

Landscape Plan

918 Barrenjoey Rd, Palm Beach NSW 2108

By Ecological Consultants Australia Pty Ltd TA

Kingfisher Urban Ecology and Wetlands

Updated 2022





About this document

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Statement of Authorship

This study and report was undertaken by Ecological Consultants Australia at Studio 1/33 Avalon Parade, Avalon. The author of the report is Geraldene Dalby-Ball with qualifications BSc. majoring in Ecology and Botany with over 20 years' experience in this field, and Jack Hastings with qualifications B EnvSc.

Limitations Statement

This Landscape Plan is based on site conditions and is undertaken in response to the brief provided by the client.

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Geraldene Dalby-Ball – Director of Ecological Consultants Australia

Summary

- This Landscape Plan provides 80% Pittwater Spotted Gum Forest species for landscaping in areas to be disturbed by the proposed development.
- All plants recommended are tube-stock (larger sizes for Spotted gum trees are not recommended as they are unlikely to be locally native stock and tube stock grow better). A condition of consent can be that 2 Pittwater Spotted Gums (*Corymbia maculata*) and two other locally native canopy trees must be alive and growing after 12 months and 5 years (at which time they will be protected under the TPO) two *Angophora costata* are proposed. It is noted that the *Angophoras* can be substituted for *Eucalyptus umbra* (White Mahogany) as needed / if available.

See also recommendations in Biodiversity Assessment Report.

Table of Contents

About this document	2
Summary	3
1 Introduction	4
2 Proposed Actions	6
2.1 Bush regeneration and on-going Maintenance in the Bushfire Asset protection Zone.	8
2.2 Plant Species and supply	8
2.2.1 Recommended Species	9
Additional vine species, locally native and well suited to cover the existing sloping exposed areas are included in Table 2.1 (see images at end of this plan).	10
2.2.2 Proposed Finishes, Accessways in landscape/bushregeneration areas	11
3 Recommendations	14
3.1 Planting techniques	14
3.2 Mitigation Measures	14
3.2.1 Delineation of work areas	15
3.2.2 Landscaping and planting natives	15
3.2.3 Erosion and runoff.....	15
3.2.4 Weed Removal Techniques	15
3.2.5 Pathogen prevention.....	15
4 Appendices	16
4.1 Appendix I – Key Weed Removal Methods	16
4.2 Appendix II– Bushland Hygiene Protocols for Phytophthora	19
5 Expertise of authors	21

1 Introduction

Kingfisher Urban Ecology & Wetlands (Kingfisher) has been contracted to update the landscape plan. For 918 Barrenjoey Road Palm Beach. This update includes the hard and soft landscaping proposed in the plan by MGAO (February 2022) LA_001 and LA_002. The species list has been replaced to fulfil the minimum requirement of 80% Pittwater Spotted Gum Forest. This plan is consistent with DCP B:7. Pittwater Spotted Gum Forest and takes into consideration the vegetated area being a Bushfire Asset protection Zone (IPA)

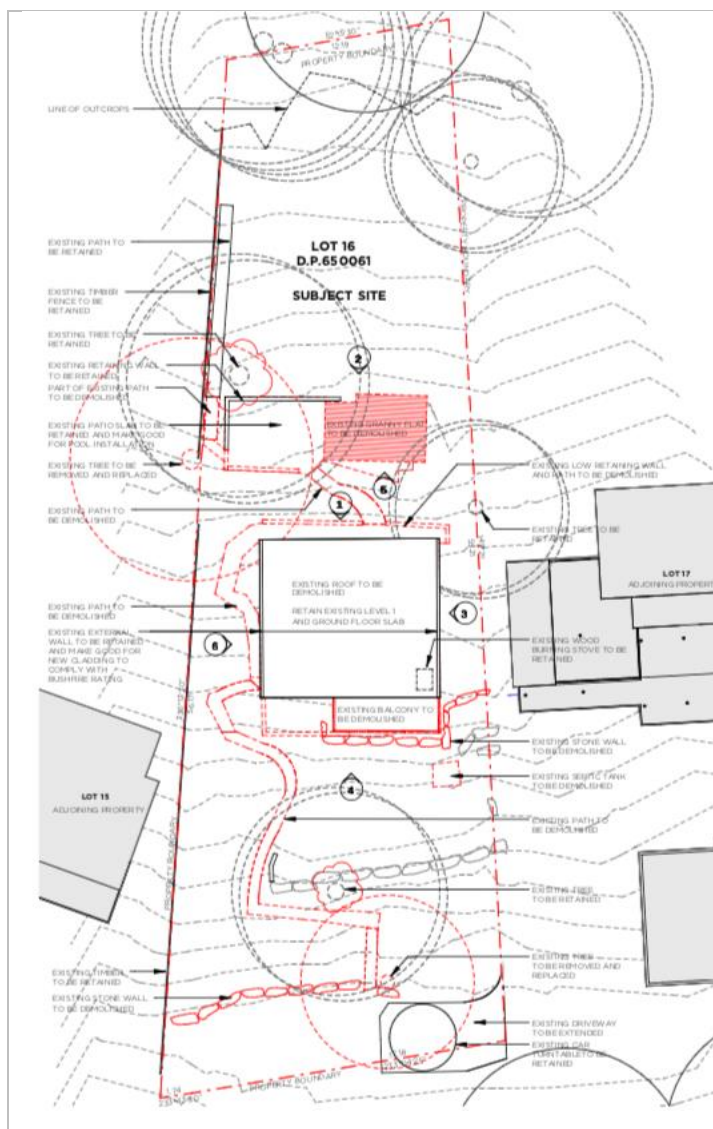
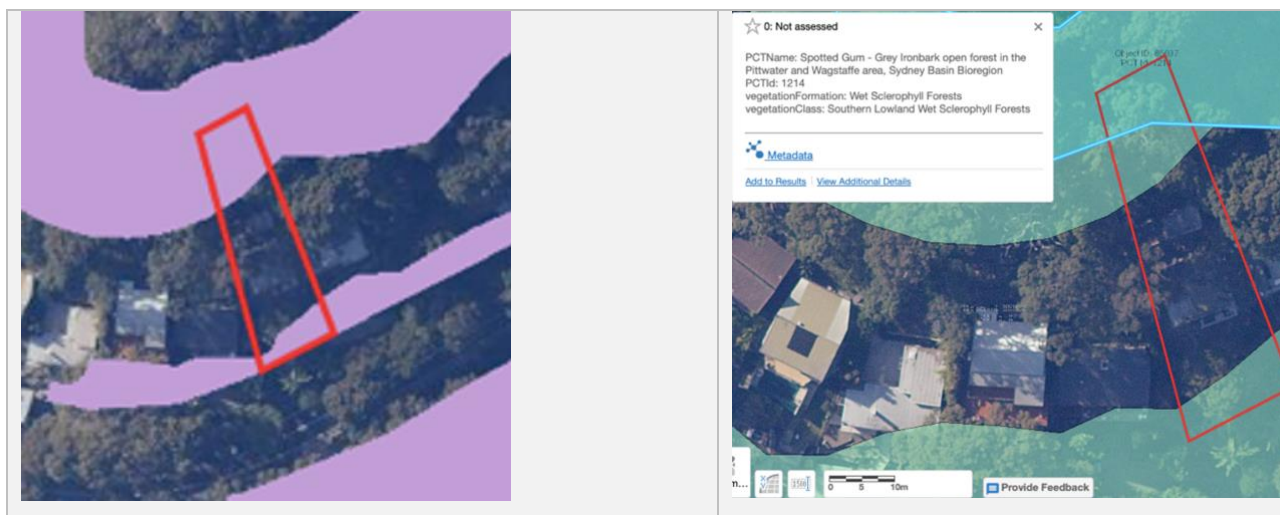


Figure 1.1 shows planned works, biodiversity mapping (purple) and Pittwater Spotted Gum Forest mapping (blue highlight area)



Outcomes of the DCP B1.7

- Conservation of intact Pittwater Spotted Gum Forest EEC. (En)
- Regeneration and/or restoration of fragmented and / or degraded Pittwater Spotted Gum Forest EEC. (En)
- Reinstatement of Pittwater Spotted Gum Forest to link remnants. (En)
- Long-term viability of locally native flora and fauna and their habitats through conservation, enhancement and/or creation of habitats and wildlife corridors. (En)
- Controls
- Development shall not have an adverse impact on Pittwater Spotted Gum Endangered Ecological Community.
- Development shall restore and/or regenerate Pittwater Spotted Gum Endangered Ecological Community and provide links between remnants.
- Development shall be in accordance with any Pittwater Spotted Gum Forest Recovery Plan.
- Development shall result in no significant onsite loss of canopy cover or a net loss in native canopy trees.
- Development shall retain and enhance habitat and wildlife corridors for locally native species, threatened species and endangered populations.
- Caretakers of domestic animals shall prevent them from entering wildlife habitat.
- Fencing shall allow the safe passage of native wildlife.

Development shall ensure that at least 80% of any new planting incorporates native vegetation (as per species found on the site or listed in Pittwater Spotted Gum Endangered Ecological Community).

Development shall ensure any landscaping works are outside areas of existing Pittwater Spotted Gum Endangered Ecological Community and do not include Environmental Weeds.

2 Proposed Actions

The proposed actions are weed removal and planting with PSGF species including 2 x locally sourced *Corymbia maculata*, 2 x *Angophora costata* (as these are common on the site and it is noted that the rear of the site is more likely Sydney Sandstone than PSGF and the soil type (eastern side). NB: Angophoras can be substituted with White Mahogany *E. umbra* if local stock are available. Species are based on those known from locally occurring PSGF species and consistent with the list in: <https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/1996-1999/pittwater-spotted-gum-forest-endangered-ecological-community-listing>

2.1 Bush regeneration and on-going Maintenance in the Bushfire Asset protection Zone.

Bush regeneration is expected to be of medium quality in the rear (eastern area). Native species are to be retained here as appropriate to be within the prescribed inner protection zone. The recolonising Bracken Fern will need to be brush-cut pre and during the fire seasons to ensure the ground fuels are low and there is not linkage of ground and canopy (though shrubs). Shrub later is not to exceed 20% of the rear of the property. Native grasses and ground covered can be favoured along with low-flammability existing plants such as the Macrozamia (Cycads).

2.2 Plant Species and supply

The required numbers and the list below can be provided to any of the locally native supply nurseries such as Indigo Native Plant nursery in Ingleside. The nurseries know which are ground, lower-mid, upper-mid and canopy and can provide what is available and in keeping with the table above for total numbers and ratios. Copy of purchase of locally native plants to be provided to council with certification pre OC. Species in the planting plan can only be changed for like species and there is to be at least the following (numbers based on the site area to attain ~ 3/m² noting bush regeneration is expected in the rear – these numbers also reference to the Matt Goodman Architecture Office (MGAO) plan LA_001 and 002. Recommended species are provided in the list below.

Table 2.1 – numbers of each type of plant

Stratum (layer)	Number of Species (no more than 20% from any one species)	Minimum total number of plants (min size = tube-stock)
Ground strata and low clumping plants	6	2000
Mid-level (shrubs)	6	85
Small trees	2	40
Canopy	2-3	4 (6 being planted - min 4 to reach maturity)
Totals	-	2107 plants

This averages at 3m² in the east and 4 m² in the west (front) – this will be 100% PSGF species. Areas of the property with existing landscaping (eg road edge) is being retained and weeds removed.

2.2.1 Recommended Species

Canopy

- *Angophora costata* – Reg Gum
- *Corymbia maculata* – Spotted Gum
- *Eucalyptus umbra* – White Mahogany
- *Livistona australis* – Cabbage Tree Palm

Small tree/ large shrub for screening

- *Acacia floribunda* (Large Shrub)
- *Allocasuarina torulosa* – Forest She Oak (Small Tree)
- *Eleocarpus reticulatis* – Blue Berry Ash (Small Tree)
- *Glochidion ferdinandi* – Cheese Tree (Small Tree)
- *Hakea sericea* (large Shrub)
- *Synoum glandulosum* – Synoum

Small shrubs

- *Dianella caerulea* – Dianella (clumping ground plant)
- *Lomandra longifolia* – Lomandra (clumping ground plant)
- *Breynia oblongifolia*
- *Dodonaea triquetra*
- *Gymnostachys anceps*
- *Macrozamia communis* - Cycad
- *Oxylobium ilicifolium* – small shrub
- *Platylobium formosum*
- *Pultenaea flexilis* – small shrub
- *Xanthorrhoea macronema* – Grass Tree

Grasses, ground-covers and Ferns

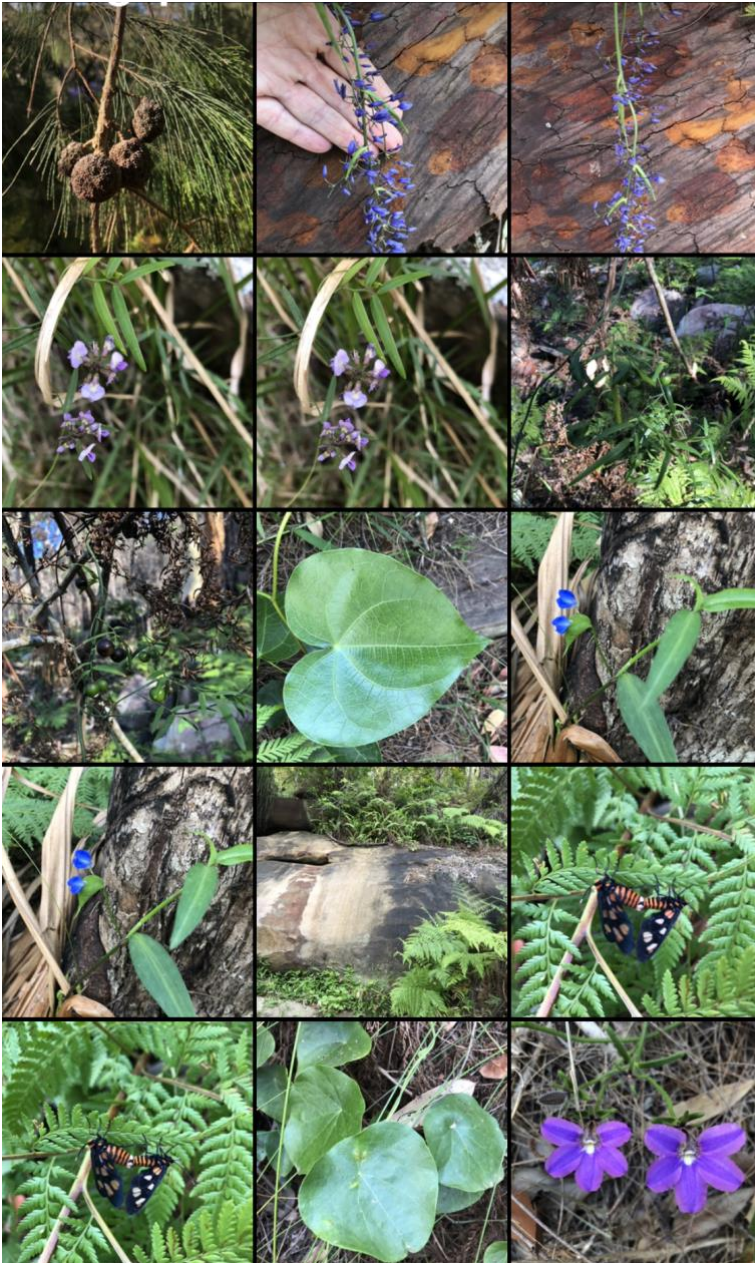
- *Centella asiatica* - Centella
- *Dichondra repens* – Kidney Weed
- *Gleichenia rupestris* – Coral Fern
- *Hydrocotyle peduncularis* – ground cover
- *Microleana stipoides* – Weeping Meadow Grass
- *Oplismenus imbecillis* – Basket Grass
- *Themeda triandra* (*T. australis*) – Kangaroo Grass
- *Viola hederacea* – Violet

Other Species that can be used in addition to or to substitute the ones above if they are not available. Changes to be approved by ecologist familiar with this vegetation community.

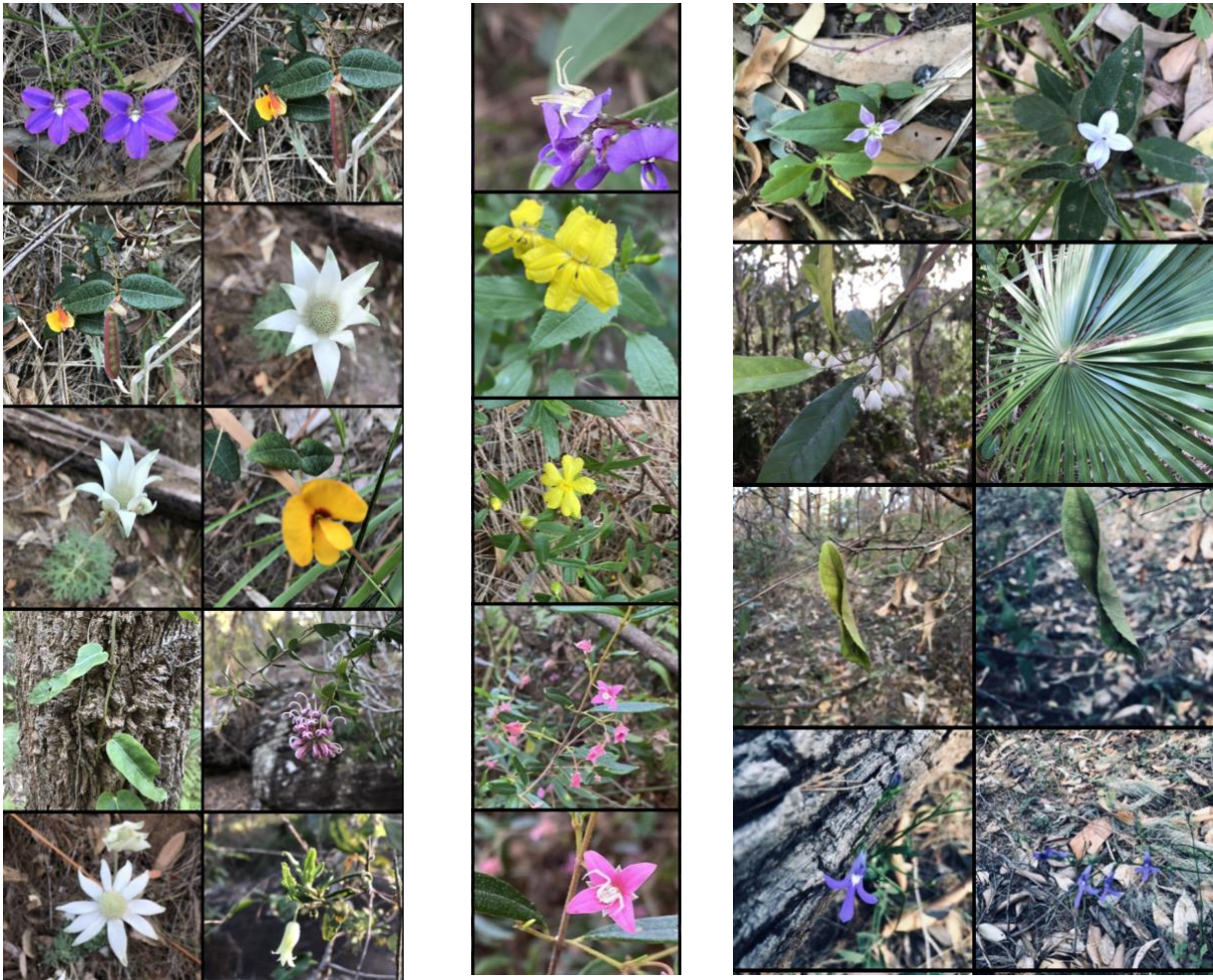
- *Adiantum aethiopicum*
- *Allocasuarina litoralis*
- *Angophora floribunda*
- *Billardiera scandens*
- *Cassytha paniculata*
- *Cayratia clematidea*
- *Cissus hypoglauca*
- *Corymbia gummifera*
- *Doodia caudata*
- *Entolasia stricta*
- *Eucalyptus botryoides*
- *Eucalyptus paniculata*

- *Eucalyptus punctata*
- *Eustrephus latifolius*
- *Geitonoplesium cymosum*
- *Notelaea longifolia*
- *Pandorea pandorana*
- *Pseuderanthemum variabile*
- *Syncarpia glomulifera*

Additional vine species, locally native and well suited to cover the existing sloping exposed areas are included in Table 2.1 (see images at end of this plan).



While not all native plants shown here are on the species list, any of these are suitable for the site. The local native plant nurseries know the species in each photo and can provide information on their availability. The ecologist can sign off on any substitutes or inclusions of species as shown here.



Examples species in local Pittwater Spotted Gum Forest with Sandstone influence (as the site has).

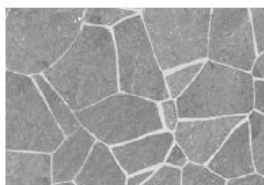
2.2.2 Proposed Finishes, Accessways in landscape/bushregeneration areas

The landscape plan has proposed finishes (as included below. The paving is limited to the area shown around the pool and is not included as 'vegetation area'. Accessways (stairs) are proposed up the northern side of the site (similar location as the existing stairs). Accessways are proposed as 'low-key' and / or porous. Acceptable accessways linking formal areas can be similar to that shown far right (photo from Angophoa Reserve). Accessways can assist in directing people away from bush regeneration areas and assist in long-term maintenance including fuel (bushfire) management.



ASPHALT

Driveway to be asphalt surface



BLUESTONE PAVING

Paving to rear deck and pool surround



TIMBER DECK

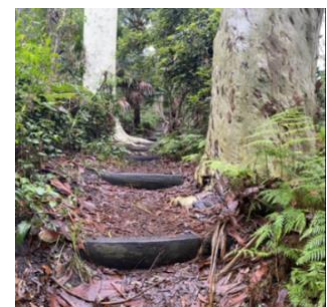






Table 2.2 – selection of vine species in the planting list. All vines species can be inter-planted. Trailing Guinea Flower and Purple Coral Pea are the most appropriate as Dusky Coral Pea can be very vigorous in growth. NB: All vines need to be managed through time to remove ‘ladders’ of dry material linking ground with canopy as the site is in a bush-fire protection area.

Common Name	Scientific Name	Photo	Growth Habit	Notes (NF) habitat for native fauna, (BF) Bush Food.
Trailing Guinea Flower	<i>Hibbertia scandens</i>		Vine NF	Trailing Guinea Flower suitable on slopes (in sun).
Dusky Coral Pea	<i>Kennedia rubicunda</i> Too vigorous for within east area.		Vine NF	To be used sparingly Dusky Coral Pea is recommended in steep areas requiring fast stabilization. NB this species is vigorous and may require cutting back in future. Recommended use low on the site.
Purple Coral Pea	<i>Hardenbergia violacea</i>		Vine NF	Purple Coral Pea is one of the most appropriate species to plant on sloping areas that need stabilizing.

Common Name	Scientific Name	Photo	Growth Habit	Notes (NF) habitat for native fauna, (BF) Bush Food.
Native Sarsaparilla	<i>Smilax glycyphylla</i>		Vine NF, BF	Native Sarsaparilla has been chosen as it is common in the area naturally and in both Spotted Gum and Angophora communities.
<p><i>Note - Habitat for Native Fauna (NF), Bush Food (BF)</i> Examples of the species available for planting in this community – are also those on the northwestern facing the PSG, and sandstone intergrading, areas of Angophora reserve – which is similar to the on-site habitat.</p>				

3 Recommendations

3.1 Planting techniques

See extract from original landscape plan. Note also that it is recommended that a professional bush regeneration company with people who know the native plants and can identify them at seedling stage be engaged to do the planting as they will ensure correct placement on site. Not only for ecological reasons but also to minimise maintenance for future and on-going compliance with Bushfire Asset Protection Zone requirements. Specialists will also know the correct species for planting along the boundaries to achieve the required screening. Planting is recommended post primary weed management and with the use of power-augers (handheld planting drills). Note all plants recommended are tube stock and so the below planting procedure is to be read with this in mind. NB: watering volume will be related to the size of the plant and existing soil conditions (not 10L).

LANDSCAPE SPECIFICATIONS

- Garden Bed Establishment - Where indicated on the drawings the contractor shall provide for the establishment of garden beds. All works are to be carried out in accordance with standard horticultural practices. All works shall only be carried out under suitable soil conditions and the use of machinery or hand tools under adverse conditions that would damage the soil structure will not be permitted.
- Finished surface level - After final settlement the finished surface level shall match the top of adjoining bedding edge. Place topsoil to within 75mm below finished level to allow for the replacement of mulch.
- Grades - All grades are to be shaped to assist drainage.
- Preparation of Subgrade - Excavate as required to establish subgrade level to allow for addition of topsoil and mulch. All garden areas that are heavily compacted from construction work shall be broken up by an initial cultivation prior to the placement of the topsoil. This shall be carried out by cultivating to a depth of 300mm and shall be along the contours to prevent erosion. This shall leave the ground in a loose and friable condition.
- Gypsum - spread gypsum at the rate of 1- 2 kilograms per square metre depending upon the manufacturers recommendations for the type of topsoil. Mix the gypsum into the sub-grade by raking in lightly to a depth of 50mm.
- Topsoil - Imported topsoil from an approved supplier will confirm the following: Texture - light to medium clay loam, ie; capable of being compressed into a ball by hand when moist yet can be broken apart immediately after.
- Topsoiling - Spread topsoil to an even depth of 250mm and do not deliver or spread in a muddy condition. Where access is required over established or proposed garden areas keep the vehicular routes in the smallest possible area.
- Garden Bed Preparation - Before laying mulch in all large garden beds and where thick screen planting(eg, border planting) occurs cultivate to a depth of 300mm minimum. In small garden areas dig to spade depth (250mm).
- Mulch - Supply and place selected mulch in all garden beds to a minimum thickness of 75mm.
- Completion - Refill any depression caused by settlement and reform any areas which prevent water run-off-.
- Planting Generally - Ensure all plants are healthy, disease free, not root bound and true to name.
- Fertilizer - Use 8-9 month osmocote fertiliser at the rate specified by the manufacturer.
- Irrigation - Appropriate irrigation system installed at the rate specified by the manufacturer (TBC).

3.2 Mitigation Measures

Mitigation Measures

Before and During works:

- Effective site management to ensure polluted water and silt/ sediment doesn't leave the site.
- Removal of weed species to prevent spread of seed.
- Bush hygiene protocols should be followed to prevent the spread of pathogens including *Phytophthora*.
- Patch removal of weed shrub species, with replanting with native shrubs, to ensure habitat for wrens remains on-site during works.

After completion of works and on-going

- Companion animals are to be kept out of bushland areas at all times.

Legislation: Various pieces of legislation apply to this location and the proposed landscaping is in keeping with the objective of the Acts. Key acts are listed below.

- *Pittwater LEP in particular 7.6 Biodiversity Protection and in the DCP B:7 B4.7 Pittwater Spotted Gum Forest - Endangered Ecological Community*
(<https://eservices.northernbeaches.nsw.gov.au/ePlanning/live/pages/plan/Book.aspx?exhibit=PDCEP&hid=11852>)
- *Biosecurity Act (superseding the Noxious Weed Act 1993) (NW Act).*
- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).*
- *Biodiversity Conservation Act 2016 (BC Act).*

3.2.1 Delineation of work areas

During construction, impacts on the site and adjacent vegetation (trees) should be minimized by the delineation of works zones and tree protection. Must implement Arborist Plan.

3.2.2 Landscaping and planting natives

The Landscape Plan is to be implemented. Any changes to be approved by ecologist with experience in PSGF. Weed management is required in a staged manner to retained patches of small bird habitat. Planting locally native species to increase the habitat value of the site.

3.2.3 Erosion and runoff

Silt and sediment controls will be put in place. These will include, but not be limited to silt and sediment fences. Sediment controls will be reviewed during site inspections and/or after significant rainfall (more than 10mm in 24hrs resulting in site runoff).

3.2.4 Weed Removal Techniques

Weed removal proposed for the site will consist of hand removal techniques, manual/mechanical removal using bush regenerator tools. This approach will reduce the amount of herbicide used and reduce the amount of off-target damage through spot on application.

Woody perennial weeds less than 2 metres in height will require cut and paint or scrape and paint bush regenerator techniques based on the germinating/epicormic behaviour of the plant (especially plants that tend to coppice or sucker).

It is recommended that seed heads are removed prior to commencement of primary works. This would be best performed carefully by hand with secateurs with the aim of avoiding the spread flowers or seeds into planting zones. See Appendix II for further details.




3.2.5 Pathogen prevention



To prevent the introduction of pathogens, Bushland Hygiene Protocols outlined in Appendix V should be followed. The site is considered to be an area which may promote the spread of Phytophthora (a group of fungus-like diseases affecting plants) due to its moist soil and proximity to water. It is recommended that Bushland Hygiene Protocols be followed closely.

4 Appendices

4.1 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 plants 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 with surrounding soil, so as 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 P.P.E.
Cut and Paint Stems 	Weed species deemed unsuitable for hand removal shall be cut. Those that have persistent or 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. Apply herbicide to the cut stem immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. Herbicide is not to reach sediment or surrounding non-targeting plants.	Tools: loppers, secateurs, pruning saw, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide and all other required P.P.E.

Technique	Method	Equipment
<p>Scrape and Painting</p> 	<p>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.</p> <p>Weed species will be scraped 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 5 cm a second scrape shall be made on the other side of the trunk.</p> <p>Apply undiluted herbicide to the cut trunk immediately, within 10-20 seconds, before the plant cells close and the translocation of the herbicide is limited. All care must be taken by the contractor not to spill herbicide onto sediment or surrounding non-targeting plants.</p> <p>Follow up treatment may be required. If plants resprout, scrape and paint the shoots using the same method after sufficient regrowth has occurred.</p>	<p>Tools: knife, chisel, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.</p>
<p>Cut with a Chainsaw and Paint</p> 	<p>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.</p> <p>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.</p> <p>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 the herbicide is limited. Ensure there is no runoff of poison. All care must be taken by the contractor not to spill herbicide into water, onto sediment, or surrounding non-targeting plants.</p> <p>Follow up treatment will be required. If plants resprout, cut and paint the shoots using the same method.</p>	<p>Tools: chainsaw, ear muffs, protective clothing, safety glasses herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide, and all other required P.P.E.</p>

Technique	Method	Equipment
Spot Spraying	Spot spraying involves spraying non-seeding annuals and grasses, and for regrowth of weeds once an area has been cleared or brushcut. 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 particular 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 P.P.E.

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 considerations are high (regeneration occurring) and the use of herbicide would kill natives. This is the case for the rear (east) of the property. Thermal weeding could assist in stimulating regeneration and killing annual weed seed on the western side as well.

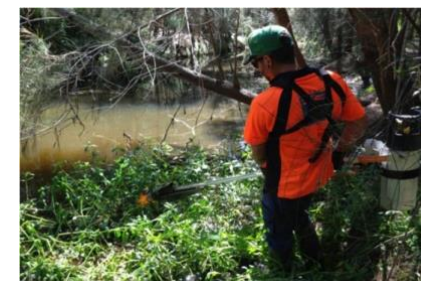
While flame weeding is not suited to most streetscapes due to the fire hazard nor can it be used on materials such as soft fall and similar playground equipment it is noted that ‘flame’ weeding in waterways allows weed management in areas where herbicides are not permitted.

Also 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*.

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.



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. See native plants regenerating after flame weeding.



4.2 Appendix II– Bushland Hygiene Protocols for Phytophthora

- 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 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 metho 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 % metho. Bleach solution (1% strength) or household/commercial disinfectant (as per label) are also suitable.
- Check all tools and equipment that comes 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% metho.
- 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 % metho. 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 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 to be used.

Kit should contain: 1 bucket, 1 scrubbing brush, 1 spray bottle (metho 70% solution), 1 bottle tap water, 1 bottle 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.

5 Expertise of authors

Geraldene Dalby-Ball

DIRECTOR

With over 25 years wetland and urban ecology experience, a great passion for what she does, and extensive technical and on-ground knowledge make Geraldene 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. Geraldene was a key contributor to the recent set of Guidelines commissioned by South East 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.

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.
- **Accredited Biobank Assessor**