N

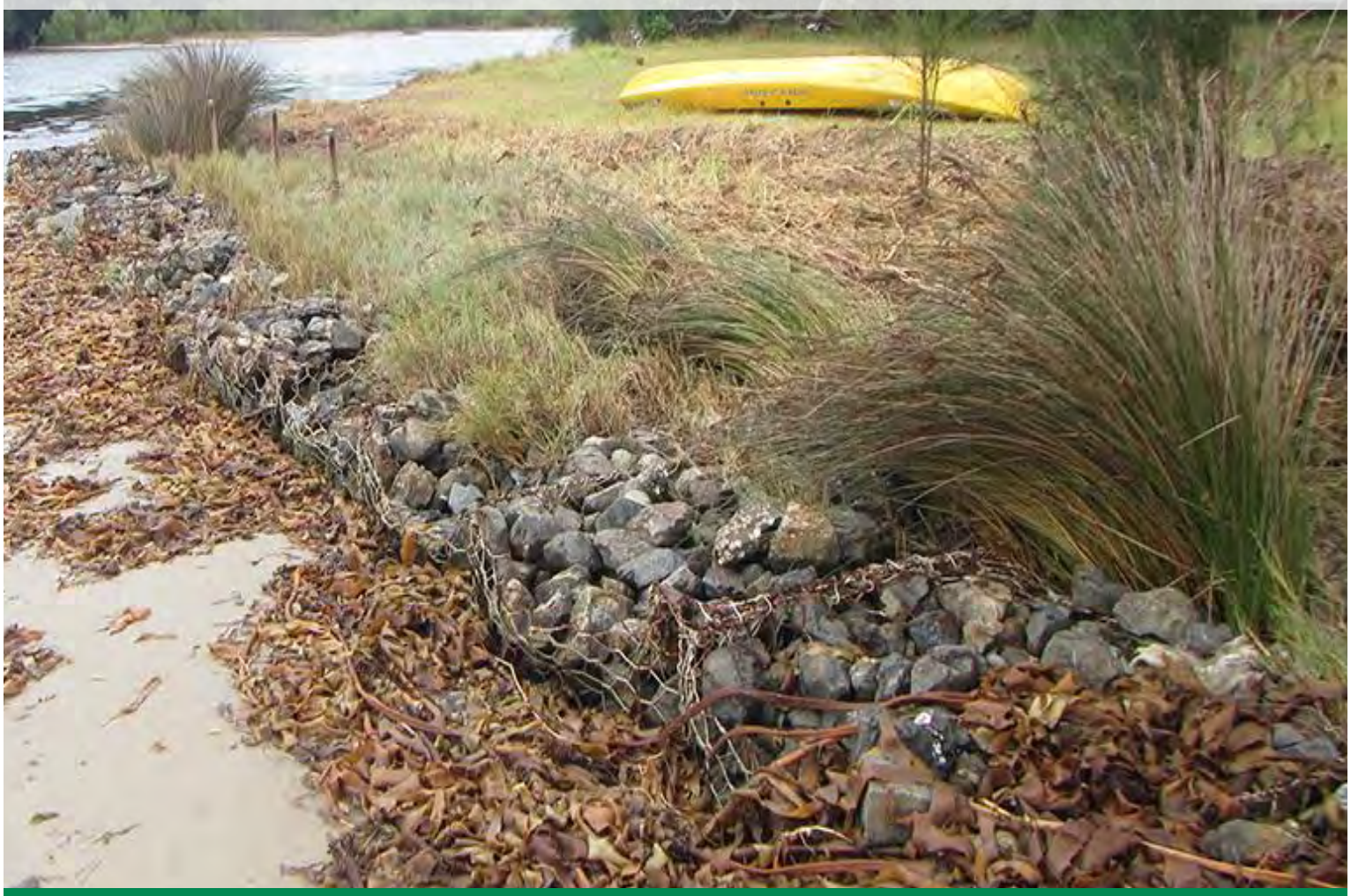
VEGETATION MANAGEMENT PLAN

ecosure

Conceptual Vegetation Management Plan – Proposed Seawall Arrawarra Caravan Park

Final Report
March 2017

Keiley Hunter Urban Planning



ecology / vegetation / wildlife / aquatic ecology / GIS

Contents

List of tables

1 Introduction

1.1 Summary

This conceptual vegetation management plan (VMP) has been prepared to address compensatory planting requirements for native vegetation removal associated with coastal protection works on Lot 1 and Lot 2 DP 1209371, Arrawarra Caravan Park (46 Arrawarra Beach Road, Arrawarra). This plan draws upon information provided in Coffs Harbour City Council's (CHCC) Development Control Plan (DCP) 2015 Appendix 2 guideline for preparing vegetation management plans, as well as the Australian Standard AS 4970 - 2009 (Protection of trees on development sites).

The proposed works consist of the construction of a seawall and revegetation of the associated E2 environmental conservation zone (CHCC 2013). The E2 environmental conservation zone consists of a riparian buffer, 20 m in width, within which a work zone of between 4 m and 6 m in width will facilitate the construction of the rock revetment wall.

It should be noted that this VMP is conceptual only and draws upon relevant components of the guideline. A detailed VMP will be prepared at a future date once a construction certificate is issued.

1.2 Description of site and project

For ease of reference the seawall will be referred to as the work zone. The E2 zone will be referred to as that area of the 20 m riparian buffer which excludes the work zone. The site (proposed E2 zone and work zone) forms part of an existing caravan park which is predominantly comprised of maintained lawn with scattered native and exotic trees. A tree survey undertaken in June 2016 identified the vegetation communities present on the site (Ecosure 2016). The vegetation across the site and adjoining caravan park is comprised largely of scattered mature remnant trees and regrowth native trees, which form a fragmented woodland canopy within a modified and cultivated parkland. Infrastructure associated with the caravan park e.g. caravans and cabins currently exists within and adjacent to the site. Although the vegetation is heavily fragmented and modified by past clearing and land uses, these communities are largely consistent with the CHCC fine-scale vegetation mapping (OEH 2012) being:

- Modified swamp sclerophyll (CH_DOF06) – scattered trees and heavily cleared understorey. This is the dominant vegetation type. The remainder of the vegetation is cleared/not mapped; however there is a pocket of modified swamp oak woodland (CH_FrW10) in the southeastern section of the site, and a small patch of saltmarsh vegetation (CH_SW01) in the east.

Mapped koala habitat area (OEH 2012) occurs over a portion of the eastern and southern sections of the site (Appendix 2).

Arrawarra Creek borders the site's eastern boundary (Arrawarra Gully) and southern boundary, while Yarrawarra Creek borders the property to the north. Topography on the site is relatively flat.

For further information and mapping of vegetation communities, refer to the Addendum to Statutory Ecological Assessment – Arrawarra Caravan Park (Ecosure 2016).

1.3 Aims and objectives

This VMP aims to:

- provide an overview of the location, species and density of vegetation to be planted to assist in compensating for vegetation removal
- provide details of how vegetation to be retained will be managed during and post construction works.

The objective of the conceptual VMP is to maximise revegetation of the site by undertaking compensatory planting, including the utilisation of koala feed trees where appropriate, and weed control in the E2 zone. This riparian zone will provide a vegetated buffer to Arrawarra and Yarrawarra Creeks.

2 Tree retention and protection

2.1 Tree retention/removal

A total of 136[1] trees comprising native, cultivated and exotic trees was identified within the E2 zone and work zone, with three of these trees found to be hollow bearing in a previous assessment (Naturecall 2015). Of these 136 trees, 70 occur within the work zone and 66 occur within the E2 zone (Figure 1 Maps 1 - 4, Appendix 1).

All native trees within the E2 zone will potentially be retained. There are 66 trees within the E2 zone; 33 are natives with the remaining 33 either cultivars or exotic (Table 1). Of the 33 native trees, 12 are potential koala feed trees (KFT) (Table 1).

Within the work zone, 70 trees were recorded, consisting of 54 native trees and the remainder cultivars or exotic. Of the 54 native trees, nine (9) are potential KFT (Table 1).

Table 1 Summary of trees within the E2 zone and work zone

Tree type	Work zone	E2 zone
Native	***54**	**33**
· Potential KFT	9	12
Cultivated/exotic	**16**	**33**
Total	**70**	**66**

*Reflects total number of native trees to be removed (for compensatory planting calculations)

All trees within the work zone will be removed. No hollow bearing trees were found within this area. All exotics will be removed from both the work zone and E2 zone. Cultivated trees will be retained where possible although these have not been included in compensatory planting calculations (Section 3.1).

Until a construction certificate is issued, the trees to be retained/removed are subject to change pending any alterations to the seawall design required by CHCC (or relevant authority). The tree locations were identified using handheld GPS. The number of trees to be removed (and thus the compensatory planting numbers) may change slightly due to GPS error (i.e. some identified for removal may be retained and vice versa). Any potential changes are likely to be minimal. We have taken a precautionary approach and included trees that are on the boundary between the work zone and the E2 zone, as occurring within the work zone and therefore requiring removal. Subsequently these have been included in calculating compensatory numbers.

[1] Only trees within the E2 zone and work zone have been provided in Figure 1 and Appendix 1. For information on all trees within the site and adjacent caravan park, refer to Ecosure 2016

It should also be noted that there were some data inconsistencies found between the two tree surveys (Ecosure 2016 and Naturecall 2015) with regards to hollow bearing trees and native tree locations. Variation in the data collection method, including accuracy of GPS devices used, is likely to have contributed to any differences. The most recent tree data was therefore used (Ecosure 2016) and as hollow bearing trees were not recorded at that time, the previous data was used (Naturecall 2015). There are three hollow bearing trees known to occur within the E2 zone (Appendix 2). As no hollow bearing trees have been observed within the work zone (Naturecall 2015), none will require removal as a result of the seawall works.

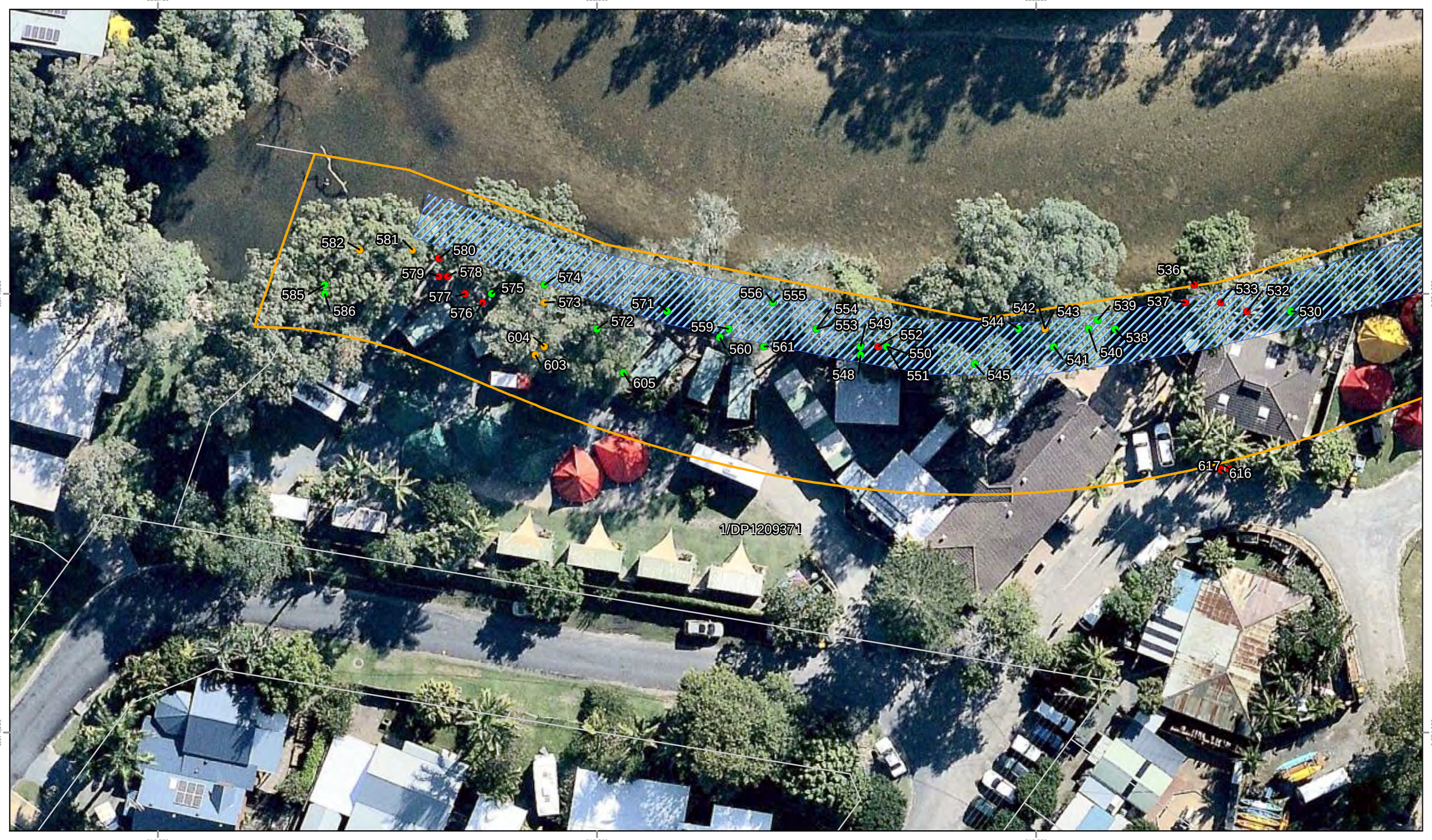


Figure 1: Conceptual VMP proposed seawall (Map 1 of 4)

Keiley Hunter Urban Planner

VMP proposed sea wall

Cultivated/Exotic

Koala habitat

Mangrove

Other Remnant native trees

Property boundary

E2 Zone

Work zone

*Tree numbers - refer to Appendix 1 for the tree data

ecosure

Job number: PR2323
Revision: 1
Author: ALM
Date: 13/03/2017

0 2 4 8
Metres

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

Data Sources: Arrawarra Shire Council, 2017 © Ecosure Pty Ltd, 2017; Image Nearmap, 2016
ECOSURE does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. ECOSURE shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

PR2323_MP1_Figure_1
A4

Figure 1: Conceptual VMP proposed seawall (Map 2 of 4)

Keiley Hunter Urban Planner

VMP proposed sea wall

- Cultivated/Exotic
- Koala habitat
- Mangrove
- Other Remnant native trees
- Property boundary
- E2 Zone
- Work zone

*Tree numbers - refer to Appendix 1 for the tree data

ecosure

Job number: PR2323
Revision: 1
Author: ALM
Date: 13/03/2017

0 2 4 8
Metres

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

Data Sources: Arrawarra Shire Council, 2017 © Ecosure Pty Ltd, 2017; Image Nearmap, 2016
ECOSURE does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. ECOSURE shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

PR2323_MP1_Figure_1
A4

Figure 1: Conceptual VMP proposed seawall (Map 3 of 4)

Keiley Hunter Urban Planner

VMP proposed sea wall

- Cultivated/Exotic
- Koala habitat
- Mangrove
- Other Remnant native trees
- Property boundary
- E2 Zone
- Work zone

*Tree numbers - refer to Appendix 1 for the tree data

ecosure

Job number: PR2323
Revision: 1
Author: ALM
Date: 13/03/2017

0 2 4 8
Metres

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

Data Sources: Arrawarra Shire Council, 2017 © Ecosure Pty Ltd, 2017; Image Nearmap, 2016
ECOSURE does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. ECOSURE shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

PR2323_MP1_Figure_1
A4

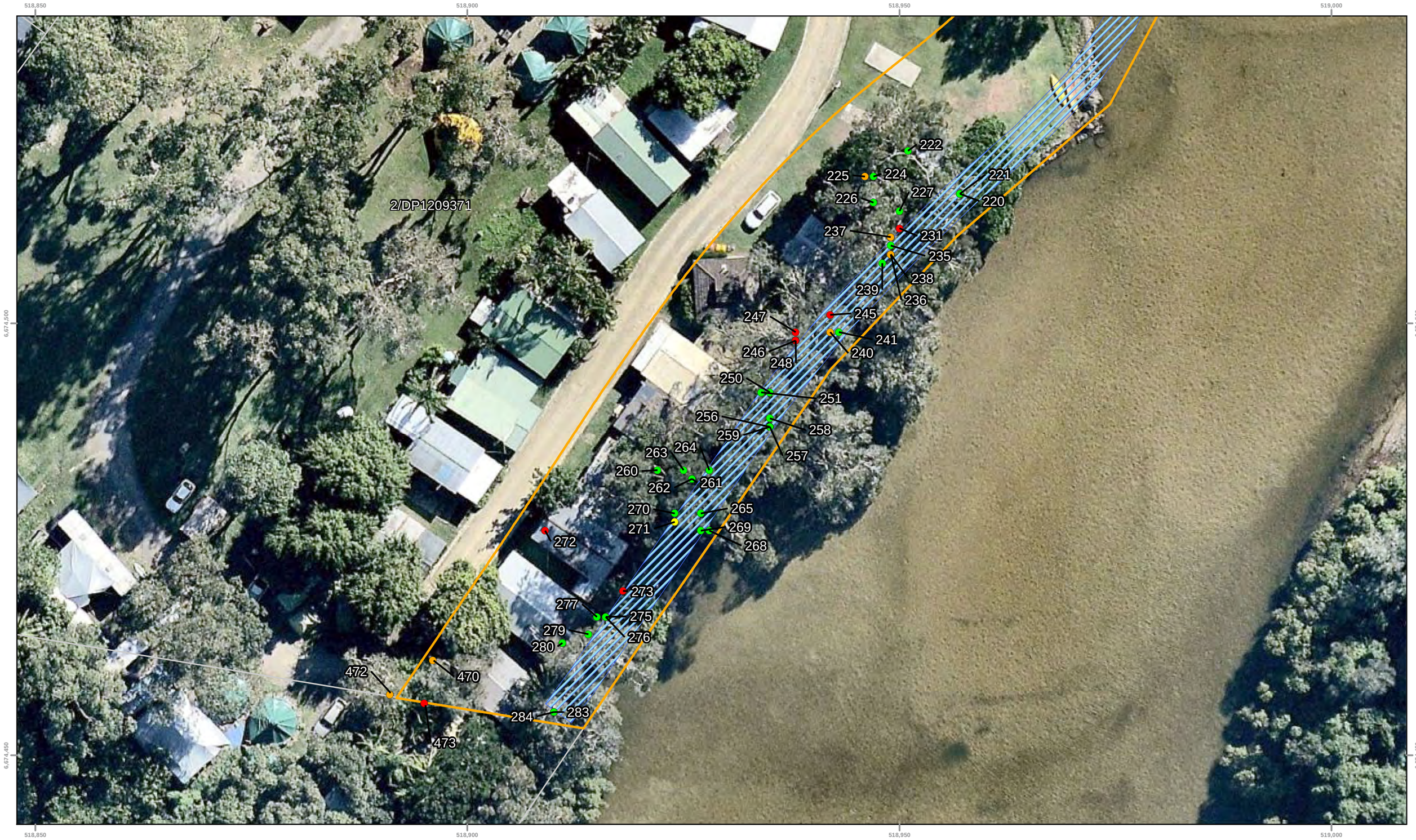


Figure 1: Conceptual VMP proposed seawall (Map 4 of 4)

Keiley Hunter Urban Planner

VMP proposed sea wall

- Cultivated/Exotic
- Koala habitat
- Mangrove
- Other Remnant native trees
- Property boundary
- E2 Zone
- Work zone

*Tree numbers - refer to Appendix 1 for the tree data

ecosure

Job number: PR2323
Revision: 1
Author: ALM
Date: 13/03/2017

0 2 4 8
Metres

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

Data Sources: Arrawarra Shire Council, 2017 © Ecosure Pty Ltd, 2017; Image Nearmap, 2016
ECOSURE does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. ECOSURE shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

PR2323_MP1_Figure_1
A4

2.2 Tree protection measures

Prior to any machinery arriving at site, tree protection fencing is to be installed around the tree protection zone (TPZ) of trees to be retained. Where groups of trees or communities are being retained, the fencing can be around the community rather than each single tree.

The tree protection fencing can be either:

- high visibility power webbing/mesh installed with 1500 mm stakes with 3 m centres

  or;
- rope flagging installed with 1500 mm stakes at 3 m centres.

Signs will be installed intermittently (at high visibility locations) stating that the fenced area is a TPZ, with no unauthorised access.

Once installed, fencing is not to be removed or altered until works with machinery have ceased, or access is required for rehabilitation purposes. In accordance with Australian Standard (AS) 4970 – 2009 (Protection of trees on development sites), the following activities are not permitted within the fenced off tree protection area:

- trenching or excavation
- placing of fill or sediment
- installation of sediment fencing
- cultivation activities, or parking of vehicles or plant
- storage of items
- mixing, storage or preparation of chemicals
- machine or equipment wash-downs or cleaning
- damage to vegetation
- any other activity detrimental to the ongoing health of the tree or vegetation to be retained.

In accordance with AS 4970-2009, the TPZ is calculated at 12 x diameter at breast height (DBH).

All personnel are to be briefed at the site induction on the tree protection locations and other relevant information, including the fact that the fencing is not to be removed. Fencing inspections are to be included on the supervisor's daily inspection sheet and maintained as required. Trees to be removed are to be felled away from any TPZ.

3 Restoration zone

3.1 Compensatory planting requirements

Based on the CHCC DCP (Section E1.2) environment controls, compensatory requirements, compensatory planting is to be provided for the removal of high conservation value vegetation. High conservation value vegetation applicable to the site and relevant rates are:

- hollow bearing trees (1:20)
- secondary B koala habitat - not adjacent to primary koala habitat (1:3)
- riparian zones (1:10)
- other (1:2).

As the work zone and E2 zone are classified as the riparian zone, and no hollow bearing trees are being removed, compensatory planting calculations have been based on the highest rate for vegetation removal applicable for this site; riparian zones 1:10. Based on the number of native trees within the work zone to be removed (54), the total compensatory planting required is **540 plants** (trees and shrubs/small trees). Note that cultivated and exotic trees have not been included in these numbers. Details of the species and composition of compensatory plants proposed are provided in Section 3.2.

The compensatory planting requirements have been calculated as preliminary only, as the exact number of trees to be removed will not be confirmed until the construction certificate is issued. As discussed in Section 2.1, trees will be retained where possible. Tree planting will be conducted to the maximum extent practical to offset the required tree removal. The revegetation will occur within the E2 zone riparian buffer on completion of the seawall construction.

Ongoing weed control works will be conducted for a period of four years by the land owner. Maintenance and monitoring will occur quarterly for the first four years after tree planting (however if weed occurrence is high, the maintenance/monitoring period should be increased). After four years, the maintenance/ monitoring period should be reassessed and adjusted appropriately.

The restoration of the E2 zone will enhance the ecological values of the area, as currently the vegetation is sparse with a mixture of native and exotic species and infrastructure e.g. caravans and cabins.

3.2 Restoration zone

The revegetation/restoration zone consists of the E2 zone adjacent to Yarrawarra and Arrawarra Creeks (including Arrawarra Gully). No large trees will be planted within 3 m of the work zone; however appropriate vegetation (shallow roots and prostrate growth pattern) can be planted along the top of the sloping face of the seawall. In addition:

- trees and shrubs/small trees will be planted at 1 per 4 m^2 i.e. for every second tree, a shrub/small tree will be substituted
- groundcovers to be planted at 1 per 4 m^2

Planting density will be at one tree or small tree/shrub per 4 m^2 which is approximately 2.5 times greater than the recommended guide for species selection in Stehn C1 (2015). These plantings will be supplemented by groundcover plantings. The densities will assist with reducing weed occurrence and will allow for a high ecological value environmental conservation area as well as accommodating compensatory planting requirements.

The E2 restoration zone is approximately 0.61 ha in size and could potentially accommodate 1533 plants (which surpasses the initial estimated compensatory planting requirement of 540 replacement plants). The planting area available will be confirmed once the construction certificate is issued.

Revegetation will incorporate KFT where possible. Mulch will be spread and tree guards erected to reduce predation. Tubestock will be used for revegetation works and will be sourced from a nursery specialising in local provenance species. Species have been selected from those observed at the site, the fine-scale vegetation map for the Coffs Harbour local government area vegetation community profiles, and the guide to species selection for revegetation projects in the Coffs Harbour Local Government Area (Stehn C1 2015) (Table 2).

Vehicle exclusion bollards (with one lockable bollard), will be required for any areas where the revegetated areas abut roads, to prevent unauthorised vehicle access. This will ensure the long-term protection of vegetation and reduce the potential of accidental damage.

Maintenance activities will need to be undertaken including:

- watering
- weed removal (see Section 3.3 below)
- replacement of lost plants
- mulching.

Due to the location and size of the restoration area, it should be easily accessed from the caravan park and maintenance undertaken on foot once the initial restoration works are completed.

Table 2 Recommended species planting list

Genus	Species	Common name	Form*	E2 zone	Littoral rainforest in E2+
Acmena	*smithii*	lilly pilly	ST	X	X
Allocasuarina	*littoralis*	black oak	ST	X	
Banksia	*integrifolia subsp. integrifolia*	coastal banksia	ST	X	X
Breynia	*oblongifolia*	dwarfs apple	SH	X	X
Callistemon	*salignus var. salignus*	white bottlebrush	ST	X	
Casuarina	*glauca*	swamp oak	ST	X	
Clerodendrum	*floribundum*	lolly bush	SH	X	
Corymbia	*intermedia*	pink bloodwood	T	X	
Cupaniopsis	*anacardioides*	tuckeroo	ST	X	X
Dianella	*caerulea*	blue flax lilly	GC	X	
Dianella	*longifolia*	dianella	GC	X	
Elaeocarpus	*obovatus*	hard quandong	ST	X	X
Elaeocarpus	*reticulatus*	blueberry ash	ST	X	
Eucalyptus	*microcorys*	tallowwood	T	X	
Eucalyptus	*propinqua*	small-fruited grey gum	T	X	
Eucalyptus	*robusta*	swamp mahogany	T	X	
Eucalyptus	*tereticornis*	forest red gum	T	X	
Eupomatia	*laurina*		T	X	
Euroshinus	*falcata*	ribbonwood	T		X
Glochidion	*ferdinandi var. ferdinandi*	cheese tree	ST	X	X
Glochidion	*sumatranum*	umbrella cheese tree, buttonwood	ST	X	
Hibbertia	*scandens*	hibbertia	GC	X	
Jagera	*pseudorhus*	foambark tree	ST		X
Lepidosperma	*lateralea*	variable sword sedge	GC	X	
Lomandra	*hystrix*	river mat-rush	GC	X	
Lomandra	*longifolia*	long-leaved mat-rush	GC	X	X
Lophostemon	*confertus*	brush box	T	X	X
Mallotus	*philippensis*	red kamala	ST		X
Melaleuca	*quinquenervia*	broad-leaved paperbark	ST	X	X
Pittosporum	*revolutum*	hairy pittosporum	SH	X	X
Smilax	*australis*		V		X
Syncarpia	*glomulifera subsp. glomulifera*	turpentine	T	X	
Syzgygium	*australe*		ST		X
Syzygium	*francisii*	giant water gum	T	X	
Syzygium	*luehmannii*	riberry	ST	X	
Tabernaemontana	*pandacaqui*	banana bush	SH	X	
Viola	*banksii*	native violet	GC		X

* T = tree ST = small tree SH = Shrub GC = Ground cover V = vine

\+ refer to Figure 1- Map 1 and Appendix 1, trees 549 to 551, for approximate area of Littoral rainforest plantings. This zone can be extended out (currently 600 m^2). Species selected from NSW Scientific Committee (2004), Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions

3.3 Weed control

It is expected that over time, the revegetated area will become a self-sustainable community. Weed control is likely to be required in the early stages of revegetation works (generally every three months), however after approximately four years will only be required on an as-needs basis. Any chemicals used for weed treatment are to be environmentally friendly (such as glyphosate bioactive) given the proximity to the creek. The land owner is to designate a responsible contractor specialising in native bushland maintenance to undertake weeding and replacement planting works and on-going monitoring/maintenance works. Appendix 3 provides best practice weed control methods that can be utilised for the management of this site. Weeds identified throughout the property (Lot 1 and Lot 2 DP 1209371) include asparagus fern *(Asparagus plumosus*) and blue billygoat weed (*Ageratum houstonianum*) (Table 3) (Naturecall 2015; Ecosure 2016).

Table 3 Weeds recorded within Lot 1 and Lot 2 DP 1209371

Genus	Species	Common Name
Ageratum	*houstonianum*	blue billygoat weed
Asparagus	*aethiopicus cv Sprengeri*	asparagus fern
Asparagus	*plumosus*	climbing asparagus fern
Axonopus	*compressus*	broad-leaved carpet grass
Baccharis	*halimifolia*	groundsel bush
Bidens	*bipinnata*	beggar's ticks
Chloris	*gayana*	Rhodes grass
Corymbia	*torelliana*	cadaghi
Crassocephalum	*crepidioides*	thickhead
Erythrina	*cristi-gali*	
Gamochaeta	*pensylvanica*	a cudweed
Hypochaeris	*radicata*	catsear, flatweed
Ixora	*sp cv*	lipstick plant
Lantana	*camara var. camara*	lantana
Nephrolepis	*cordifolia*	fishbone fern
Ochna	*serrulata*	mickey mouse bush
Rhaphiolepis	*indica*	indian hawthorn
Sansevieria	*trifasciata*	mother-in-Laws tongue
Schefflera	*actinophylla*	umbrella tree
Solanum	*mauritianum*	wild tobacco
Solanum	*nigrum*	blackberry nightshade
Solanum	*seaforthianum*	brazilian nightshade
Syagrus	*romanzoffiana*	cocos palm
Syngonium	*podophyllum*	syngonium
Trifolium	*repens var. repens*	white clover

4 Conclusion

This VMP provides an overview of the number of trees that could potentially require removal as part of the proposed seawall construction. The tree removal will be offset by planting within the E2 zone. Compensatory planting proposed within this VMP will meet the objectives of Section E1.2 of the Biodiversity DCP by:

- offsetting impacts associated with the removal (or other specified action) of high conservation value vegetation
- protecting and maintaining important linkages between habitats.

High conservation value vegetation will be removed from the site, however this vegetation (including KFT) is located within a highly modified urban area (caravan park) and does not currently have any protection in terms of inclusion within a conservation reserve or plan of management. Compensation for the construction of the proposed seawall will result in an area of replacement compensatory planting located within the remaining E2 zone. This revegetation area will be protected under CHCC environmental protection zone requirements and actions of a vegetation management plan to be annexed to the land.

Habitat linkages from crown land to the south of the site and the Coffs Coast Regional Park to the north will be significantly improved once the compensatory trees, shrubs and groundcovers are established in the E2 zone.

The number of trees to be removed/retained are preliminary only. Once the construction certificate is issued, the work zone will be finalised and the number of trees to be removed can then also be confirmed. Once the number of trees to be removed/retained has been determined, the final compensatory numbers will be determined.

The implementation of measures recommended in the conceptual VMP will assist in mitigating any impacts arising from the removal of vegetation. The ecological value will be improved through the revegetation works and ongoing weed control and maintenance.

References

CHCC (2013) Coffs Harbour Local Environmental Plan, NSW Legislation http://www.legislation.nsw.gov.au/#/view/EPI/2013/564/partlanduseta/include23 Accessed 13 March 2017

Stehn C1 (2015), *A guide to species selection for revegetation projects in the Coffs Harbour Local Government Area*, Coffs Harbour City Council, Coffs Harbour, New South Wales, Australia, unpublished draft report.

Office of Environment and Heritage (2012), *Fine-scale vegetation map for the Coffs Harbour local government area vegetation community profiles*. Office of Environment and Heritage, NSW.

Ecosure (2016), *Addendum to Statutory Ecological Assessment – Arrawarra Caravan Park*. Ecosure, Burleigh Heads.

Naturecall Environmental (2015), *Statutory Ecological Assessment Residental Subdiviion of Arrawarra Beach Caravan Park, Arrawarra*, Nature Call.

NSW Scientific Committee (2004), *Littoral rainforest in the NSW North Coast, Sydney Basin and South East Corner bioregions – endangered ecological community listing NSW Scientific Committee – final determination*, OEH

Standards Australia (2009), AS 4970-2009 *Australian Standard Protection of trees on development sites.* Standards Australia, Sydney.

Appendix 1
Preliminary tree removal/retention summary

ID number	Scientific Name	Common Name	Category	Location	Retain
190	*Banksia integrifolia*	Coastal Banksia	Remnant	Work zone	N
193	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
195	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Koala	E2	Y
197	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
198	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
199	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
204	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
205	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
214	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
215	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
216	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
217	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
218	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
220	*Cupaniopsis anacardioides*	Tuckeroo	Remnant	Work zone	N
221	*Cupaniopsis anacardioides*	Tuckeroo	Remnant	Work zone	N
222	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
224	*Cupaniopsis anacardioides*	Tuckeroo	Remnant	E2	Y
225	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Koala	E2	Y
226	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
227	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
231	*Howea forsteriana*	Kentia Palm	Cultivated	work zone	N
235	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
236	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Koala	Work zone	N
237	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Koala	Work zone	N
238	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Koala	Work zone	N
239	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
240	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Koala	Work zone	N
241	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
245	*Erythrina crista-galli*	Cockspur Coral Tree	Exotic	Work zone	N
246	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
247	*Erythrina crista-galli*	Cockspur Coral Tree	Exotic	E2	Y
248	*Howea forsteriana*	Kentia Palm	Cultivated	Work zone	N
250	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
251	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
256	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Koala	Work zone	N

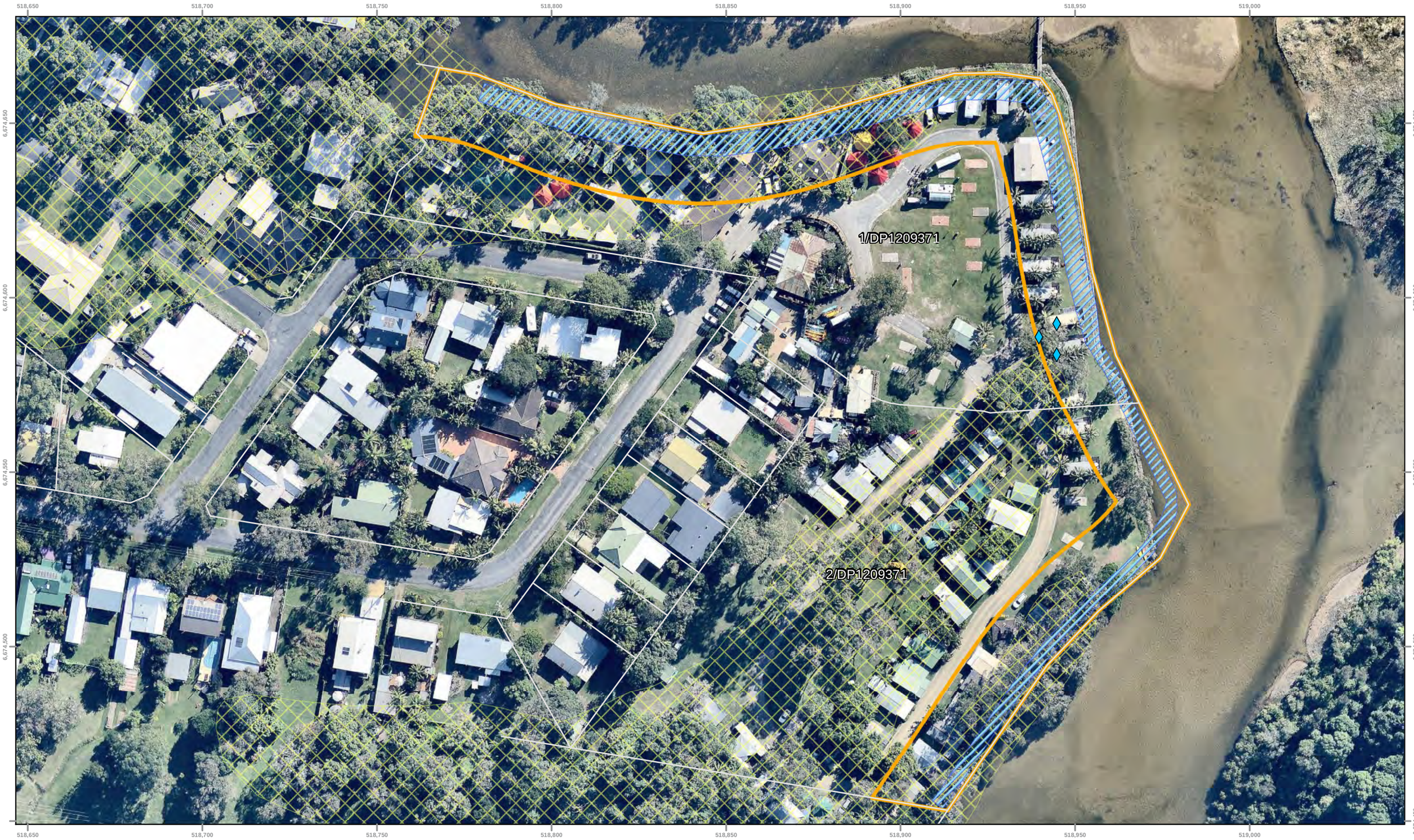
ID number	Scientific Name	Common Name	Category	Location	Retain
257	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
258	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
259	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
260	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
261	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
262	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
263	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
264	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
265	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
268	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
269	*Banksia integrifolia*	Coastal Banksia	Remnant	Work zone	N
270	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
271	*Avicennia marina*	Grey Mangrove	Mangrove	Work zone	N
272	*Schefflera arboricola*	Arbour Tree	Cultivated	E2	Y
273	*Howea forsteriana*	Kentia Palm	Cultivated	Work zone	N
275	*Howea forsteriana*	Kentia Palm	Cultivated	Work zone	N
276	*Clerodendrum floribundum*	Lolly Bush	Remnant	Work zone	N
277	*Cupaniopsis anacardioides*	Tuckeroo	Remnant	E2	Y
279	*Casuarina glauca*	Swamp Oak	Remnant	E2	Y
280	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
283	*Howea forsteriana*	Kentia Palm	Cultivated	Work zone	N
284	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
470	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Koala	E2	Y
472	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Koala	E2	Y
473	*Ficus benjamina*	Benjamin's Fig	Cultivated	E2	Y
485	*Eucalyptus robusta*	Swamp Mahogany	Koala	E2	Y
486	*Melaleuca quinquenervia*	Broad-leaved Paperbark	Koala	E2	Y
487	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
488	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
489	*Archontophoenix alexandrae*	Alexander Palm	Cultivated	E2	Y
491	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
492	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
493	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
496	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
497	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
499	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y

ID number	Scientific Name	Common Name	Category	Location	Retain
500	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
501	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
502	*Howea forsteriana*	Kentia Palm	Cultivated	Work zone	N
503	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
504	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
505	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
506	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
507	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
508	*Howea forsteriana*	Kentia Palm	Cultivated	E2	Y
509	*Syagrus romanzoffiana*	Queen Palm	Cultivated	E2	Y
510	*Syagrus romanzoffiana*	Queen Palm	Cultivated	E2	Y
511	*Syagrus romanzoffiana*	Queen Palm	Cultivated	Work zone	N
512	*Cupaniopsis anacardioides*	Tuckeroo	Remnant	Work zone	N
513	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
515	*Ficus benjamina*	Benjamin's Fig	Cultivated	E2	Y
516	*Eucalyptus robusta*	Swamp Mahogany	Koala	E2	Y
523	*Howea forsteriana*	Kentia Palm	Cultivated	Work zone	N
524	*Erythrina crista-galli*	Cockspur Coral Tree	Exotic	Work zone	N
525	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
526	*Tecoma stans*	Tecoma	Exotic	Work zone	N
528	*Eucalyptus robusta*	Swamp Mahogany	Koala	E2	Y
530	*Rhizophora stylosa*	Red Mangrove	Remnant	Work zone	N
532	*Howea forsteriana*	Kentia Palm	Cultivated	Work zone	N
533	*Howea forsteriana*	Kentia Palm	Cultivated	Work zone	N
536	*Howea forsteriana*	Kentia Palm	Cultivated	Work zone	N
537	*Howea forsteriana*	Kentia Palm	Cultivated	Work zone	N
538	*Eleocarpus ovatus*	Hard Quandong	Remnant	Work zone	N
539	*Ficus rubinogosa*	Port Jackson Fig	Remnant	Work zone	N
540	*Ficus rubinogosa*	Port Jackson Fig	Remnant	Work zone	N
541	*Ficus rubinogosa*	Port Jackson Fig	Remnant	Work zone	N
542	*Eucalyptus robusta*	Swamp Mahogany	Koala	Work zone	N
543	*Eucalyptus robusta*	Swamp Mahogany	Koala	Work zone	N
544	*Euroshinus falcata*	Ribbonwood	Remnant	Work zone	N
545	*Syncarpia glomulifera*	Terpentine	Remnant	Work zone	N
548	*Guioa semiglauca*	Wild Quince	Remnant	Work zone	N
549	*Euroshinus falcata*	Ribbonwood	Remnant	Work zone	N

ID number	Scientific Name	Common Name	Category	Location	Retain
550	*Euroshinus falcata*	Ribbonwood	Remnant	Work zone	N
551	*Ficus rubinogosa*	Port Jackson Fig	Remnant	Work zone	N
552	*Erythrina crista-galli*	Cockspur Coral Tree	Exotic	Work zone	N
553	*Eucalyptus robusta*	Swamp Mahogany	Koala	Work zone	N
554	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
555	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
556	*Ficus coronata*	Sandpaper Fig	Remnant	Work zone	N
559	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
560	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
561	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
571	*Casuarina glauca*	Swamp Oak	Remnant	Work zone	N
572	*Rhodosphaera rhodanthema*	Red Yellow Wood	Remnant	Work zone	N
573	*Eucalyptus microcorys*	Tallowood	Koala	Work zone	N
574	*Ficus coronata*	Sandpaper Fig	Remnant	Work zone	N
575	*Cupaniopsis anacardioides*	Tuckeroo	Remnant	E2	Y
576	*Syagrus romanzoffiana*	Queen Palm	Cultivated	E2	Y
577	*Syagrus romanzoffiana*	Queen Palm	Cultivated	E2	Y
578	*Syagrus romanzoffiana*	Queen Palm	Cultivated	E2	Y
579	*Syagrus romanzoffiana*	Queen Palm	Cultivated	E2	Y
580	*Syagrus romanzoffiana*	Queen Palm	Cultivated	E2	Y
581	*Eucalyptus robusta*	Swamp Mahogany	Koala	E2	Y
582	*Eucalyptus microcorys*	Tallowood	Koala	E2	Y
585	*Syncarpia glomulifera*	Terpentine	Remnant	E2	Y
586	*Corymbia intermedia*	Pink Bloodwood	Remnant	E2	Y
603	*Eucalyptus robusta*	Swamp Mahogany	Koala	E2	Y
604	*Eucalyptus robusta*	Swamp Mahogany	Koala	E2	Y
605	*Callistemon salignus*	Willow Bottlebrush	Remnant	E2	Y
616	*Archontophoenix alexandrae*	Alexander Palm	Cultivated	E2	Y
617	*Archontophoenix alexandrae*	Alexander Palm	Cultivated	E2	Y

Note - tree locations taken using GPS, therefore actual on-ground locations may differ from those mapped.

Appendix 2 Hollow bearing trees



Appendix 2: Hollow bearing trees to be retained

Keiley Hunter Urban Planner

VMP proposed sea wall

Hollow-bearing trees

Property boundary

E2 Zone

Work zone

Mapped koala habitat (CHCC city wide mapping)

ecosure

Job number: PR2323
Revision: 1
Author: ALM
Date: 13/03/2017

0 5 10 20
Metres

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

Data Sources: Arrawarra Shire Council, 2016; © Ecosure Pty Ltd, 2017; Image Nearmap, 2016
ECOSURE does not warrant the accuracy or completeness of information displayed in this map and any person using it does so at their own risk. ECOSURE shall bear no responsibility or liability for any errors, faults, defects, or omissions in the information.

PR2323_MP2_Appendix2
A4

Appendix 3
Weed removal methods

Cut-scrape-paint method (CS&P)

This method applies to all woody shrubs, trees and some vines.

1. Cut plant low to the ground (approx. 1–2 cm above soil level) and level so herbicide does not run off. Cut stems are less hazardous to workers who may kneel on the ground at a later date.
2. Apply herbicide immediately at the suitable rate with a paintbrush approximately 1.5 cm wide.
3. Scrape 3-4 sides of the remaining stump lightly to reveal green tissue and apply the herbicide to the scraped area.
4. Take care that the brush is not contaminated with soil.

Note all seed that has high viability and longevity should be removed from the parent and removed from the site e.g. Senna spp. and other members of the *Fabaceae* family with large seed pods or plants with a high invasive potential such as moth vine (*Araujia sericifera*).

Note larger trunks, stems or tubers should be scraped and painted in sections as cells quickly shut down once exposed preventing the translocation of herbicide.

Gouge-paint method

This method applies to those plant species that have a fleshy root system such as rhizomes or large bulbs. It is particularly appropriate for the treatment of Kahili ginger (*Hedychium gardnerianum*) or canna lily (*Canna indica*) but can also be applied to prickly pear (*Opuntia spp.*) if each cladode (flattened stem) is treated.

1. Cut the stems of the plant at head height and then at ground level. The stems are then cut up and spread over the ground to act as part of the leaf litter.
2. Gouge out sections of the fleshy base with a knife.
3. Apply herbicide at the recommended rate with a paintbrush approximately 1.5 cm wide avoiding contact with soils.

Stem Injection method

This method applies to all woody trees and shrubs with a diameter of about 6-10 cm or greater.

1. With a tomahawk make a cut the width of the blade at an angle of about 45 degrees into the trunk.
2. Apply herbicide at recommended rate immediately into the cut using a tree injecting device.

3. Repeat this procedure in a brickwork pattern around the circumference of the tree as close to the ground as possible. Where the presence of a crotch angle makes this difficult make a cut above it. Ensure cuts are also made on the inside of forks. This may need to be done with a Drill, Hand Saw or Chisel. Note two rows of cuts will be sufficient for trees with trunks of 6-10 cm. Larger trunk diameters will need correspondingly more.
4. Treat all visible lateral roots as per 1 and 2.

Note stem injection can also be carried out using a drill. Holes can be inserted approximately 10 cm apart and filled with the appropriate herbicide. Lateral roots should also be drilled and filled with the appropriate herbicide.

Scrape and paint method

This method is applicable to many species of vines where it is desirable to treat the vines intact, particularly those with aerial tubers such as Madeira vine (*Anredera cordifolia*) or those which will propagate from segments e.g. Cape ivy (*Delairia odora*ta).

1. Remove and bag tubers before scraping to avoid dislodging them during treatment.
2. Scrape the stem tissue on one side of the stem only for up to 100cm if possible before leaving a small gap (approx. 5cm) and changing sides. Note on Madeira vine it is necessary to scrape heavily, to expose white inner tissue. Scrape as much of the stem as possible.
3. Apply undiluted Glyphosate with a paintbrush within 7 seconds of scraping the stem i.e. scrape and paint in sections.
4. In the case of *Anredera cordifolia* (Madeira vine) it is essential that ground tubers and lateral roots are also treated with a heavy scrape and paint. If the tuber is of substantial size a gouge can be made into the tuber with a knife and apply herbicide. Any side roots must also be scraped and painted.

Spot spraying method

This is carried out using a 15 litre backpack spray unit with a modified spray nozzle that gives an accurate and easily adjustable spray pattern e.g. Rega®. It is advised to fill up the backpack to 10 litres only, to avoid back strain, particularly where spraying for extended periods. All rates in control methods (Appendix 8) are for a 10 L amount. Glyphosate and metsulfuron methyl are the main herbicides used with the addition of a marker dye. A surfactant such as Pulse® is added in some treatments to assist the transfer of the herbicide through the surface tissue – particularly plants with waxy leaves, such as camphor laurel, Madeira vine and trad.

Overspray method

This method is applicable to large, dense infestations of such plants as lantana (Lantana camara). This method may be used where it is desirable to leave partially dead or dead plants intact to prevent erosion and over exposure of large areas, to protect native seedlings from predators such as wallabies, to avoid trampling, to retain habitat and to save on resources.

1. Spray over the top of the infestation using a solution of water and herbicide at the recommended rate. **Note** any native plants that may be under the weed will be protected by the foliage cover of the weed.
2. Leave the sprayed plants intact so that native seedlings can establish under the shelter provided.
3. **Alternatively**, weeds can be cut and flattened with brush hooks or loppers and the subsequent regrowth sprayed with glyphosate or metsulfuron methyl (species specific).

Crowning method

This method is applicable to weeds which have their growing points at ground level or below the surface of the ground such as corms, bulbs, rhizomes, clumped or fibrous root systems e.g. Asparagus spp., spider plant (*Chlorophytum comosum*) and grasses.

1. Cut asparagus vines at head height.
2. Grasp the leaves or stems and hold them tightly and close to the ground so that the base of the plant is visible.
3. Insert the knife close to the base of the plant at a slight angle with the tip well under the root system.
4. Cut through the roots close to the base. Depending on the size of the plant two or more cuts may be needed to sever all the roots.
5. Remove the plant. Make sure that the base of the plant where the roots begin is completely removed.
6. Shake off excess soil and hang the plant up in a tree to prevent it from reshooting, or remove it from site. NB. If Asparagus sp. have a huge rhizome, cut at head height and then cut through entire rhizome, (may need to do with loppers or a hand saw, Scrape and Paint.

Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed by	Approved by
00	27/01/2017	Conceptual VMP – Proposed Seawall Arrawarra Caravan Park	Trudy Thompson Senior Environmental Scientist	Julie Whelan Senior Environmental Scientist	Beth Kramer Gold Coast Environmental Manager
Final	13/03/2017	Conceptual VMP – Proposed Seawall Arrawarra Caravan Park Final Report; updated to reflect client comments	Trudy Thompson Senior Environmental Scientist	Elvira Lanham Principal Ecologist	

Distribution List

Copy #	Date	Type	Issued to	Name
1	13/03/2017	Electronic	Keiley Hunter Urban Planner	K. Hunter
2	13/03/2017	Electronic	Ecosure	Administration

Citation: Ecosure (2017), Conceptual Vegetation Management Plan – Proposed Seawall Arrawarra Caravan Park Final Report, Report to Keiley Hunter, Compiled by Ecosure Pty Ltd, Coffs Harbour

ABN: 63 106 067 976

admin@ecosure.com.au www.ecosure.com.au

PR2323-RE.Conceptual VMP Proposed Seawall.FI

Adelaide
PO Box 145
Pooraka SA 5095
P 1300 112 021
M 0407 295 766

Brisbane
PO Box 675
Fortitude Valley QLD 4006
P 07 3606 1030

Coffs Harbour
PO Box 4370
Coffs Harbour Jetty NSW 2450
P 02 562 8103

Gold Coast
PO Box 404
West Burleigh QLD 4219
P 07 5508 2046
F 07 5508 2544

Rockhampton
PO Box 235
Rockhampton QLD 4700
P 07 4994 1000
F 07 4994 1012

Sydney
PO Box 880
Surry Hills NSW 2010
P 1300 112 021

Environment ISO 14001 Quality ISO 9001 Health & Safety AS 4801

© Ecosure Proprietary Limited 2017
Commercial in confidence. The information contained in this document produced by Ecosure Pty Ltd is solely for the use of the Client identified on the cover sheet for the purpose for which it has been prepared and Ecosure Pty Ltd undertakes no duty to or accepts any responsibility to any third party who may rely upon this document. All rights reserved. No section or element of this document may be removed from this documents, reproduced, electronically stored or transmitted in any form without the written permission of Ecosure Pty Ltd.