Vegetation Management Plan

53A and 53B Warriewood Rd, Warriewood NSW 2102

By Ecological Consultants Australia Pty Ltd

TA Kingfisher Urban Ecology and Wetlands

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About this document

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Statement of Authorship

This study and report were undertaken by Ecological Consultants Australia for the client. The author of the report is Geraldene Dalby-Ball whose qualifications are BSc majoring in Ecology and Botany with over 25 years' experience in this field and specialising in projects within Sydney urban areas.

Limitations Statement

Information presented in this report is based on an objective study undertaken in response to the brief provided by the client. Any opinions expressed in this report are the professional, objective opinions of the authors and are not intended to advocate any particular proposal or pre-determined position.

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Executive Summary

Ecological Consultants Australia (ECA) has been contracted by Willowtree Planting to provide a Vegetation Management Plan (VMP) for vegetation within the subject site identified as 53A Warriewood Rd and 53B Warriewood Rd, Warriewood NSW 2102 within the Northern Beaches Council Local Government Area (LGA).

This VMP was prepared for the proposed development at 53A and 53B Warriewood Rd, Warriewood NSW 2102 identified as Lot 2 and 3 respectively DP 1115877 which includes a five (5) lot Community Title Subdivision of the site, including the future public reserve, the extension of Lorikeet Grove, an internal road, stormwater works, associated landscaping and tree removal to facilitate the future residential development of the site. Three (3) super lots are proposed which will be further subdivided at a later date.

Methods

- On-ground site inspection took place in August 2022 by Senior Ecologist Geraldene Dalby-Ball and Ecologist Gabriel James.
- Flora and fauna observations were recorded on-site using binoculars and physical examination. Notes, photos, and samples of flora species were taken, on-site and neighbouring sites, to assess the ecological health and value of the site.
- BioNet searches were performed for flora, fauna, endangered populations, and communities to identify if there were previous records of threatened species occurring within the local area using a 10km radius around the site.

Summary of findings

Key ecological values identified within the site include:

- Desktop mapping identified two plant community types (PCT) within the site identified as *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (PCT 1795) and *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (PCT 1232), however due to past clearing and weed invasion, the site does not reflect the natural structural attributes of this community and habitat on the site is in poor condition.
- The site consists of a large open lot with evidence of past cultivation resulting in a turfed terrace of exotic grass species. The western corner of the property includes a water-logged area adjacent to the creek line made up of both exotic and native wetland species.
- Tree species include a mix of *Eucalyptus* and *Casuarina* species in low abundance.
- No significant habitat features, values, or corridors will be impacted by the proposed development.
- No threatened species were observed/recorded during the site inspection or previously recorded via BioNet.

Conclusions

- The site shows evidence of prior disturbance due to the presence of exotic turf and tree species. There are some native tree species on the edge of the property, however no hollows or other habitat features were present.

- The property borders Swamp Mahogany and Cabbage Tree Palm Endangered Ecological Communities as well as Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (EEC's), however the impacts due to the proposed development are negligible. Therefore, the ecological values of the site have been deemed poor.
- Weed management must occur as per the schedule of works within the management zone to ensure exotic species do not establish.
- Planting of native species is recommended in this VMP to reinstate the condition of the site to that prior of clearing and disturbance. Once plantings become established, the site will add ecological value to the Swamp Mahogany and Cabbage Tree Palm and Swamp Oak Floodplain Forest EEC's and provide habitat (such as foraging habitat and potentially roosting habitat) for listed threatened species including Microbats and Glossy Black Cockatoos.

Recommendations

Key recommendations of this VMP include:

- Planting locally native plants of local provenance stock,
- On-going weed management,
- Soil scarification,
- Erosion management,
- Reporting and monitoring as per schedule,
- Recommendations have been costed for a 5-year VMP.

1 Introduction

1.1 Aims and objectives

The aim for this VMP is to provide a working document that will successfully protect, maintain, and enhance the native vegetation on the site both for immediate rehabilitation purposes and for maintenance into the future. This report details recommendations relating to site rehabilitation, fulfilling the requirements of a VMP.

Vegetation within the site is cover by this report. The authors Brooke Thompson and Geraldene Dalby-Ball have over 25 years' experience in ecology projects and large-scale environmental restoration works in Sydney and are very familiar with the requirements of the VMP.

The objectives of this VMP are to ensure that biodiversity values on the site are improved or maintained. The overarching objectives of the VMP are to:

- conserve and preserve the existing vegetation;
- undertake rehabilitation works in degraded native vegetation areas;
- undertake native vegetation protection measures;
- restore native vegetation to a level that reflects the cover, diversity, and density of the indigenous vegetation; and
- provide educational material to promote responsible management of native vegetation areas.

The information in the following sections will ensure that the objectives of the VMP are achieved.

1.2 Legislation and policy

The implications for the project were assessed in relation to key biodiversity legislation, policy and guidelines including:

- *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act);
- *Environmental Planning and Assessment Act, 1979* (EP&A Act);
- *Biodiversity Conservation Act, 2016* (BC Act);
- *National Parks and Wildlife Act, 1974* (NP&W Act);
- *Local Land Services Act, 2013* (LLS Act);
- *Biosecurity Act, 2015;* and
- *Planning for Bush Fire Protection, 2019* (NSW RFS).

2 Site Description

2.1 Identification and description of the site and surrounds

The site identified as 53A and 53B Warriewood Rd, Warriewood (Lot 2 & 3 respectively DP 1115877) is located within the Northern Beaches Council LGA, 31.7 kilometres northeast of the Sydney CBD. The site fronts Warriewood Road. The primary land use of the site is residential. Narrabeen Creek runs adjacent to the southwestern boundary of the property. This waterway runs south to join Mullet Creek which leads into Narrabeen Lagoon. The bushland surrounding the site forms part of the riparian vegetation community that lines this creek.

Table 2.1 Site administrative information

Category	Details
Title reference (Lot/Section/Plan No)	2/-/1115877 and 3/-/1115877
Area (m^2)	16,091 m^2
Street address	53A & 53B Warriewood Rd, Warriewood NSW 2102
LGA	Northern Beaches Council
Land zoning	R3 – Medium Density Residential

The VMP applies to the entire site at 53A and 53B Warriewood Rd, Warriewood NSW 2102.

Refer to Figure 2.1 Site Map and Figure 2.2 Location Map.

2.2 Site features

The sites include a largely cleared block which sits next to a block with an existing dwelling and cleared ground at its rear. A raised terrace made up of exotic grass and tree species with evidence of previous modification is present. The rear of the property descends into a soak area adjacent to the creek line behind the property. This contains a greater variety of grass and sedge species containing both native and exotic species due to its high-water content, however habitat and vegetation condition remains poor with the presence of some weed species.

The existing habitat does not meet the required benchmark conditions of the Swamp Mahogany / Cabbage Tree Palm or Swamp Oak Floodplain Forest Endangered Ecological Communities (EEC) which it borders. There is a high composition of exotic species present, and no habitat corridors currently exist. No threatened flora or fauna were recorded on the site. It is expected that the planting of native vegetation and the removal and management of weed species will increase the ecological value of the site adjoining the Narrabeen Creek.

Figure 2.1 Site map showing the site boundary outlined. Source: SixMaps 2023.

Figure 2.2 Location map showing the site relative to surrounding area. Source: SixMaps 2023.

3 Site Assessment

3.1 Vegetation

Desktop reviews of the most up to date vegetation mapping, the Native Vegetation of the Sydney Metropolitan Area – Version 3.1 (OEH, 2016) VIS_ID 4489, identified two plant community types (PCT) within the site. The PCT's identified are; PCT 1795 – *Swamp Mahogany / Cabbage Tree Palm - Cheese Tree - Swamp Oak tall open forest on poorly drained coastal alluvium in the Sydney basin* and PCT 1232 - *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*. Refer to Figure 3.1 Vegetation Composition.

Table 3.1 Vegetation community synonyms as per NSW and Commonwealth legislation

NSW PCT Code	TEC Name	BC Act 2016	EPBC Act 1999
1795	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Endangered Ecological Community (EEC)	No Associated TEC
1232	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Endangered Ecological Community (EEC)	No Associated TEC

The species selected from PCT 1795 and 1232 are considered suitable for revegetation activities and a recommended planting list is included in Appendix V. Species lists for the two communities are very similar. The site represents a swamp forest coastal alluvium community and species should be selected appropriately to ensure maximum recruitment. Refer to Figure 3 Vegetation Community Map.

Figure 3.1 Vegetation composition on site 53A belonging to PCT 1795. Source: SEED 2022.

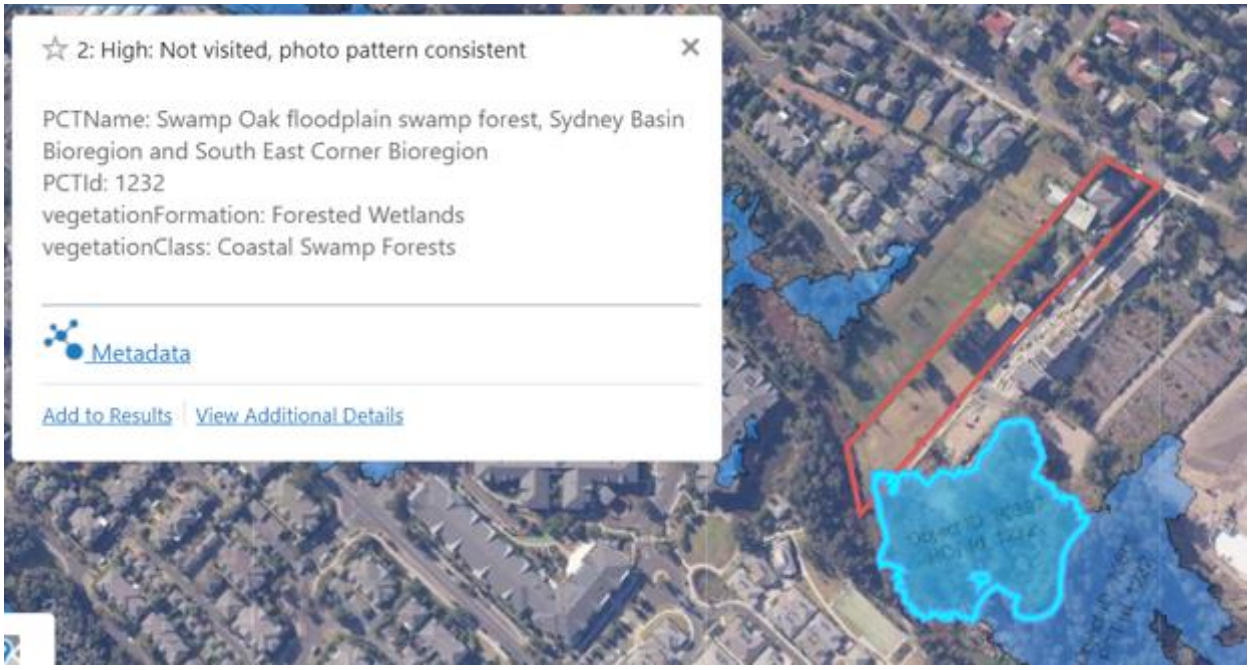


Figure 3.2 Vegetation composition on site 53B belonging to PCT 1232. Source: SEED 2023.

3.2 Current condition

The site shows evidence of disturbance and vegetation removal due to the high percentage of exotic turf species. The depressed area at the rear of the property holds a high-water content, and as a result, contains a mix of largely exotic grass and sedge species with some native species present. The site does

contain some native trees along the central border of 53A and 53B, however exotic trees have also been planted throughout both the sites.

Weed invasion and sediment transport are the primary threats at the site, due to the existing presence of some weed species and the slope of the site which includes a creek that runs behind the property. The mitigation measures outlined in this report will be implemented to reduce the likelihood of these factors causing further degradation to the site.

3.3 Weeds

The following weeds of significant importance were identified within the site during the site assessment. Weeds must be controlled as required under the *Biosecurity Act 2015*. Refer to Table 3 Weeds.

Table 3.2 Weeds present in the area with the potential to spread – species on the site in bold

Scientific name	Common name	Legal requirements under the Noxious Weed Act
Asparagus asparagoides	Bridal Creeper	The plant must not be sold, propagated, or knowingly distributed
Asparagus aethiopicus	Asparagus fern	The plant must not be sold, propagated, or knowingly distributed
Cestrum parqui	**Green Cestrum**	**The plant must not be sold, propagated, or knowingly distributed**
Cortaderia sp.	Pampas grass	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Lantana camera	**Lantana**	**The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread**
Ludwigia peruviana	**Peruvian Primrose**	**The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread**
Ligustrum lucidum	Broad-leaf Privet	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Ligustrum sinense	Small-leaf Privet	The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread
Ipomoea purpurea	Morning Glory	Environmental Weed

Scientific name	Common name	Legal requirements under the Noxious Weed Act
***Opuntia* sp.**	**Prickly Pear**	**The plant must not be sold, propagated, or knowingly distributed**

3.4 Fauna sightings and habitat

Fauna sightings

A number of faunae were identified during the site assessment including:

- Noisy Minor Minor (*Manorina melanocephala*);
- Blue Wren (Malurus cyaneus);
- Willie Wagtail (*Ripidura leucophrys);*
- Black-faced Cuckooshrike (C*oracina novaehollandiae*);
- Australian Raven (*Corvus coronoides*);
- Red Wattlebird (*Anthochaera carunculata*);
- Spotted Pardolote (*Pardalotus punctatus*);
- Eastern Whipbird (*Psophodes olivaceus*); and
- Striped Marsh Frog (*Limnodynastes peronii*).

No reptiles or mammals were identified during the site assessment. No threatened fauna listed under the BC Act 2016 or EPBC Act 1999 were identified during the site assessment.

Fauna habitat

Several potential habitat features were identified during the site assessment including:

- Grass and sedge soak provide habitat for amphibian species including the threatened Green and Golden Bell Frog (*Litoria aurea*) and potential foraging habitat for the threatened Southern Myotis (*Myotis aelleni*).
- Casuarina species provide potential foraging habitat for the threatened Glossy Black Cockatoo (*Calyptorhynchus lathami*).

3.5 Site photos

The following photos were taken during the August 2022 site inspection. Plates display the vegetation condition on the site.

Plate 1. Site closest to the creek in the foreground and neighbouring property with exotics including Arundo and coral trees on the neighbouring property

Plate 2. Coral trees on creek edge.

Plate 3. The immediate creek line is exotic species practically coral trees large leaf privet and annual weeds. Swamp Mahogany species present as are Swamp She Oaks in low number.

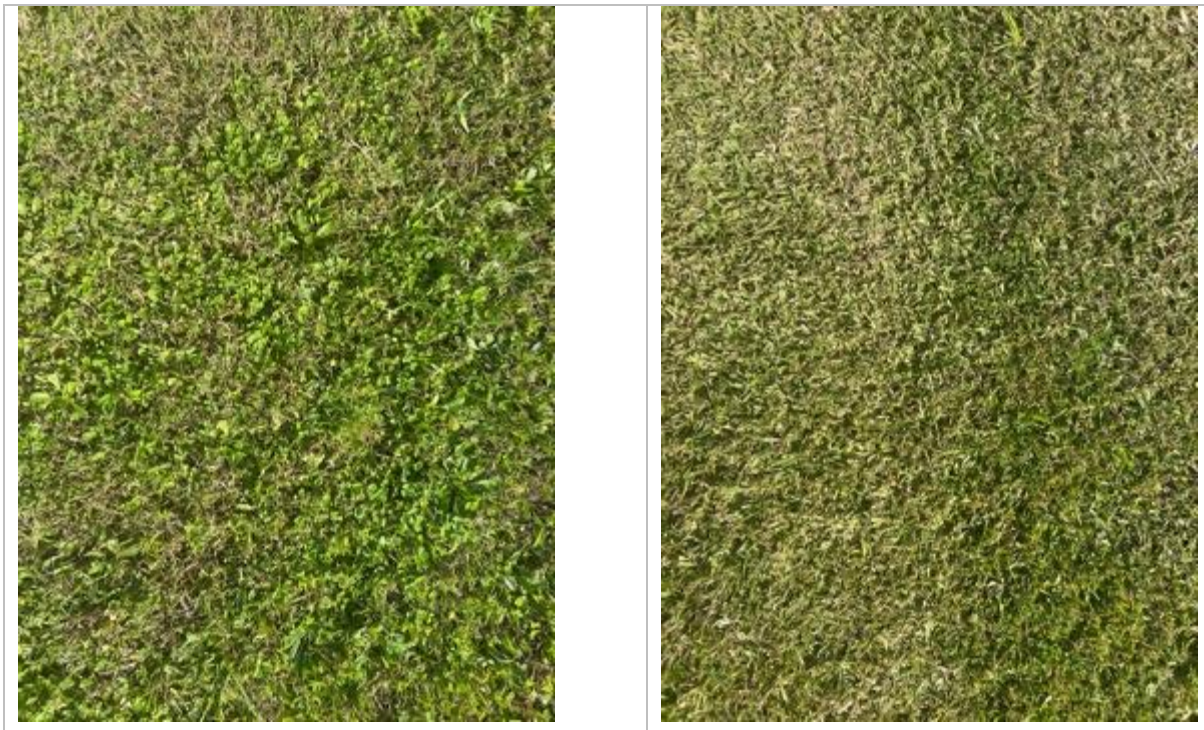


Plate 4. Turf area on the raised part of the site all exotic species.

4 Management Zones

The management zones are identified based on the future management of the site.

Due to the size of the site and available area for vegetation, only one management zone has been identified. Proposed activities within the management zone include but are not limited to:

- Primary and secondary weeding;
- Native species landscaping;
- Soil scarification;
- Revegetation using locally sourced native species; and
- Installation of nest boxes.

The management zone is located on the southwestern side of both properties and Lorikeet Grove. The zone extends back from the top of bank by approximately 20 m to the end of the property boundaries. Native vegetation within this management zone has likely been modified prior to clearing for the proposed development. The current state of the vegetation is poor, and it is unlikely that the native vegetation within the zone was at benchmark conditions at the time of clearing.

The primary objective within the management zone is to restore the native vegetation community to an appropriate level that reflects the original condition prior to any clearing or disturbance.

Refer to Figure 4 Management Zones.

Figure 4.1 Management zone for both the sites shown in yellow.

4.1 Management tasks

4.1.1 Restoration activities

4.1.1.1 Delineation of Work Areas

During the construction, impact to the site and the adjacent vegetation should be reduced by the delineation of work zone areas. The access to the site would be best restricted to the development footprint only. An exclusion zone should be established for the vegetation outside the work areas.

4.1.1.2 Tree Protection

Tree protection will be consistent with the Arborist report (RainTree Consulting, 2021). The main trees to be managed are the trees within close proximity to the building works. NB see final Arborist report for details of works and tree numbers.

4.1.1.3 Primary Weed Removal

Weed species are present within the management zone. Most weeds on-site are woody or fleshy in nature. It is recommended that larger woody weeds are poisoned via cut and scrape techniques before their removal, while small weeds can be sprayed with a combination of non-selective and selective herbicides prior to planting. The appropriate control methods for several different weed types are species in Table 4.1 Weed Removal Methods.

There must be ongoing maintenance of the management zone, otherwise it may result in increased weed growth within the site. All bush regeneration activities requiring the use of chemicals must be performed in accordance with the *NSW Pesticides Act 1999*. Herbicides must not be applied whilst exotic plants are setting seed. The weed removal program aims to be broad in approach and sustained in application to provide the best possible conditions for natural regeneration and to control weeds within the site.

Performance targets for weed species include:

- A reduction in noxious weed density to 5% or less in the management zone; and
- A reduction in all other weed density to 10% or less in the management zone.

Although soil borne pathogens have not been identified as a Key Threatening Process, accidental spread of pathogens can occur at any time. To prevent the introduction of pathogens, Bushland Hygiene Protocols outlined in Appendix II must be followed. Hydrological conditions may promote the spread of Phytophthora (a group of fungus-like diseases affecting plants) due to moist soil and proximity to water. It is recommended that Bushland Hygiene Protocols be followed closely.

4.1.1.4 Weed Removal Methods

As part of the VMP, weed removal methods have been provided and tailored specifically to the site. Along with traditional bush regeneration techniques, thermal weeding has been recommended in controlling non-seeding annuals and grasses. Thermal weeding may stimulate natural regeneration and germination of native species as well as achieving ecological burns. Refer to Table 4.1 Weed Removal Methods.

Table 4.1 Weed removal methods

Weed type	Primary control treatment	Follow up control	Maintenance weeding post-planting (revegetation)	Disposal
Woody weeds (e.g., shrubs and trees)	Cut/scrape and paint with herbicide for small shrubs[1]. Large trees greater than four metres high and diameter > 10 cm drill and inject with registered herbicide[2].	Retain dead trunks in or on ground has habitat. Continue to Cut/scrape and paint remaining weeds. Monitored monthly and controlled as required (and within a minimum of three months) and up until the date of final plantings.	Cut/scrape and paint germinating weeds. Monitored and carried out regularly for a period of five years from the date of final planting.	Raft and pile non-reproductive parts on site (for later pile burns or left as habitat) and bag flower heads, berries, and seeds.
Climbing weeds (e.g., vines and scramblers)	Hand pull/ Dig juvenile growths and bag. Bag seeds, pods and flowers then skirt vines out of the canopy and Scrape and paint for established growths. Scrape from the base up the stem covering 1 m length. Large infestations foliar spray using registered herbicides.	Scrape and paint and bag reproductive parts. Monitored monthly and controlled as required (and within a minimum of three months) and up until the date of final plantings.	Scrape and paint and bag reproductive parts. Monitored and carried out regularly for a period of five years from the date of final planting.	Bag and remove from site.
Herbaceous weeds	Spraying using a combination of non-selective and selective	Spray or hand pull seedlings. Monitored monthly and	Spray or hand pull seedlings. Monitored and carried out	Bag and remove from site.

Weed type	Primary control treatment	Follow up control	Maintenance weeding post-planting (revegetation)	Disposal
	herbicides where damage to adjoining native vegetation can be avoided. Spray herbicide close to and before flowering.	controlled as required (and within a minimum of three months) and up until the date of final plantings.	regularly for a period of five years from the date of final planting.	
Exotic grasses and broadleaf annuals around native grasses	Spray prep around natives. Low volume spot spraying of broadleaf selective and non-selective herbicides. Flame (thermal) weed in areas of large infestation of grasses and annuals.	Continue spray prep and spot spraying for re-established growths. Hand pull and bag weeds in amongst natives. Monitored monthly and controlled as required (and within a minimum of three months) and up until the date of final plantings.	Hand weed isolated patches. Monitored and carried out regularly for a period of five years from the date of final planting.	Bag and remove from site.
Weeds and seedlings in close proximity to protected native vegetation	Spray prep around natives and Spot spray. Hand weeding.	Spray prep around natives and Spot spray. Where possible hand weed. Monitored monthly and controlled as required (and within a minimum of three months) and up until the	Monitored and carried out regularly for a period of five years from the date of final planting.	Bag and remove from site.

Weed type	Primary control treatment	Follow up control	Maintenance weeding post-planting (revegetation)	Disposal
		date of final plantings.		
Bulbous and succulent weeds	Hand pull/dig, bagging all plant parts and removing from site[3].	Foliar spray and/or Cut and Paint.	Monitored and carried out regularly for a period of five years from the date of final planting.	Bag and remove from site.
Aquatic weeds	Hand dig/pull juvenile plants. Contact your local weed officer if you require a permit to spray near water.	Hand pull.	Monitored and carried out regularly for a period of five years from the date of final planting.	Bag and remove from site.

Note: [1] Some weeds will have different treatment requirements i.e., *Ochna serrulata* requires scrape and paint on one side with stem width less than 2 cm thick, scrape and paint both sides from root to 2/3 up the stem >2 cm thick. *Ligustrum s*pp. and Lantana are treated with cut and paint.

[2] After drill and inject treatment, the plant usually will drop its leaves within six weeks and dies within a few months. Monitor the plant and if it re-sprouts, the process will need to be repeated. Drill around the base of the tree and on exposed lignotubers less than 20mm apart and as deep as possible.

[3] If hand pulling/dig, ensure all reproductive parts of the plant e.g., corms, tubers and rhizomes are removed.

Refer to Appendix I for more details on Bush Regeneration Techniques.

4.1.1.5 Revegetation Activities

The desired outcome within the management zone is to reinstate the condition of the site to that prior of clearing and disturbance, or to its neighbouring PCT. The restoration activities should aim to establish a community which reflects that of a *Coastal Flats Swamp Mahogany Forest/ Coastal Freshwater Swamp Forest* community. The management zone should be planted with local wetland species that are suitable to tolerate the saturated conditions on the site to ensure maximum recruitment. This should include a mix of canopy, shrubs, and clumping grasses/ groundcover species. Planting is to occur during the Spring, if possible, with Autumn planting reserved as backup. Restoration planting should only occur once all weed species are removed.

Refer to Appendix V for the Recommended Planting List for the site.

The management zone covers an area of 2,600 m^2. Restoration plantings should aim to cover approximately 70% of the management area (1,820m^2). The other 30% of the management zone can be maintained as grassy understorey as this reflects the natural attributes of the site prior to unauthorised clearing. Planting density for the vegetation community on-site has been calculated as 1 plant per 1m^2. Estimated number of tube stock required is 1,820. Plantings should be planted in an irregular pattern to mimic a natural bushland configuration. This can be achieved via tube stock plantings and strategic bush regeneration activities to promote natural regeneration over the duration of the VMP, thus reducing the cost of planting for the project. It is expected that natural recruitment of native species will occur within the management zone after 1-3 years.

***Locally Native**: Locally native (local provenance stock) refers to the area the stock is collected from, i.e., being within the area that the natural pollinators and / or natural dispersal agents would be expected to move in usual circumstances.*

***Stock:** Nurseries supplying locally native plants have been included in Appendix III.*

***Diversity:** Plants recommended here include a wider diversity than expected. A wide range has been provided to ensure a diversity of locally native plants is available and then established in the restoration area. Table 3 summarises the minimum diversity (number of different species) of each plant type (ground, vines, shrubs, & trees).*

***Size:** All plants can be Hikos (50mm) and or Forestry tubes (75mm).*

***Bushfire Protection:** Planting densities should adhere to any Bushfire Protection requirements for the site. This may result in lower planting densities or modified planting schedules in areas which are identified as Asset Protection Zones.*

4.1.1.6 Soil Scarification

The management zone consists of dense saturated soil with a high-water content. To ensure successful plant recruitment within the management zone, it is recommended that soil scarification is undertaken prior to tube stock plantings.

Soil scarification can be implemented by light mechanical tillage of the ground surface, via a rotary hoe or ripper implement on a tractor. Soil should be ripped to a depth of 20 to 50 cm. Where the ground is sloping, the rip lines should follow the bank contour to prevent erosion. Soil scarification of the soil is likely to stimulate weed growth, and this should be monitored and treated as part of the maintenance program.

4.1.1.7 Mulching

All planted tube stock should be mulched post planting. This will ensure successful plant recruitment and prevent exotic species from establishing. Mulch stockpiles must be kept under 1m in height, must be monitored for the presence of weeds and turned frequently to avoid spoilage. If the site does not contain enough mulch in situ, a native composition mulch may be imported to the site. Mulch may be used to supress weeds within planting areas.

4.1.1.8 Sediment Controls

Sediment controls are required immediately after soil scarification to prevent sediment transport. The management zone is gently sloped towards the western boundary of the property which continues into Narrabeen Creek. Due to the slope, immediate measures to stabilise the soil and reduce erosion risk may

include slitted jute matting, coir log baffles, and sediment fencing. Thick jute matting will be implemented to stabilise the soil on the bank with the additional benefit of suppressing weed growth. Additional sediment controls may be required throughout the site post primary weeding and soil scarification. The installation of additional soil stabilisation apparatuses (slitted jute matting, coir log baffles, and sediment fencing) will be performed at the discretion of the property owner and/or bush regeneration contractor if necessary.

Sediment and erosion control measures must ensure that no settlement of sediment or silt is to occur within areas of vegetation to be retained. All sediment fences should be retained for as long as practical. If removed, then monitoring is required to ensure flows do not concentrate and cause further erosion. If concentrated flows do occur and/or erosion gullies develop then coir logs baffles are required across the slope.

Table 4.2 Sediment control methods

Sediment control method	Recommendations	Examples of appropriate sediment control method
Slitted jute matting	Slitted jute matting should be place on the bank to stabilise the soil and reduce the likelihood of erosion or sediment transport.	
Coir log baffles	Coir log baffles should be installed where run off water may increase erosion or sediment transport. Baffles are recommended to be constructed with coir logs that have been staked into the soil. This method will ensure soil is not disturbed and the baffles are secure.	
Sediment fence	Sediment fencing should be installed around any areas of exposed or disturbed soil. Any excavated or cleared areas must be stabilised or covered to minimise the risk of sediment transport occurring.	

4.1.1.9 Secondary Weed Removal

Secondary weed removal should occur quarterly, considering the life cycles of targeted weed species, with greater effort required in the warmer months when weed growth will be greater. Secondary weed removal will follow the protocols outlined for primary weed removal, with more of a focus on controlling new weed growth in their early stages to prevent future release of propagules.

4.1.1.10 Natural Regeneration Areas

Natural regeneration on the site will be suitable once initial tube stock plantings become established and weeds are being consistently maintained. Natural regeneration must only be encouraged in the areas where vegetation is displaying medium to high resilience. Two methods of natural regeneration are expected to be implemented including assisted and unassisted natural regeneration.

Assisted

During the initial planting phase, soil scarification should be implemented. Disturbing the soil via soil scarification or ploughing encourages native seed germination and is a key factor to ensure successful plant recruitment. Soil scarification is expected to increase the survival rate of tube stock and encourage natural regeneration in the later stages of the VMP. Natural regeneration areas should be continually monitored for the presence of exotic flora species and sediment transport. Soil scarification should be supervised by qualified bush regeneration contractors to ensure areas of existing native vegetation and plantings remain unaffected.

Unassisted

Unassisted natural regeneration may be applicable in the final stages of the VMP (4-5 years). Unassisted natural regeneration should only be implemented where bushland is expected to recover naturally once exotic species are removed. Weed removal techniques including thermal weeding, cut and paint, spot spraying, and hand pulling should be used to remove exotics and encourage native seed germination.

4.1.1.11 Plant Replacement

Plant replacement must account for the 10-20% of planted vegetation that is expected to fail. Any plants that fail are to be replaced by another individual of the same species, except for the case that an entire species displays low success rates. In this case, individuals from the same growth form may be substituted. Plant replacement must occur within three months following the death of a plant.

4.1.1.12 Watering

Within two hours of planting, each plant will require 10L of water if the soil profile is moist and 20L of water if the soil profile is dry. It is recommended that an irrigation system is be established within the planting areas. The irrigation system is to be established within each planting area for a total duration of 6 weeks to ensure adequate watering of establishing plants and to reduce the risk of plant loss.

4.1.1.13 Habitat supplementation

Although not critical, the installation of a single nest box designed for microbats should be added to the management zone to replace the potential loss of roosting habitat. Other significant habitat features

including rocks, logs, and leaf litter should remain within the management zone. This will encourage native animals to use the area including amphibians and reptiles.

4.1.1.14 Maintenance Inspections

Maintenance inspections will be required to determine how the management zone is responding to rehabilitation works, and whether the performance criteria are being met. Maintenance inspections will be performed by comparing the objectives of the VMP to the maintenance information recorded by the property owner and/or bush regeneration contractors. Maintenance inspections must be performed quarterly during the restoration phase, reduced to bi-annually during the post-restoration phase if performance criteria are consistently being met.

Quarterly maintenance inspections at the time of monitoring will including the following:

- **Weeds**: Weeds must be assessed in terms of total weed cover per management zone with average densities of each species provided and updates to treatment recommendations.
- **Pests and disease**: Regenerating areas within the management zone must be monitored for herbivory by exotic and native fauna and the presence of any other disease or infection. The species being impacted must be recorded in addition to the type of pest or disease, proportion of the total individuals being impacted and treatment recommendations.
- **Sedimentation and erosion**: Regenerating areas within the management zone must be monitored for sedimentation and erosion.

4.1.2 Management and mitigation measures

All managed areas should be maintained and monitored for at least five years after last planting completed. Table 4.3 provides a summary of mitigation measures to be implemented with each year of operation of the restoration plan. Mitigation measures or other activities have been divided into three broad phases:

- Pre-restoration works
- Restoration phase
- Post-restoration works

Table 4.3 Summary of mitigation activities associated with each year of operation of the restoration plan

Mitigation Measure	Timing			Frequency	Management Zone	Responsibility
	Pre-restoration	Restoration phase	Post-restoration			
Biodiversity Management						
Define work areas and access paths	✓			Prior to commencement of works and continually maintained	✓	Property owner and/or bush regeneration contractor
Any surplus woody debris to be mulched and reused within the site where appropriate		✓		Throughout all activities	✓	Property owner and/or bush regeneration contractor
Restoration Activities						

Mitigation Measure	Timing			Frequency	Management Zone	Responsibility
	Pre-restoration	Restoration phase	Post-restoration			
Tube stock plantings		✓		Spring plantings recommended	✓	Property owner and/or bush regeneration contractor
Soil scarification	✓			Once	✓	Property owner and/or bush regeneration contractor
Installation of a 75 mm layer of mulch to planted areas and/or in cleared areas to suppress weeds	✓	✓		With plantings or as weed suppression	✓	Property owner and/or bush regeneration contractor
Sediment and Erosion Control						
Implementation of sediment, soil, or water controls	✓	✓	✓	Applied continually and daily	✓	Property owner and/or bush regeneration contractor
Bush Regeneration						
Primary weeding	✓			Once	✓	Property owner and/or bush regeneration contractor

Mitigation Measure	Timing			Frequency	Management Zone	Responsibility
	Pre-restoration	Restoration phase	Post-restoration			
Secondary weeding		✓		Quarterly	✓	Property owner and/or bush regeneration contractor
Weed inspections	✓	✓	✓	Quarterly	✓	Property owner and/or bush regeneration contractor
Maintenance Activities						
Pest and disease monitoring	✓	✓	✓	Quarterly	✓	Property owner and/or bush regeneration contractor
Maintenance weeding		✓	✓	Quarterly	✓	Property owner and/or bush regeneration contractor
Maintenance watering		✓	✓	Initially after planting followed by quarterly deep watering	✓	Property owner and/or bush regeneration contractor
Replacement plantings		✓	✓	Approximately 6 months following initial planting	✓	Property owner and/or bush regeneration contractor

Mitigation Measure	Timing			Frequency	Management Zone	Responsibility
	Pre-restoration	Restoration phase	Post-restoration			
Maintenance inspections		✓	✓	Quarterly	✓	Property owner and/or bush regeneration contractor
Reporting		✓	✓	Annually throughout the implementation of the restoration plan	✓	Ecologist / bush regeneration contractor
Confirmation of completion of key performance indicators			✓	Once all performance criteria have been met including: Reduction in noxious weed density to 5% or less in all management zones. Reduction in all other weed density to 10% or less in all management zones. Native vegetation displays a diversity of species resembling Blue Gum High Forest.	✓	Ecologist / bush regeneration contractor

Mitigation Measure	Timing			Frequency	Management Zone	Responsibility
	Pre-restoration	Restoration phase	Post-restoration			
				Evidence of gradual expansion of native plant cover. Appropriate erosion and sediment control throughout the project.		
Bushland Management Plan						
Development of a bushland management plan as a continual management tool reflecting the aims and objectives of the VMP			✓	Post-maintenance certification	✓	Ecologist

5 Monitoring and Reporting

5.1 Performance criteria

In order to provide an effective method of assessing the success of the VMP, performance evaluation targets such as the following must be provided. Table 5.1 provides a summary of the outcomes to be achieved each year.

Table 5.1 Summary of the outcomes to be achieved each year

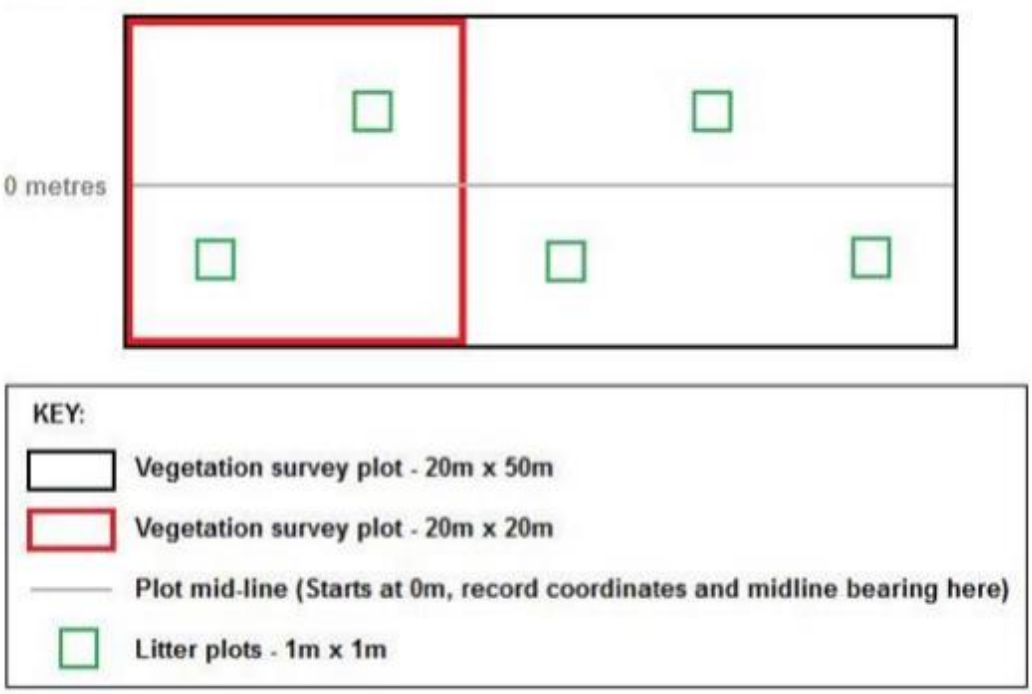
Time	Native Plant Species Diversity	Native Plant Cover	Weed Cover
6 months	At least 10 species of native plants included in the plantings. – At least **7** different species from herbs, grasses, and groundcovers, with no more than 25% of any 1 species. – At least **1** different shrub species and no more than 25% of any 1 species. – At least **2** different tree species and no more than 25% of any 1 species.	5-10% tree cover 5-10% shrub cover 15% ground cover	<10%
12 months	At least 10 species of native plants included in the plantings. – At least **7** different species from herbs, grasses, and groundcovers, with no more than 25% of any 1 species. – At least **1** different shrub species and no more than 25% of any 1 species. – At least **2** different tree species and no more than 25% of any 1 species.	10-20% tree cover 10-20% shrub cover 20-30% ground cover	<10%
30 months	At least 10 species of native plants included in the plantings. – At least **7** different species from herbs, grasses, and groundcovers, with no more than 25% of any 1 species. – At least **1** different shrub species and no more than 25% of any 1 species. – At least **2** different tree species and no more than 25% of any 1 species.	10-30% tree cover 10-20% shrub cover 30-40% ground cover	<10%
Final Criteria	At least 10 species of native plants included in the plantings.	20-40% tree cover 20-30% shrub cover	<5%

Time	Native Plant Species Diversity	Native Plant Cover	Weed Cover
(60 months)	– At least **7** different species from herbs, grasses, and groundcovers, with no more than 25% of any 1 species. – At least **1** different shrub species and no more than 25% of any 1 species. – At least **2** different tree species and no more than 25% of any 1 species. – Unassisted natural regeneration present. – Overall density of 5 plants per m^2 made up of groundcovers, shrub, and tree species. – Groundcovers average 4 per m^2. – Shrubs average 4 per m^2. – Trees average 1 per $16m^2$. – Site displaying signs of *Coastal Flats Swamp Mahogany Forest/ Coastal Freshwater Swamp Forest* community.	30-50% ground cover >15 large shrubs /trees	

A suitability qualified Ecologist should monitor and report on the condition of the site on an annual basis. The Ecologist should use the Biodiversity Assessment Method (BAM) to monitor vegetation condition on site. The location of BAM plots and photo monitoring points should be identified via aerial imagery and included within the first monitoring report.

The BAM methodology is as follows: 20 x 20 plot ($400m^2$) for assessing structure and composition with a centre line extending 50m to create a 20 x 50 plot ($1000m^2$) to assess function. See Biodiversity Assessment Method Operational Manual – Stage 1 (OEH, 2018) page 26-28 for methods.

https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-operational-manual-stage-1-180276.pdf



- Ongoing maintenance will be required to ensure that ratios and performance targets are maintained in the long-term.
- Reduction in noxious weed density to 5% or less in all management zones and a reduction in all other weed density to 10% or less in all management zones at the end of the maintenance period.
- Plant replacement must account for the 10-20% of planted vegetation that is expected to fail. Any plants that fail are to be replaced by another individual of the same species, except for the case that an entire species displays low success rates. In this case, individuals from the same growth form may be substituted. Plant replacement must occur within three months following the death of a plant.

5.2 Reporting

To assess the success of the VMP against the established performance evaluation targets, subsequent reporting will be required. This is to include:

- Demonstrated compliance with performance evaluation targets.
- Identification of deficiencies and corrective actions taken to ensure targets are met.
- A photographic record before, during, and after works is to be provided with the final compliance certification.
- Copies of annual reports are to be provided to the Environmental Compliance Officer at Northern Beaches Council.
- Reporting at the completion of the first year should be provided to Council to enable a review and consideration in the development of actions and objectives for the following year. This first-year report also enables an early assessment of the works and suitability of performance criteria.
- Monitoring to be performed by a suitably experienced Ecologist on an annual basis, in consultation and collaboration with the property owner and/or project bush regeneration contractor. Reporting

must be performed in association with maintenance inspections to form the primary source of information for monitoring and review reports. Monitoring by the property owner and/or project bush regeneration contractor must occur quarterly during the restoration phase and bi-annually in the post- restoration phase if adequate progress towards performance criteria is achieved. A primary goal of monitoring and reporting will be to provide recommendations to improve compliance.

6 Schedule of Works

The schedule of works will commence on the day of approval from the consent authority. Refer to Figure 6 Schedule of Works.

The VMP is to be implemented for a period of 5 years from date of commencement. Council is to be consulted in the initial review after 12 months on receiving the first annual report.

			Year 1												Years 2-5											
			Month												Month											
Section	**Management Task**	**Frequency**	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
4.1.1.1	Exclusion Zone	Once and Ongoing																								
4.1.1.3	Primary Weed Removal	Once																								
4.1.1.6	Soil Scarification	Once																								
4.1.1.8	Sediment Controls	Once and Ongoing																								
4.1.1.5	Revegetation Activities	Once																								
4.1.1.7	Mulching	Once																								
4.1.1.10	Watering	6 weeks																								
4.1.1.13	Habitat Supplementation	Once																								
4.1.1.9	Secondary Weed Removal	Quarterly and Bi-annually																								
4.1.1.11	Plant Replacement	Quarterly and Bi-annually																								
4.1.1.14	Maintenance Inspections	Quarterly and Bi-annually																								
Legend																										
	Pre-restoration Phase																									
	Restoration Phase																									
	Post-restoration Phase																									

Figure 6.1 Schedule of works for the VMP at 53A Warriewood Rd, Warriewood NSW 2102. Kingfisher 2022.

7 Estimate Costs

The following cost estimates have been provided by a bush regeneration company based on a management period of five years. This estimate provides an indication of the costs associated with the bush regeneration aspects of the implementation of the VMP. This estimate of cost does not include construction related items such as fencing, signage, or the production of mulch in situ. Estimates are indicative only, final costs should be expected to vary. A formal quote from a bush regeneration company would be required to refine these estimates. Table 7.1 provides a detailed breakdown of estimated costs.

Table 7.1 Cost indication summary

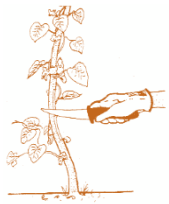
Item	Cost excl. GST
Primary Weeding	$6000
Planting, mulching and irrigation	$5000
Year 1 Maintenance	$3000
Year 2 Maintenance	$5000
Year 3 Maintenance	$5000
Year 4 Maintenance	$4000
Year 5 Maintenance and confirmation of compliance with performance criteria	$4000
Total excl. GST	$32,000

8 Appendices

Appendix I – Key Weed Removal Methods

Physical removal

Technique	Method	Equipment
Hand Removal 	Seedlings and smaller weed species where appropriate will be pulled out by hand, without risk of injury to workers. The size that this can occur varies throughout the treatment area. Generally, it ranges from post seed to approximately 300mm in height. Rolling and raking is suitable for larger infestations of Wandering Jew. The weed can be raked, and stems and plant parts rolled. The clump of weed material can then be bagged and removed from site.	Tools: gloves, rakes, knife, and weed bags
Crowning 	Plants that possess rhizomes or bulbs might not respond to various removal techniques and may need to be treated with crowning. A knife, mattock, or trowel is to be driven into the soil surrounding the bulb or rhizome at an angle of approximately 45 degrees, to cut any roots that may be running off. This is to occur in 360 degrees around the bulb/rhizome. The rhizome or bulb is to be bagged and removed from the site and disposed of at an appropriate waste recycling facility. Soil disturbance is to be kept to a minimum when using this technique.	Tools: knife, mattock, trowel, impervious gloves, and all other required PPE
Cut and Paint Stems 	Weed species deemed unsuitable for hand removal shall but cut. Those that have persistent vigorous growth will be cut and painted with Roundup® Biactive Herbicide or equivalent. Juvenile and smaller weed species will be cut with secateurs at base of plant, and herbicide applied via applicator bottle. Stem to be cut horizontally as close to the ground as possible, using secateurs, loppers, or a pruning saw. Horizontal cuts to be made on top of stem to prevent the herbicide running off the stump.	Tools: loppers, secateurs, pruning saw, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive

Technique	Method	Equipment
	Apply herbicide to the cut stem immediately, within 10-20 seconds, before the plant cells close and the translocation of herbicide is limited. Herbicide is not to reach sediment or surrounding non-target plants.	Herbicide and all other required PPE
Scrape and Painting 	More resilient weed species, where other techniques are less reliable are to be scraped with a knife or chisel and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current herbicide license. Weed species will be scrapped with a knife or chisel up the length of the trunk, and herbicide applied via applicator bottle. Scrape the trunk from as close to the ground as possible to approximately ¾ of the plants height. Where trunk diameters exceed approximately 5cm a second scrape shall be made on the other side of the trunk. Apple undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of herbicide is limited. Herbicide is not to reach sediment or surrounding non-target plants. Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.	Tools: knife, chisel, protective clothing, safety glass, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required PPE
Cut with a Chainsaw and Paint 	Larger size weed species, too large for cutting with hand tools, shall be cut with a chainsaw, and painted with undiluted Roundup® Biactive Herbicide. Works to be carried out by a contractor with a current chainsaw and herbicide license. Larger weed species will be cut with a chainsaw at base of plant, and herbicide applied via applicator bottle. Cut the stem horizontally as close to the ground as possible, using the chainsaw. Remove upper branches to reduce bulk of plant. If cutting at the base is impractical, cut higher to get rid of the bulk of the weed, then cut again at the base and apply herbicide. Make cuts horizontal to prevent the herbicide running off the stump. Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of herbicide is limited. Herbicide is not to reach sediment or surrounding non-target plants.	Tools: chainsaw, earmuffs, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required PPE

Technique	Method	Equipment
	Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.	
Spot Spraying	Spot spraying involves spraying non-seeding annuals and grasses, and for regrowth of weeds once an area has been cleared or brush cut. Works to be carried out by a contractor with a current herbicide license. Herbicide will be mixed up according to the manufacturer's directions for the weed species being targeted. Mixed herbicide shall be applied to the targeted weed species with a backpack sprayer. All care must be taken by the contractor not to spill herbicide onto sediment or surrounding non-targeting plants.	Tools: protective clothing, safety glasses, herbicide sprayer, impervious gloves, Herbicide, and all other required PPE

Flame Weeding

Thermal (flame) weeding is a method where high temperatures are applied to weeds, causing the plant to die. Thermal weeding is particularly useful in situations where conservation or health considerations are high and weed density is low such as waterways where herbicide use is not permitted.

For native vegetation areas, thermal weeding, with a flame weeder, has been shown to stimulate germination of native plants while killing the seeds of annual weeds such as Devils Pitchfork, *Bidens pilosa*. Flame weeding is also effective in killing persistent weeds like Mother of Millions.
Best results are obtained when follow up weed control is undertaken 4-6 weeks after treatment. In addition, weed control should be conducted periodically after that for example to control weeds over a period of a year it is likely that between 3-5 applications will be necessary, depending on rainfall and the extent of the weed seed bank. This method is most effective on young annual weeds and least effective on older perennial weeds. In some cases, control of perennial weeds will be ineffective however this depends on the species present and its age.

Images provided by Dragonfly Environmental

Flame weeding should be undertaken outside of the fire seasons. Flame weeding allows for the mimicking of a burn in areas where a control burn could not be undertaken. Find native plants regenerating after flame weeding.

Appendix II – Bushland Hygiene Protocols for Phytophthora (Hornsby Council Recommendations)

- Always assume that the area you are about to work in is free of the disease and therefore needs to be protected against infection.
- And always assume that the activity you are about to undertake has the potential to introduce the disease.
- Arrive at the site with clean shoes, i.e., no dirt encrusted on them.
- If you arrive with shoes that are encrusted with dirt, they will have to be completely soaked in methylated spirit or disinfectant and allow a few minutes to completely soak in. NEVER scrape untreated dirt off your shoes onto the ground.
- Before you move onto the site spray the bottom of your shoes with 70% methylated spirit. Bleach solution (1% strength) or household/commercial disinfectant (as per label) are also suitable.
- Check all tools and equipment that come in contact with soil are clean before entering the area (they should have been cleaned on-site at the end of the previous work session). If there is any dirt on them, spray them with 70% methylated spirit.
- Clean all tools at the end of each work session while still on site ensuring this is done away from drainage lines and adjacent work areas. Knock or brush off encrusted dirt and completely spray with 70 % methylated spirit. Replace in storage/transport containers.
- Preferably compost all weed material on site.
- Never drag vegetation with exposed roots and soil through bushland.
- When removing weeds from the site, remove as much soil as possible from them in the immediate work area and carefully place vegetative material into plastic bags.
- Try not to get the bag itself dirty; don't put it on/in a muddy area.
- Always work from the lower part of a slope to the upper part.
- Always work in areas known to be free of the pathogen before working in infected areas.
- Minimise activities wherever possible when the soil is very wet.
- Vehicles should not be driven off track or into reserves (unless vehicle decontamination is carried out before and after entering a single work site)
- Only accredited supplies of plants/mulch are to be used.

Kit contents: 1 bucket, 1 scrubbing brush, 1 spray bottle (methylated spirit 70% solution), 1 bottle of tap water, and 1 bottle of methylated spirits.

Facts about Phytophthora

Phytophthora cinnamomi (Phytophthora) is a microscopic, soil-borne, water-mould that has been implicated in the death of remnant trees and other plants in Australian bushland. Phytophthora is not native to Australia. It is believed to have been introduced sometime after European settlement. Phytophthora is a national problem and is listed as a key threatening process under the Commonwealth's *Environmental Protection and Biodiversity Conservation Act 1999*.

Symptoms including Dieback

"Dieback" simply means dying or dead plants. There are many causes of dieback; Phytophthora is just one of them. Often dieback is the result of a combination of factors such as changed drainage patterns and nutrient loads (e.g., increased stormwater run-off) or changed soil conditions (e.g., dumped fill or excavation of/near root zone). Plants that are stressed are more vulnerable to Phytophthora.

Initial symptoms of Phytophthora include wilting, yellowing and retention of dried foliage, loss of canopy and dieback. Infected roots blacken and rot and are therefore unable to take-up water and nutrients. Severely infected plants will eventually die. Symptoms can be more obvious in summer when plants may be stressed by drought. If you suspect that Phytophthora is on your site, please contact the Bushcare team to collect a soil sample to be lab tested. This is usually done in the warmer months where conditions are optimum for the disease.

Infection

There is no way of visually telling if Phytophthora is present in the soil as its structures and spores are microscopic (invisible to the naked eye). Phytophthora requires moist soil conditions and warm temperatures for infection, growth, and reproduction. Spores travel through moist soil and attach to plant roots. Once Phytophthora has infected a host plant it can grow inside plant root tissue independent of external soil moisture conditions. After infection, Phytophthora grows through the root destroying the tissue which is then unable to absorb water and nutrients.

Appendix III – Native Plant Nurseries

Wirreanda Nursery Ingleside NSW 2101

(02) 9450 1400

wirreandanursery.com.au/

Kulgoa Nursery Terrey Hills NSW 2084

(02) 9450 1217

kulgoa.com.au/

Indigo Native Nursery Ingleside NSW 2101

(02) 9970 8709

indigonursey.com.au/

New Leaf Nursery Ingleside NSW 2101

(02) 9913 3709

newleafnursery.com.au/

Harvest Seeds & Native Plants Nursery Terrey Hills NSW 2084

(02) 9450 2699

harvestseeds-nativeplants.com.au/

Ingleside Plant Growers Ingleside NSW 2101

(02) 9912 1028

Avalon Aquatics Ingleside NSW 2101

(02) 9918 4486 or sales@dragonflyenv.com.au for enquiries

Wildflower Nursery Ku-ring-gai

(02) 9423 0353 or kwg@krg.nsw.gov.au for enquiries

Appendix IV – Checklists

The following checklists have been included as a simple guide to ensure management measures within each stage of restoration are implemented.

Pre-restoration Checklist

Management Measure	Details
1. Soil and Water Management	• Bushland Hygiene Protocols outlined in Appendix II must be followed. The hydrological conditions of the site may promote the spread of Phytophthora. • Sediment controls may be implemented following weed removal and are to remain implemented throughout the restoration period.
2. Access Controls	• Parking, access/egress routes, stockpiles and materials storage areas must be identified and mapped outside the protected vegetation areas.
3. Biodiversity Protection	• Fencing must be erected to protect the native flora and fauna within the site. An exclusion zone will be established for bushland.
4. Weed Control	• Weeds must be managed, to a small degree in areas of earthworks, prior to commencement of works. Weed propagules must be disposed of within the site waste streams.

Restoration Phase Checklist

Management Measure	Details
1. Soil and Water Management	• Bushland Hygiene Protocols outlined in Appendix II must be followed. The hydrological conditions of the site may promote the spread of Phytophthora. • Sediment controls may be implemented following weed removal and are to remain implemented throughout the restoration period.
2. Access Controls	• Parking, access/egress routes, stockpiles and materials storage areas must be identified and mapped outside the protected vegetation areas.
3. Biodiversity Protection	• Fencing must be erected to protect the native flora and fauna within the site. An exclusion zone will be established for bushland.

4. Planting	• Planting is to occur during Spring, if possible, with Autumn planting reserved as a backup.
5. Bush Regeneration	• Primary weeding is to commence throughout the site to facilitate rehabilitation of native vegetation.
6. Reporting	• Reporting is to occur yearly (Ecologist) including the results of quarterly maintenance inspections and whether performance criteria are being met.

Post- restoration Phase

Management Measure	Details
1. Soil and Water Management	• Soil, sedimentation, erosion, and water management strategies implemented in earlier phases are to be retained where appropriate to continue to protect native vegetation zones from additional minor works and impacts arising from site operation.
2. Access Controls	• Parking, access/egress routes, stockpiles and materials storage areas must be identified and mapped outside of biodiversity protection exclusion zones.
3. Biodiversity Protection	• Fencing must be erected to protect the native flora and fauna within the site. An exclusion zone will be established for bushland.
4. Bush regeneration	• Maintenance weeding is to commence throughout the site to facilitate rehabilitation of native vegetation. • The soil seedbank is to be triggered to encourage natural regeneration in areas of medium to high resilience or where appropriate at the discretion of the bush regeneration contractors.
5. Planting	• Planting is to commence once performance criteria are on track to being met and there is little risk of plantings being outcompeted by exotics.
6. Reporting	• Reporting is to occur yearly (Ecologist) including the results of quarterly maintenance inspections and whether performance criteria are being met.

Appendix V – Recommended Planting List for the Site

Plant species have been selected from PCT 1795 - *Swamp Mahogany / Cabbage Tree Palm - Cheese Tree - Swamp Oak tall open forest* and PCT 1232 - *Swamp Oak floodplain swamp forest*.

PCT 1795	
Scientific name	Common name
Trees	
Eucalyptus robusta	Swamp Mahogany
Shrubs	
Acacia longifolia	Coastal Wattle
Casaurina glauca	Swamp Oak
Dodonaea triquetra	Large-leaf Hop Bush
Elaeocarpus reticulatus	Blueberry Ash
Homalanthus populifolius	Bleeding Heart
Livistona australis	Cabbage Palm
Melaleuca linariifolia	Flax-leaved Paperbark
Melaleuca styphelioides	Prickly-leaved Tea Tree
Pittosporum undulatum	Sweet Pittosporum
Groundcovers	
Blechnum camfieldii	Water Fern
Entolasia marginata	Bordered Panic
Oplismenus aemulus	Broad-leaved Basket Grass
Oplismenus imbecillis	
Alternanthera denticulata	Common Joyweed
Viola hederacea	Native Violet
Commelina cyanea	Blue Spiderwort
Gahnia clarkei	Tall Saw-sedge
Hypolepis muelleri	Harsh Ground Fern
Hydrocotyle peduncularis	
Pteridium esculentum	Bracken Fern
Calochlaena dubia	Rainbow Fern
Phragmites australis	Common Reed

Centella asiatica	Indian Pennywort

PCT 1232	
Scientific name	Common name
Trees	
Casuarina glauca	Swamp Oak
Melaleuca quinqunervia	Broad-leaved Paperbark
Shrubs	
Myoporum spp.	Boobialla
Melaleuca ericifolia	Swamp Paperbark
Melaleuca styphelioides	Prickly-leaved Tea Tree
Groundcovers	
Samolus repens	Creeping Brookweed
Sarcocornia quinqueflora	
Suaeda australis	
Alternanthera denticulata	Common Joyweed
Commelina cyanea	Blue Spiderwort
Cynodon dactylon	Common Couch
Centella asiatica	Indian Pennywort
Baumea juncea	Bare Twig-rush
Carex appressa	Tall Sedge
Juncus kraussii	Sea Rush
Phragmites australis	Common Reed

9 Expertise of Authors

With over 25 years wetland and urban ecology experience, a great passion for what she does, and extensive technical and on-ground knowledge make Mia a valuable contribution to any project.

Geraldene has over 8 years local government experience as manager of environment and education for Pittwater Council. Geraldene presented papers on the topic at the NSW Coastal Conference, Sydney CMA and Hawkesbury Nepean forums. Geraldene is a Technical Advisor Sydney Olympic Park Wetland Education and Training (WET) panel.

Geraldene has up to date knowledge of environmental policies and frequently provides input to such works. Mia was a key contributor to the recent set of Guidelines commissioned by Southeast Queensland Healthy Waterways Water Sensitive Urban Design Guidelines. Geraldene's role included significant contributions and review of the Guideline for Maintaining WSUD Assets and the Guideline for Rectifying WSUD Assets.

Geraldene is a frequent contributor to many community and professional workshops on ecological matters particularly relating to environmental management. She is an excellent Project Manager.

Geraldene is a joint author on the popular book Burnum Burnum's Wildthings published by Sainty and Associates. Author of the Saltmarsh Restoration Chapter Estuary Plants of East Coast Australia published by Sainty and Associates (2013). Geraldene's early work included 5 years with Wetland Expert Geoff Sainty of Sainty and Associates. Geraldene is an expert in creating and enhancing urban biodiversity habitat and linking People with Place.

Geraldene Dalby-Ball

DIRECTOR

SPECIALISATIONS

- Urban Ecology – and habitat rehabilitation and re-creation.
- Urban waterway management – assessing, designing, and supervising rehabilitation works
- Saltmarsh and Wetland re-creation and restoration – assessment, design, and monitoring
- Engaging others in the area of environmental care and connection
- Technical Advisor – environmental design, guidelines, and policies
- Sound knowledge and practical application of experimental design and statistics
- Project management and supervision
- Grant writing and grant assessment
- Budget estimates and tender selection
- Expert witness in the Land and Environment Court

CAREER SUMMARY

- **Director and Ecologist**, Ecological Consultants Australia. 2014-*present*
- **Director and Ecologist**, Dragonfly Environmental. 1998-*present*
- **Manager** Natural Resources and Education, Pittwater Council 2002-2010
- **Wetland Ecologist** Sainty and Associates 1995-2002

QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of Science with 1st Class Honors**, Sydney University.
- WorkCover WHS General Induction of Construction Industry NSW White Card.
- Senior First Aid Certificate.
- **Practicing member and vice president** Ecological Consultants Association of NSW

Gabriel James

ECOLOGIST

Finishing his environmental degree at Macquarie University, Gabriel's passion for nature is evident through his pursuit as an ecologist, working on a range of projects across all sectors. Gabriel has contributed to a number of government projects where he conducted ecological surveys to identify the presence of any threatened species and habitat features. These have been for the development of sustainable energy alternatives as well as the construction of a feral predator-free fence with aims to introduce endangered native species and re-establish their populations.

Within these projects, Gabriel has developed his skills in fauna handling and species identification for both flora and fauna across multiple regions within NSW. Additionally, Gabriel has been required to liaise with clients to achieve both efficiency for the client as well as a positive outcome for the environment.

SPECIALISATIONS

- Urban and Landscape Ecology
- Fauna and Flora Assessments
- Habitat Tree Assessment, Marking and Mapping
- GIS Mapping

CAREER SUMMARY

- **Ecologist**, Ecological Consultants Australia. 2022-*present*
- **Natural Area Specialist**, Dragonfly Environmental. 2021
- **Landscaping Laborer**, Oxygenhort Horticultural Services. 2019-*present*

QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of Environmental Science majoring in Biology**, Macquarie University.
- WorkCover WHS General Induction of Construction Industry NSW White Card.
- First Aid Certificate.

Brooke Thompson

ECOLOGIST

Brooke is an ecologist with valuable on-ground experience working on bush regeneration projects throughout the Sydney region, including revegetation and weed management projects. Brooke is passionate about conserving and restoring natural areas for native species to thrive.

Brooke completed her undergraduate Bachelor of Science degree majoring in Conservation Biology. Brooke has knowledge of experimental design and analysis, research and reports, geographic information systems (GIS), environmental legislation, and flora identification.

Brooke has experience working with conservation organisations, including Sea Shepherd Australia, helping to raise awareness around the destruction of habitats in the world's oceans. She has participated in the organisation and delivery of fundraising events around Sydney.

Brooke has exceptional communication and customer service skills and an extended client relations history.

SPECIALISATIONS

- Urban and Landscape Ecology
- Fauna and Flora Assessments
- Vegetation Management
- Habitat Tree Assessment, Marking and Mapping

CAREER SUMMARY

- **Ecologist**, Ecological Consultants Australia. 2022-*present*
- **Natural Area Specialist**, Dragonfly Environmental. 2022

QUALIFICATIONS AND MEMBERSHIPS

- **BSc Conservation Biology**, University of Wollongong.
- WorkCover WHS General Induction of Construction Industry NSW White Card.