned in Greater Sydney or Hunter Management Plans	- Hand Weed - Spot Spray - Glyphosate 10mL/1L
Zantedeschia aethiopica	Arum lily	Araceae	Other Weed of Regional Concern	No	Greater Sydney Management Plan 2017-2022	- Hand weed - Spray regrowth seedlings with Glyphosate 10mL/1L - Dig out with hand tools - Care needs to be taken to remove the established root system in established plant

Table Key: *MP = Management Plan, WoNS = Weeds of National Significance*

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APPENDIX C :

Flora Planting Species List

Table 7 Flora Planting Species List

Scientific Name	Common Name	Family	Growth Form
TREES			
Allocasuarina torulosa	Forest Oak	Casuarinaceae	Tree (TG)
Banksia integrifolia	Coast Banksia	Proteaceae	Tree (TG)
Casuarina glauca	Swamp Oak	Casuarinaceae	Tree (TG)
Eucalyptus botryoides	Bangalay	Myrtaceae	Tree (TG)
Eucalyptus piperita	Sydney Peppermint	Myrtaceae	Tree (TG)
Eucalyptus robusta	Swamp Mahogany	Myrtaceae	Tree (TG)
Glochidion ferdinandi	Cheese Tree	Phyllanthaceae	Tree (TG)
Notelaea longifolia f. longifolia		Oleaceae	Tree (TG)
SHRUBS			
Acacia longifolia var. longifolia	Sydney Golden Wattle	Fabaceae (Mimosoideae)	Shrub (SG)
Dodonaea triquetra	Large-leaf Hop-bush	Sapindaceae	Shrub (SG)
Elaeocarpus reticulatus	Blueberry Ash	Elaeocarpaceae	Shrub (SG)
Eupomatia laurina	Bolwarra	Eupomatiaceae	Shrub (SG)
Hibiscus diversifolius	Swamp Hibiscus	Malvaceae	Shrub (SG)
Melaleuca linariifolia	Flax-leaved Paperbark	Myrtaceae	Shrub (SG)
Homalanthus nutans		Euphorbiaceae	Shrub (SG)
Pittosporum undulatum	Sweet Pittosporum	Pittosporaceae	Shrub (SG)
Polyscias sambucifolia	Elderberry Panax	Araliaceae	Shrub (SG)
Synoum glandulosum subsp. glandulosum	Scentless Rosewood	Meliaceae	Shrub (SG)
OTHERS			
Calochlaena dubia	Rainbow Fern	Dicksoniaceae	Other (OG)
Cayratia clematidea	Native Grape	Vitaceae	Other (OG)
Cissus hypoglauca	Giant Water Vine	Vitaceae	Other (OG)
Cyathea australis	Rough Treefern	Cyatheaceae	Other (OG)
Eustrephus latifolius	Wombat Berry	Luzuriagaceae	Other (OG)
Geitonoplesium cymosum	Scrambling Lily	Luzuriagaceae	Other (OG)
Glycine clandestina	Twining glycine	Fabaceae (Faboideae)	Other (OG)
Hibbertia dentata	Twining Guinea Flower	Dilleniaceae	Other (OG)

Scientific Name	Common Name	Family	Growth Form
Hibbertia scandens	Climbing Guinea Flower	Dilleniaceae	Other (OG)
Kennedia rubicunda	Dusky Coral Pea	Fabaceae (Faboideae)	Other (OG)
Livistona australis	Cabbage Palm	Arecaceae	Other (OG)
Parsonsia straminea	Common Silkpod	Apocynaceae	Other (OG)
Smilax australis	Lawyer Vine	Smilacaceae	Other (OG)
Smilax glyciphylla	Sweet Sarsparilla	Smilacaceae	Other (OG)
Stephania japonica	Snake vine	Menispermaceae	Other (OG)
GRASS & GRASSLIKE			
Baumea juncea		Cyperaceae	Grass & grasslike (GG)
Entolasia marginata	Bordered Panic	Poaceae	Grass & grasslike (GG)
Gahnia clarkei	Tall Saw-sedge	Cyperaceae	Grass & grasslike (GG)
Juncus usitatus		Juncaceae	Grass & grasslike (GG)
Oplismenus imbecillis		Poaceae	Grass & grasslike (GG)
Phragmites australis	Common Reed	Poaceae	Grass & grasslike (GG)
FORBS			
Alternanthera denticulata	Lesser Joyweed	Amaranthaceae	Forb (FG)
Cardamine paucijuga		Brassicaceae	Forb (FG)
Centella asiatica	Indian Pennywort	Apiaceae	Forb (FG)
Commelina cyanea	Native Wandering Jew	Commelinaceae	Forb (FG)
Gonocarpus teucrioides	Germander Raspwort	Haloragaceae	Forb (FG)
Hydrocotyle peduncularis		Apiaceae	Forb (FG)
Lobelia anceps		Campanulaceae	Forb (FG)
Opercularia aspera	Coarse Stinkweed	Rubiaceae	Forb (FG)
Oxalis exilis		Oxalidaceae	Forb (FG)
Persicaria decipiens	Slender Knotweed	Polygonaceae	Forb (FG)
Persicaria hydropiper	Water Pepper	Polygonaceae	Forb (FG)

Scientific Name	Common Name	Family	Growth Form
Persicaria strigosa		Polygonaceae	Forb (FG)
Pomax umbellata	Pomax	Rubiaceae	Forb (FG)
Pratia purpurascens	Whiteroot	Campanulaceae	Forb (FG)
Sigesbeckia orientalis subsp. orientalis	Indian Weed	Asteraceae	Forb (FG)
Solanum americanum	Glossy Nightshade	Solanaceae	Forb (FG)
Viola hederacea	Ivy-leaved Violet	Violaceae	Forb (FG)
FERNS			
Blechnum camfieldii		Blechnaceae	Fern (EG)
Blechnum indicum	Swamp Water Fern	Blechnaceae	Fern (EG)
Gleichenia dicarpa	Pouched Coral Fern	Gleicheniaceae	Fern (EG)
Hypolepis muelleri	Harsh Ground Fern	Dennstaedtiaceae	Fern (EG)
Pteridium esculentum	Bracken	Dennstaedtiaceae	Fern (EG)

Table 8 Flora Planting Aquatic Species List for Vegetation Management Zone 4

Scientific Name	Common Name	Family	Growth Form
GRASS & GRASSLIKE			
Baumea juncea		Cyperaceae	Grass & grasslike (GG)
Bolboschoenus fluviatilis	Marsh Club-rush	Cyperaceae	Grass & grasslike (GG)
Eleocharis sphacelata		Cyperaceae	Grass & grasslike (GG)
Gahnia clarkei	Tall Saw-sedge	Cyperaceae	Grass & grasslike (GG)
Juncus usitatus		Juncaceae	Grass & grasslike (GG)
Phragmites australis	Common Reed	Poaceae	Grass & grasslike (GG)
Typha orientalis	Broadleaf Cumbungi	Typhaceae	Grass & grasslike (GG)
FORBS			
Alternanthera denticulata	Lesser Joyweed	Amaranthaceae	Forb (FG)
Lythrum hyssopifolia	Hyssop Loosestrife	Lythraceae	Forb (FG)
Persicaria decipiens	Slender Knotweed	Polygonaceae	Forb (FG)
Persicaria hydropiper	Water Pepper	Polygonaceae	Forb (FG)
Persicaria strigosa		Polygonaceae	Forb (FG)

FIGURES

Legend

- BMP Area
- Study Area
- Subject Land
- Council Dedicated Land

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMap 2021
Dated: 2/6/2021

Data Source:
NSW Government Spatial Services
SIX Maps 'Clip and Ship'
Northern Beaches LGA

cumberland ecology

I:\...\21097\Figures\RP1\20231212\Figure 1. Location_BMP area

Figure 1. Location of the study area and BMP area

0 50 100 m

Legend

BMP Area

Study Area

Vegetation Community

PCT 4006: Northern Paperbark-Swamp Mahogany Saw-sedge Forest

PCT 4006: Northern Paperbark-Swamp Mahogany Saw-sedge Forest

PCT 4006: Northern Paperbark-Swamp Mahogany Saw-sedge Forest

Exotic Vegetation

Cleared Land

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMap 2021
Dated: 2/6/2021

Data Source:
NSW Government Spatial Services
SIX Maps 'Clip and Ship'
Northern Beaches LGA

cumberland ecology

0 40 m

I:\...\21097\Figures\RP1\20231212\Figure 2. Vegetation mapping

Figure 2. Vegetation mapping within study area

Legend

BMP Area

Study Area

Management Zones

- Zone 1: Northern Paperbark-Swamp Mahogany Saw-sedge Forest
- Zone 2: Northern Paperbark-Swamp Mahogany Saw-sedge Forest (Revegetation)
- Zone 3: Exotic Vegetation and Cleared Land
- Zone 4: Infiltration Basin
- Zone 5: Landscaped Areas

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:
Image © NearMap 2021
Dated: 2/6/2021

Data Source:
NSW Government Spatial Services
SIX Maps 'Clip and Ship'
Northern Beaches LGA

cumberland ecology

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I:\...\21097\Figures\RP1\20230121212\Figure 3. Vegetation management zones

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Figure 4. Monitoring plots and photopoints