

VEGETATION MANAGEMENT PLAN

Woolooware Bay Town Centre – Retail Project Application

Prepared for Bluestone Property Solutions Pty Ltd

27 February 2013



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Abbreviations

ABBREVIATION	DESCRIPTION
BPS	Bluestone Property Solutions
EEC	Endangered ecological community
ELA	Eco Logical Australia
m²	Metre squared
VMP	Vegetation Management Plan

1 Introduction

1.1 SUBJECT SITE

This Vegetation Management Plan (VMP) has been prepared by Eco Logical Australia (ELA) at the request of Bluestone Property Solutions (BPS). It relates to the proposed foreshore riparian buffer areas of the retail facility of the Woolooware Bay Town Centre, as indicated in **Figure 1**. The VMP is consistent with the Concept Approval that was given for the Town Centre in accordance with the NSW *Environmental Planning and Assessment Act 1979*.

1.2 STUDY OBJECTIVES

The objectives of this VMP are to identify:

- A design for the riparian buffer that compensates or offsets the loss of native vegetation from the site due to development
- Suitable species consistent with estuarine vegetation communities (i.e. Mangrove Swamp Oak Floodplain Forest)
- Sources of seed/tubestock available within project development timeframes, using local provenance species where possible
- Replanting techniques
- Removal and disposal of weeds
- Ongoing monitoring and adaptive management

The VMP is not intended for use as a technical specification to perform on-ground works, although it will inform future detailed specifications. This VMP has been prepared in accordance with the Guidelines for Vegetation Management Plans on Waterfront Land (DPI 2012).

1.3 LANDSCAPE DESIGN

The landscape design (**Figure 1**) was prepared by Aspect Studios in consultation with BPS, ELA and Sutherland Shire Council. It features:

- A loosely stacked rock seawall between the mangroves and area to be planted this will be designed in accordance with DECC's 2009 Environmentally Friendly Seawalls Guide to create niches for establishment of estuarine species as well as good visual amenity and slope stabilisation
- A main shared path (3 m wide) which will eventually link to paths east and west around the bay
- Access from the main path to the boardwalk through the mangroves (current boardwalk location to be maintained to avoid the need to clear mangroves)
- Species selected will be consistent with the Swamp Oak Floodplain Forest Threatened Ecological Community (TEC)
- Native grass lawn, wide steps and raised timber decks suitable for seating in 'The Waterfront' area
- No TEC's will be removed as a result of the proposed development



Figure 1: Subject area (Aspect Landscape Plan by Aspect Studios 2013)

² Swamp Oak Floodplain Forest

Flood modelling by AT&L suggests that elevations higher than the top of the proposed seawall in the subject area will not be subject to tidal inundation (allowing for predicted sea level rise, king tides etc). Vegetation to be planted in the riparian buffer therefore needs to be suited to conditions on estuarine margins, but outside tidal influences.

Swamp Oak Floodplain Forest is an ecological community that would have existed on the margins of the original mudflats and foreshores of Woolooware Bay, prior to infilling several decades ago. There are no remnants of this community in the subject area and only isolated pockets or individual *Casuarina glauca* (Swamp Oak) trees in the broader area of the proposed Woolooware Bay Town Centre. It is proposed to re-establish this community within the study area. No species consistent with this ecological community will be removed as a result of the proposed development.

Swamp Oak Floodplain Forest is an Endangered Ecological Community (EEC) listed under the *Threatened Species Conservation Act 1995.* An EEC is an ecological community listed as facing a very high risk of extinction in NSW so recovery efforts are supported. The size of the proposed riparian buffer is shown in **Figure 1** and has been endorsed under the Concept Plan.

Swamp Oak Floodplain Forest is a community of plants that is generally dominated by the tree/s *C. glauca* and/or *Melaleuca ericifolia* (Swamp Paperbark). The community is found in close proximity to rivers and estuaries and is generally associated with humic clay and sandy loam soils with a saline influence. The soils of the community may be waterlogged or periodically flooded, and the composition of species present will reflect this. Depending on the level of salinity in the groundwater, the understorey will be composed of salt tolerant grasses and herbs, and sedges and reeds in more saline areas.

Species that are associated with this community are listed in Appendix A.

³ Propagation and planting guidelines

3.1 SPECIES LIST

Appendix A provides a list of species suitable for planting in the riparian zone that are:

- Associated with the Swamp Oak Floodplain Forest community as it exists in Sutherland Shire
- Expected to be available as local provenance through seed collection and propagation, or tubestock
- Likely to have good survival rates in the subject area under the proposed site preparation and maintenance regime

The table identifies the plant types (e.g. tree, rush), availability of plant stock at Sutherland Shire Council Nursery, and timeframes for seed collection and propagation required prior to planting.

3.2 TIMEFRAMES, LICENSES AND RESPONSIBILITIES

Revegetation and associated activities within the riparian buffer need to be complete by December 2014 to coincide with the development of the retail facilities.

All vegetation management works need to be undertaken by suitably qualified and experienced bush regeneration contractors who are members of the Australian Association of Bush Regenerators or have significant bush regeneration experience.

A section 132C license under the NSW *National Parks and Wildlife* Act 1974 will be required by bush regeneration contractors collecting seed from areas of EECs and working on site. The application for a section 132C license may take up to two weeks for approval. This needs to be factored into project timeframes.

All relevant approvals from the NSW Office of Water (NOW) will be obtained prior to commencement of construction activities. This VMP may be refined in consultation with NOW is required.

3.3 SITE PREPARATION

Preparation of the riparian buffer will involve clearing the site of asphalt and existing exotic vegetation. Litter and weeds will need to be removed by hand if mangroves could be directly affected or there is a risk that the bank could be destabilised. Clean topsoil may need to be imported as a suitable plant growing medium. No species consistent with the EEC Swamp Oak Floodplain Forest will be removed as a result of the proposed development.

3.3.1 Weed control

Weed control involves a combination of physical and chemical techniques to remove the weeds and prevent regrowth. A selection of the best suited weed control method within the site depends on a number of factors including:

- The species or combination of weeds being targeted (refer to **Appendix B** for list of flora recorded on site)
- The density of the weeds

- Resources available (time, labour, equipment and finances)
- The proximity to sensitive receptors (Mangroves)
- Weather conditions of the day

Appendix C outlines standard weed removal techniques. It is recommended that weed mapping is undertaken immediately prior to weed control to ensure appropriate methods are applied.

3.3.2 Landform and soils

Once cleared, the bank may need to be recontoured to allow for construction of the seawall at a suitable gradient. Temporary erosion matting may be required to stabilise the bank until the sea wall is constructed. All site preparation must be conducted in accordance with a soil and water management plan to protect water quality and mangroves in the bay.

Good soil preparation will be needed to achieve target plant survival rates. Options to be investigated regarding soil preparation include:

- Ripping 20 cm of the current soil to reduce compaction followed by addition of minimum 20 cm suitable soil medium (e.g. sandy loam)
- Capping with crushed sandstone and suitable soil to >20 cm depth

It is recommended that soils be tested once the asphalt has been removed to determine the best method for preparing the soil prior to planting. The following table is a guide to suitable topsoil conditions.

PROPERTY	LIMIT	
Texture	Light – medium friable (i.e. capable of being handled when	
	moist, but lacking cohesion, so that it will fall apart easily	
	when dry)	
Organic Matter by mass (minimum)	2%	
Chloride Content (maximum)	500mg/kg	
Electrical Resistivity of a 1 in 5 soil/water mixture	1mS/cm	
(maximum)		
pH (minimum)	5.5	
pH (maximum)	6.5	
Linear Shrinkage (maximum)	3% – Type A	
	5% – Туре В	

Table 1: Preferred topsoil properties (general condition)

Source: O'Brien 2008

3.4 SEED COLLECTION AND PROPAGATION

Seed for revegetation works and direct seeding will be collected from the local area (<5 km) to ensure the seed is of local provenance. Where seed sources are not available within the local area, seed collection may extend to a 10 km radius of the site (e.g. for wetland species which are typically widely dispersed). All seed used in revegetation will be of appropriate provenance with seed collection undertaken in accordance with Florabank Guidelines (Mortlock 2000).

Seed collection must be collected from multiple plants over as wide an area as possible, to maximise genetic diversity. Seed should only be collected from strong, healthy plants and less than 20% of the seed is to be collected from any one plant to allow natural regeneration at the donor site. Seeds must

only be collected from fruits that are close to maturity to ensure that viable seed is collected. If seeds are to be stored, bags containing seed should be kept in a well-ventilated location to avoid fungal contamination (DECC 2008).

The germination period for plant stock can take up to three months (**Appendix A** indicates the timeframes for each species). However, a further six to eight months is required for the seedlings to reach maturity and be ready for planting. This needs to be factored into project timeframes along with seed collection requirements. Confirmation from suppliers will be required regarding seed origin prior to revegetation works.

3.5 PLANTING

All plants will be installed as tube stock or hiko cells. Planting should take place over one year in order to ensure proper establishment and achieve a final density of one plant per m² for trees / shrubs and three plants per m² for sedges/rushes and grasses.

Planting should be done via a low impact method such as hand digging or hand auger. The holes dug for each tubestock should be at least 1.5x the width and 2x the depth of the rootball. Fertiliser should be added to each hole dug as per the label specifications.

If the soil has not been capped with clean topsoil, additional procedures will need to be followed to protect safety when handling soils during the planting process.

Water crystals or wetting agents should be added to each plant hole. This will increase the water holding capacity of the soil and reduce watering schedules especially in difficult to access locations. Initial irrigation of the tubestock is not needed if plantings are undertaken before sufficient rainfall.

Watering shall be carried out so as to maintain the best possible condition and growth rates of the plants. A semi-automatic irrigation system is recommended and the system should be programmed to suit:

- The precipitation requirements of the plants/vegetation community
- Consideration as to the irrigation rate of the soil and associated physical factors including seasons, evaporation, exposure, topography and local authority restrictions
- Allowance for adjustment or shut down during and after periods of prolonged heavy rains

The use of mulch is very important because it provides organic matter to the top soil, improves soil structure and aeration, water infiltration, nutrient availability, and is also useful in the suppression of weed growth. Mulch should be sourced from within the local area. Mulch must be free of weed propagules and invasive woody species such as *Erythrina* X *sykesii* (Coral Tree).

3.6 MONITORING AND MAINTENANCE

Ongoing monitoring and maintenance will be essential to ensure good health and amenity of the riparian buffer. Vegetation in the riparian zone should be monitored for dieback and possible reasons determined (e.g. imbalance in fresh/salt water; trampling). Litter and weeds will need to be removed regularly by bush regenerators.

Replacement planting, particularly in the initial years, will be required by the bush regeneration team. If the soil is prepared well, we could expect about 10% of plants would need to be replaced. If there are difficulties with soil preparation or if there are unforeseen events (e.g. extreme hot weather), the proportion of replacement planting is likely to be higher.

References

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DECC 2008. Best Practice Guidelines for Coastal Saltmarsh. State of NSW and Department of Environment and Climate Change NSW. Sydney

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Mortlock W. 2000. *Florabank Guideline 10: Seed collection ranges for revegetation.* http://www.florabank.org.au/ Florabank, Yarralumla, ACT

O'Brien M 2008. *Soil Management Factsheet* Online Resource <u>http://yourdevelopment.org/factsheet/view/id/50.</u> Accessed 25 January 2013

Appendix A: Recommended species list for revegetation

SCIENTIFIC NAME	COMMON NAME	SSC NURSERY AVAILABILITY	SEED COLLECTION MONTHS	TREATMENT	GERMINATION PERIOD
Tree					
Acmena smithii	Lilly Pilly	39	Autumn-Winter	С	4-8 weeks
Casuarina glauca	Swamp Oak	0	Spring	А	2-3 weeks
Cupaniopsis anacardioides	Tuckeroo	0	Summer	С	4-6 weeks
Glochidion ferdinandi	Cheese Tree	0	Winter-Spring	A	4-8 weeks
Melaleuca ericifolia	Swamp Paperbark	127	Spring	А	2-3 weeks
Melaleuca quinquenervia	Broad-leaved Paperbark	0	Spring	А	2-3 weeks
Sedge / Rush					
Baumea juncea	Bare Twig Rush	0	Summer	В	
Carex appressa	Tall Sedge	0	Summer	D	2-6 weeks
Dianella caerulea	Blue Flax Lily	0	Summer	A	4-5 weeks
Isolepis inundata	Swamp Club Rush	0	Summer	D	4-5 weeks

SCIENTIFIC NAME	COMMON NAME	SSC NURSERY AVAILABILITY	SEED COLLECTION MONTHS	TREATMENT	GERMINATION PERIOD
Juncus kraussii	Sea Rush	250	Summer	D	4-5 weeks
Juncus usitatus	Common Rush	40	Summer	D	4-5 weeks
Lomandra longifolia	Spiny Mat Rush	400	Summer	А	8-10 weeks
Fern / Herb					
Blechnum indicum	Swamp Water-fern	0	Spring	E	2-4 weeks
Hypolepis muelleri	Harsh Ground Fern	0	Spring	E	2-4 weeks
Persicaria decipiens	Slender Knotweed	0	Summer	D	2-4 weeks
Vine					
Parsonsia straminea	Common Silkpod	0	Summer/Autumn	А	4-6 weeks
Stephania japonica	Snake Vine	0	Summer/Autumn	А	4-6 weeks
Grass					
Cynodon dactylon	Sand Couch	0	Summer	F	2-4 weeks
Imperata cylindrica var. major	Blady Grass	0	Summer	F	2-4 weeks
Oplismenus imbecillis	Basket Grass	0	Summer	F	2-4 weeks

Appendix B: Existing flora

The following list of plant species was collated for the Cronulla Sharks Redevelopment Ecological Assessment of the Concept Plan report (ELA 2011). It shows the high proportion of non-native species at the site. No species were found that are listed under the TSC Act.

Key to symbols used in table below			
V	Vulnerable - listed under the EPBC Act (Commonwealth)		
N	Native		
Ni	non-indigenous native species (Australian in origin, but not indigenous to this locality)		
E	Introduced species (exotic)		
Nox	Noxious weed listed under the NSW Noxious Weeds Act 1993		
Р	Planted specimen		

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS
Agavaceae	Yucca aloifolia	Yucca	E
Aizoaceae	Carpobrotus glaucescens	Pigface	Ν
	Tetragonia tetragonioides	New Zealand Spinach	Ν
Amaryllidaceae	Agapanthus praecox	Agapanthus	E, P
Apiaceae	Centella asiatica	Swamp Pennywort	Ν
	Foeniculum vulgare	Fennel	E
	Hydrocotyle bonariensis	Kurnell Curse	E
	Hydrocotyle peduncularis		Ν
Araceae	Philodendron selloum	Philodendron	E, P
Araliaceae	Schefflera actinophylla	Umbrella Tree	E, P
Araucariaceae	Araucaria heterophylla	Norfolk Island Pine	Ni, P
Arecaceae	Howea forsteriana	Kentia Palm	Ni P
	Syagrus romanzoffianum	Cocos Palm	E, P
	Washingtonia filifera	Fringe Palm	E, P
Asclepiadaceae	Araujia hortorum	Moth Vine	E
Asparagaceae	Myrsiphyllum asparagoides	Bridal Veil Creeper	E
	Protasparagus aethiopicus	Asparagus Fem	E
Asteraceae	Ageratina adenophora	Crofton Weed	E
	Bidens pilosa	Cobbler's Pegs	E
	<i>Chrysanthemoides</i> <i>monilifera</i> subsp.	Bitou Bush	E, Nox (4)

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS
	rotundata		
	Cirsium vulgare	Spear Thistle	E
	Conyza albida	Tall Fleabane	E
	Conyza bonariensis	Flax-leaf Fleabane	E
	Conyza canadensis	Canadian Fleabane	E
	Coreopsis lanceolata	Coreopsis	E
	Cotula coronopifolia	Waterbuttons	E
	Erigeron karvinskianus	Bony-tip Fleabane	E
	Hypochaeris radicata	Cats Ears	E
	Senecio madagascariensis	Fireweed	E
	Sonchus oleraceus	Common Sow-thistle	E
_	Tagetes minuta	Stinking Roger	E
Avicenniaceae	Avicennia marina	Grey Mangrove	N
Basellaceae	Anredera cordifolia	Madeira Vine	E
Boraginaceae	Baraga officinalis	Borage	E
Brassicaceae	Brassica rapa	Wild Turnip	E
	Brassica tournefortii	Mediterranean Turnip	E
	Capsella bursa-	Shepherds purse	E
	Raphanus raphanistrum	Wild Radish	E
Buxaceae	Buxus microphylla var. japonica	Japanese Box	E, P
	Buxus sempervirens	English Box	E, P
Caryophyllaceae	Stellaria media	Chickweed	E
Casuarinaceae	Casuarina cunninghamiana	River Oak	N
	Casuarina glauca	Swamp Oak	N
Chenopodiaceae	Sarcocornia	Samphire	N
	Suaeda australis	Austral Seablite	N
Commelinaceae	Commelina cyanea	Native Wandering Jew	N
	Tradescantia albiflora	Wandering Jew	E
Convolvulaceae	Dichondra repens	Kidney Weed	N
	Ipomoea indica	Morning Glory	E
Cyperaceae	Cyperus brevifolius	Mullumbimby Couch	E
	Isolepis sp.		N

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS
Doryanthaceae	Doryanthes excelsa	Gymea Lily	Ν
Euphorbiaceae	Breynia oblongifolia	Coffee Bush	Ν
	Euphorbia peplus	Petty Spurge	E
	Glochidion ferdinandi var. ferdinandi	Cheese Tree	Ν
	Homalanthus nutans	Native Bleeding Heart	Ni
	Ricinus communis	Castor Oil Plant	Nox (4)
Fabaceae (Caesalpinioideae)	Senna pendula var. glabrata	Winter Senna	E
Fabaceae (Faboideae)	<i>Erythrina</i> x sykesii	Coral Tree	E
(*********	Glycine clandestina	Love Creeper	Ν
	Trifolium repens	White clover	E
	Trifolium campestre	Hop Clover	E
	Vicia tetrasperma	Slender Vetch	E
Fabaceae (Mimosoideae)	Acacia linifolia	Flax-leaved Wattle	N
	Acacia Iongifolia subsp. longifolia	Sydney Golden Wattle	Ν
	Acacia Iongifolia subsp. sophorae	Coastal Wattle	Ν
	Acacia parramattensis	Parramatta Green Wattle	Ν
Fumariaceae	Fumaria muralis	Wall Fumitory	E
Iridaceae	Ixia maculata	Ixia	E
Juncaceae	Juncus kraussii var. australasica	Sea Rush	N
Lamiaceae	Westringia fruticosa	Coastal Westringia	Ν
	Westringia longifolia	Long-leaved Westringia	Ν
Lauraceae	Cinnamomum camphora	Camphor Laurel	+
Lomandraceae	Lomandra longifolia	Spiny headed Mat Rush	Ν
Malvaceae	Brachychiton acerifolius	Illawarra Flame tree	Р
	Hibiscus sp.	Hibiscus	E, P
	Lagunaria patersonii	Norfolk Island Hibiscus	E, P
	Sida rhombifolia	Paddy's Lucerne	E
Moraceae	Ficus microphylla	Moreton Bay Fig	Ν
	Ficus rubiginosa	Port Jackson Fig	Ν
Myrtaceae	Callistemon citrinus	Crimson Bottlebrush	Ν

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS
	Callistemon salignus	Willow Bottlebrush	Ν
	Callistemon viminalis	Weeping Bottlebrush	Ni, P
	Corymbia gummifera	Red Bloodwood	N, P
	Eucalyptus gomhocephala	Tuart	Ni, P
	Eucalyptus leucoxylon	Yellow Gum	Ni, P
	Eucalyptus microcorys	Tallowwood	N
	Eucalyptus resinifera	Red Mahogany	Ν
	Eucalyptus robusta	Swamp Mahogany	Ν
	Eucalyptus scoparia	Wallangarra White Gum	Ni, V, P
	Eucalyptus tereticornis	Forest Red Gum	N, P
	Eucalyptus viminalis	Ribbon Gum	N, P
	Kunzea ambigua	Tick Bush	Ν
	Leptospermum laevigatum	Coast tea-tree	N
	Lophostemon confertus	Brush Box	Ni P
	Leptospermum petersonii	Lemon-scented Tea-tree	Ni P
	Melaleuca armillaris	Bracelet Honey-myrtle	N, P
	Melaleuca ericifolia	Swamp Paperbark	Ν
	Melaleuca hypericifolia	-	N, P
	Melaleuca linariifolia	Snow-in-summer	Ν
	Metrosideros excels	Pohutukawa	E, P
	Syzygium paniculatum	Magenta Lilly Pilly	V, P
Nyctaginaceae	<i>Bougainvillea</i> sp.	Bougainvillea	E, P
Oleaceae	Olea europaea subsp. africana	African Olive	E, Nox (4)
Oxalidaceae	Oxalis corniculata	Creeping Woodsorrel	E
Phormiaceae	Phormium tenax	New Zealand Flax	E, P
Pittosporaceae	Pittosporum undulatum	Sweet Pittosporum	Ν
Plantaginaceae	Plantago lanceolata	Plantain	E
Poaceae	Lachnagrostis aemula	Blown Grass	Ν
	Andropogon virginicus	Whisky Grass	E
	Arundo donax	Giant Reed	E

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS
	Avena fatua	Wild Oats	E
	Briza maxima	Quaking Grass	E
	Bromus catharticus	Soft Broome	E
	Cortaderia selloana	Pampas Grass	E, Nox (3)
	Cynodon dactylon	Couch Grass	Ν
	Digitaria sanguinalis	Summer Grass	E
	Ehrharta erecta	Panic Veldt Grass	E
	Entolasia marginata	Bordered Panic	Ν
	Entolasia stricta	Wiry Panic	Ν
	Eragrostis curvula	African Love Grass	E
	Imperata cylindrical var. major	Blady Grass	N
	Microlaena stipoides var. stipoides	Meadow Rice Grass	Ν
	Paspalum dilatatum	Paspalum	E
	Pennisetum clandestinum	Kikuyu	E
	Phragmites australis	Native Reed	Ν
	Setaria pumila	Pigeon Grass	E
	Sporobolus indicus var. capensis	Parramatta Grass	E
	Stenotaphrum secundatum	Buffalo Grass	E
	Themeda australis	Kangaroo Grass	Ν
Polygonaceae	Acetosa sagittata	Turkey Rhubarb	E
	Rumex crispus	Curled Dock	E
Proteaceae	Banksia integrifolia	Coastal Banksia	N, P
	Banksia serrata	Old Man Banksia	N, P
	Banksia oblongifolia	Banksia	N, P
Grevillea	Grevillea rosmarinifolia	Rosemary Grevilla	Ni, P
Rosaceae	Photinia glabra	Photinia	E
	Rubus fruticosus subsp. aggregate	Blackberry	E
Rutaceae	Coleonema pulchrum	Coleonema	E, P
	Murraya paniculata	Murraya	E, P
Scrophulariaceae	Hebe diosmifolia	Hebe	E, P
Solanaceae	Cestrum parqui	Green Cestrum	E, Nox (3)
	Solanum mauritianum	Wild Tobacco	E
	Solanum nigrum	Blackberry Nightshade	E
	Solanum americanum	Glossy Nightshade	E
Urticaceae	Parietaria judaica	Pellitory	E, Nox (4)

FAMILY	SCIENTIFIC NAME	COMMON NAME	STATUS
Verbenaceae	Lantana camara	Lantana	E, Nox (4)
	Verbena bonariensis	Purple Top	E
	Verbena rigida	Veined Verbena	E
	Verbena officinalis	Common verbena	E
Vitaceae	Vitex purpurea	Vitex	E, P
	Hedychium gardnerianum	Wild Ginger	E

Appendix C: Weed removal techniques

WEED TYPE	EXAMPLE WEED SPECIES	PREFERRED CONTROL METHODS	CONSIDERATIONS
Small Plants Removable by Hand	 Small soft weeds and seedlings of any weed species, examples include: Panic Veldtgrass (<i>Ehrharta erecta</i>) Fleabane (<i>Conyza albida</i>) Crofton Weed (<i>Ageratina adenophora</i>) 	 Hand Removal (Minimal Disturbance): Step 1 – Gently remove and seeds or fruits and carefully place into a bag. Step 2 – Grasp the stem at ground level. Step 3 – Rock the plant backwards and forwards to loosen roots and pull out gently. Step 4 - Carefully tap the roots to dislodge any soil. Replace disturbed soil and pat down. 	 Leave weeds so that roots do not make contact with the soil or remove from site. Vary your body position to avoid fatigue when using hand removal continuously.
Vines and Scramblers	 Vines or scrambling plants with runners, examples include: Moth Vine (<i>Araujia sericifera</i>) Kikuyu Grass (<i>Pennisetum clandestinum</i>) Madeira Vine (<i>Anredera cordifolia</i>) 	 Hand Removal: Step 1 – Take hold of one runner and gently pull it along the ground towards you. Step 2 – Check points of resistance where fibrous roots grow from the nodes. Cut roots with a knife or dig out with a trowel and continues to follow the runner. Step 3 – The major root systems need to be removed manually or scrape / cut and painted with herbicide. Step 4 – Bag any reproductive parts. Step 1 – With a knife, scrape 15 to 30 cm of the stem to reach the layer below the bark / outer layer. Step 2 – Immediately apply herbicide along the length of the scrape. 	 A maximum of half the stem diameter should be scraped. Do not ring bark. Larger stems (>1 cm) should have two scrapes opposite each other. Aerial tubers on Madeira Vine should die with the plant when stem scraping is used. Those that fall from the plant in the scraping process need to be bagged. Vines can be left hanging in trees after treatment.

WEED TYPE	EXAMPLE WEED SPECIES	PREFERRED CONTROL METHODS	CONSIDERATIONS
Weeds with Underground Reproductive Structures	 Weeds with tap roots, rhizomes, tubers, bulbs and corms, examples include: Paddy's Lucerne (<i>Sida rhombifolia</i>) Asparagus Fern (<i>Asparagus aethiopicus</i>) Pampas Grass (<i>Cortaderia jubata</i>) Oxalis (<i>Oxalis</i> sp.) 	 Hand Removal of Plants With a Taproot (e.g. Paddy's Lucerne and Dandelions): Step 1 – Gently remove and bag seeds or fruit. Step 2 – Push a narrow trowel or knife into the ground next to the taproot. Carefully loosen soil. Repeat this step around the taproot. Step 3 – Grasp stem at ground level, rock plant backwards and forwards and pull gently. Step 4 – Gently tap the roots to dislodge soil. Replace disturbed soil and lightly pat down. Crowning (e.g. Pampas Grass and Asparagus Fern): Step 1 – Gently remove and bag stems with seeds or fruit. Step 2 – Grasp the leaves or stems together so that the base of the plant is visible. Step 3 – Insert, at an angle, a knife or lever, close to the "crown". Step 5 – Remove and bag the crown. Removal of Plants with Bulbs, Corms or Tubers (e.g. Onion Weed and Arrowhead Vine): Step 1 – Move leaf little away from the base of the plant. Step 2 – Dig down next to the stem until the bulb or tuber is reached. Step 3 – Remove plant and carefully bag the bulb or tuber. Herbicide Treatment – Stem Swiping: Step 1 – Gently remove any seed or fruit and carefully place into a bag. 	 Further digging may be required for plants with more that one tuber. Some bulbs (e.g. Oxalis, Onion Weed) may have small bulbils attached or present in the soil around it. These need to be removed. It may be quicker and mover effective to dig out the weed in some cases. Make sure native plants and seedlings will not be affected. Learn and understand how the herbicide works and determine the most appropriate time to apply to weeds, before flowering etc Some large grasses (e.g. Pampas Grass) may need to be trimmed back with a brush cutter to allow access to the base of the plant for crowning.

WEED TYPE	EXAMPLE WEED SPECIES	PREFERRED CONTROL METHODS	CONSIDERATIONS
Woody Weeds	Weed with woody stems and large shrubs ot trees, examples include:Lantana (<i>Lantana camara</i>)	Cut and Paint (for small to medium sized woody plants up to 10 cm basal diameter): Step 1 – Make a horizontal cut at cloes to the ground as possible	 Cuts should be horizontal to prevent herbicide from running off the stump sharp angle cuts are hazardous.
	• Bitou Bush (<i>Chrysanthemoides</i> monilifera)	with secateus loppers or a bush saw. Step 2 – Immediately apply herbicide to the exposed flat stump surface.	 Herbicide must be applied immediately before the plant cells close and translocation of the herbicide ceases.
		Stem Injection / Frilling or chipping (for use on larger shrubs or trees above 10 cm basal diameter and inaccessible sites where removal is a problem):	 If plants resprout, cut and paint the shoots after sufficient regrowth has occurred.
		Step 1 – <i>Injection</i> : At the base of the tree drill holes at a 45 degree angle into the sapwood at 5 cm intervals	 Stem scraping can be more effective on some woody weeds.
		 Frill / Chip: Make a cut into the sapwood with a chisel or axe. Step 2 – Fill each hole / cut with herbicide immediately. Step 3 – Repeat the process at 5 cm intervals around the tree. 	 Plants should be healthy and actively growing. Deciduous plants should be treated in spring and autumn when leaves are fully formed.
			• For multi-stemmed plants, inject or chip below the lowest branch or treat each stem individually.

All information within this table was obtained from the NSW Government Office of Environment and Heritage (2011) 'weed removal fact sheets for bush regenerators', 2011. Illustrated versions of this information available from http://www.environment.nsw.gov.au/cpp/WeedRemovalFactsheets.htm



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