

55 Martin Road, Badgerys Creek:

Flora and Fauna Survey and Impact Assessment

For Brent M Winning JP

By Ecological Consultants Australia Pty Ltd

March 2018



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 Mia Dalby-Ball with qualifications BSc. majoring in Ecology and Botany with over 20 years' experience in this field, Lisa Jones and Julian Reyes with qualifications BSc. Majoring in Ecology.

Limitations Statement

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

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Signed: Geraldene Dalby-Ball – Director of Ecological Consultants Australia

A handwritten signature in black ink, appearing to read "G Dalby Ball".

Executive Summary

Introduction

- The development will consist of the instalment of a waste resource and recovery facility, associated parking and retaining the existing dwelling at 55 Martin Rd Badgerys Creek NSW 2555.
- Due to the ecological values of the site, a Flora and Fauna Impact Assessment has been utilised to assess any damage from proposed works and off-target damage. Recommendations will be provided to reduce the likelihood of impact and mitigate loss.

Methods

- On-ground survey commenced on the 27th of October 2017 and again in November by Ecologist Nicholas Yu.
- Flora and fauna observations were recorded on-site using binoculars, torches and physical examination. Notes, photos and samples of flora species were taken to assess ecological health and value of the site.
- Bionet searches were performed for flora, fauna and endangered populations to identify if there were previous records of threatened species occurring within the local area using a 10km radius around the site.
- A flora and fauna survey and impact assessment were conducted rather than a biobanking assessment as this location falls within the interim proceedings (until later this year) being application of the 7-part test (rather than 5-part) and biobanking being optional. The co-author (Geraldene Dalby-Ball) if fully training in the most recent and Biobanking and environmental legislative changes and has included offsets, by way of on-site amelioration, through planting and native plant regeneration around trees to be retained. Details are included has been included in this report and accompanying landscape documentation.

Results

- The vegetation at the western end of the site is indicative of Shale Plains Woodland, also Identified as Cumberland Plain Woodland a Critically Endangered Ecological Community (CEEC) under the BC Act 2016 and Critically Endangered under the EPBC Act 1999. Shale Gravel Transition Forest EEC
- No threatened flora or fauna species were found on-site during on site searches;
- The site may be providing habitat for threatened fauna species a Test of Significance has been conducted for threatened species possibly in the area with habitat on-site;

Mitigation Measures

Prior to commencement of works:

- Tree Protection as per Arborist report by Glenyss Laws (March 2018).
- Work areas to be delineated to avoid unnecessary disturbance to soil and vegetation.
- Removal of Weeds to prevent spread of seed.
- Seed collection from any native trees approved for pruning or felling and from any other native vegetation. Seed to be propagated and used in post works revegetation or donated to an appropriate group for reuse near-by.

During works:

- Tree protection as per arborist report.
- Dead wood including upright dead trees and fallen logs (>10cm diameter) on the ground will be included into the areas retained both as landscaping and regeneration. Logs to be retained and protected during works as they provide high quality habitat for threatened fauna species, refer to
- Bush hygiene protocols are to be followed to prevent the spread of pathogens including *Phytophthora*.
- Weed management is required throughout works so that areas on site and surrounds are not degraded further by weed species.

After completion of works:

- Revegetation works with native species from the EEC and locally sourced. See Landscaping Plan for flora species and regeneration and planting details.
- Seed collected from removed vegetation to be propagated and where possible planted on-site or near-by or provided to a nursery that specialises in native species.
- Retained dead wood (over 10cm diameter) to be re-introduced to the site as habitat.
- At least two (2) microbat nest boxes are to be installed on site.

Conclusions and Recommendations

- The footprint of the proposed building / wash bay / carpark layout has been modified a number of times to reduce impact on ecological values – mostly the trees. Trees are still proposed for removal however with ~ 5 native trees proposed to be removed (see arborist report for details).
- Recommendations are to preserve and increase ecological value and condition of the site by maintaining EEC species present on-site, by having areas delineated for natural regeneration and areas for planting with planting being with locally native species to this vegetation group.
- Specific recommendations are provided in the document regarding weed management and arborist recommendations for tree care.
- Landscaping Plan provides details for retention and replanting and regenerating of native species and communities and habitats for native fauna.
- At least two (2) microbat nest boxes are to be installed on site.
- No significant impact on endangered ecological communities or threatened species due to proposed works.
- Ongoing maintenance of environmental and ecological actions is required.

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1 Introduction

Ecological Consultants Australia (ECA) has been contracted by CLARON CONSULTING PTY LTD, to provide an “Assessment of Significance” to assess potential direct and indirect impacts on the fauna and vegetation communities present within the site as per section 5A of the Environmental Planning & Assessment Act 1979. The ‘Assessment of Significance’ has been undertaken in accordance with the NSW Department of Environment & Climate Change ‘Threatened species assessment guidelines’.

It is understood that this report is to form part of a Development Application for a proposed subdivision of the current lot into four separate lots.

1.1 Legislation and policy

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

- *Cwlth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).*
- *Environmental Planning and Assessment Act 1979 (EP&A Act).*
- *Threatened Species Conservation Act 1995 (TSC Act).*
- *Fisheries Management Act 1994 (FM Act).*
- *National Parks & Wildlife Act 1974 (NP&W Act).*
- *Noxious Weeds Act 1993 (NW Act).*

1.2 Scope of works

ECA has accepted to provide ecological report and advice associated with the DA for the new dwellings and associated works. This includes the following.

- 1) Flora and Fauna Impact Assessment – including test of significance for threatened species;

The objectives of this Flora and Fauna Impact Assessment are to:

- Identify any native vegetation communities, significant species or significant habitat features present within the study area.
- Identify any known or potential habitat for threatened species.
- Review the implications of relevant biodiversity legislation and policy.
- Identify potential impacts on significant ecological communities, species or habitats from the proposed development and provide recommendations to assist with the mitigation of those potential impacts during the construction and operation stages.
- Recommend any further assessments of the site that may be required (such as targeted searches for significant species within inaccessible parts of the study area or considered to be at a low level of detectability at the time of the surveys).

All reporting will be done in communication with the Architect and any other background reports. These reports will be consistent with Liverpool City Council’s requirements.

Works include a site survey/assessment, review of project design and review of available literature to produce site specific ecological and environmental effects report. ECA will review arborist assessments and any additional reports. In addition, works will require liaison with the architect and landscape architect to ensure both comprehensive and consistent documentation and Liverpool City Council if required.

1.1 Limitations of the Study

The purpose of the flora and fauna work is to assess the sites ecological value, particularly listed species, communities and population. An impact assessment and associated Tests of Significance (7-part tests) have been conducted.

Limitations of the study may arise where certain cryptic species of plants may occur as soil-stored seed or as subterranean vegetative structures. Some species are identifiable above-ground only after particular environmental circumstances related to factors such as periodic fire frequency, intensity or seasonality, soil moisture regime, grazing pressure, biological life-cycle patterns as in the case of small plants such as species of orchids etc. No specific invertebrate surveys were conducted.

Surveys at one time of the year cannot be expected to detect the presence of all species occurring, or likely to occur, in the study area. This is because some species may (a) occur seasonally, (b) utilise different areas periodically (as a component of a more extensive home range), or (c) become dormant during specific periods of the year. Rather, the survey provides the opportunity to sample the area, search specifically for species likely to be encountered within the available time frame and assess the suitability of habitat for particular species.

Considering the site and habitat availability ECA are confident that this survey is representative of the likely species and vegetation community and that future studies at other times would not change the conclusions in this report.

NB: this is not a full flora and fauna survey however specific searches were made for species listed on the Threatened Species lists of TSC Act and EPBC Act.

1.2 Site Location

The site is a rural block of land identified as Lot 4, DP 611519 located at 55 Martin Rd Badgerys Creek NSW 2555, NSW, in the Liverpool City Council LGA. The property is located on the western side of Martin Rd and is boarded by Lawson Rd to the west. The site is located 40 kilometres west of the Sydney CBD. See Figure 1 for aerial photograph of site location.

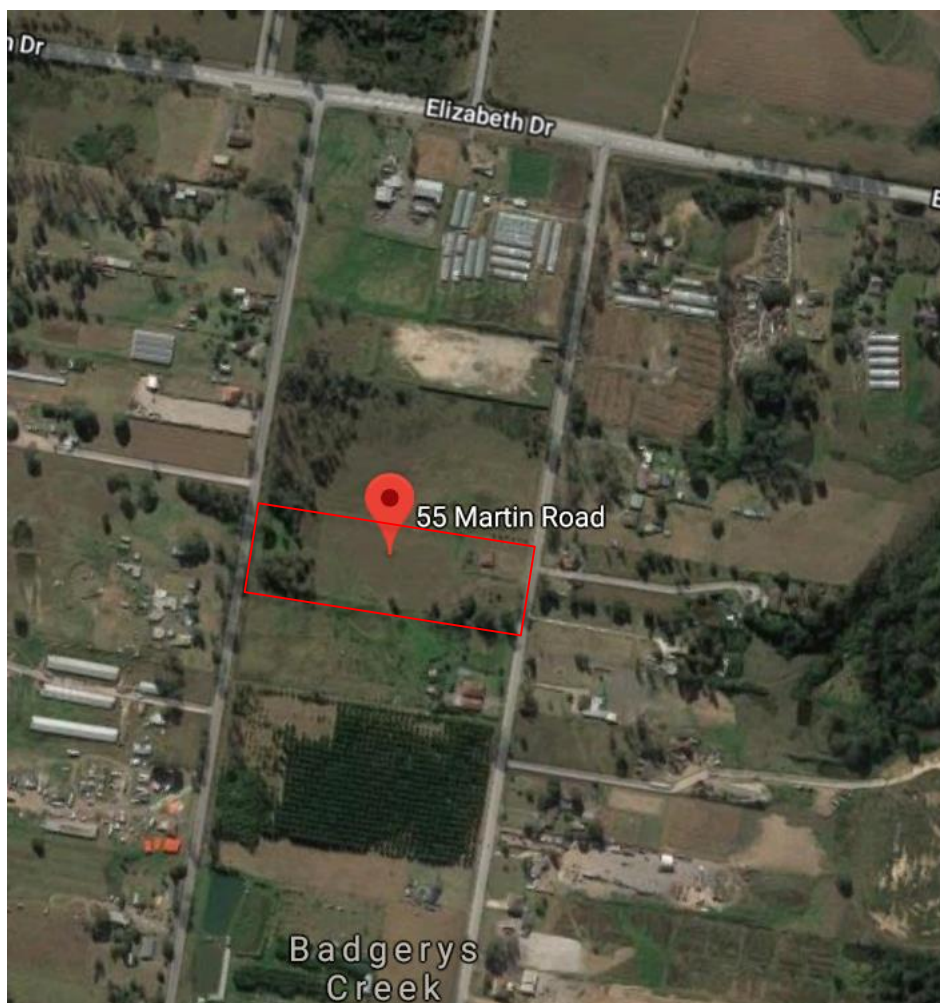


Figure 1. Site location with approximate property boundaries. Source: GoogleMaps, February 2018.

1.3 Ecology of the site

The site offers a range of ecological values and functions given to the wider ecological community. In accordance with Badgerys Creek Biodiversity Report prepared by SMEC, the area has two specific vegetation types: shale plains woodland and shale hills woodland, both components of Cumberland Plain Woodland. Additionally, shale gravel transition forest has also been identified in the area. This site has the potential for developing mature tree hollows for an array of animals to occupy.

2 Proposed Actions

The proposed actions involve the instalment of a waste resource and recovery facility, associated parking and retaining the existing dwelling. The plans show the proposed actions will have an impact on several trees in the property. The Arboricultural Report assessed seventeen individual trees plus a cluster of six closely aligned specimens, from which eight trees have been proposed for removal by the Arborist. This has primarily triggered the need for a Flora and Fauna Impact Assessment report to meet DA Council conditions.

The site currently has four (4) distinct areas which will be referred in this report as: Shale Plains Woodland area, Shale/Gravel Transition Forest area, Shale Hills Woodland area and Proposed Development area (see Figure 2 below).

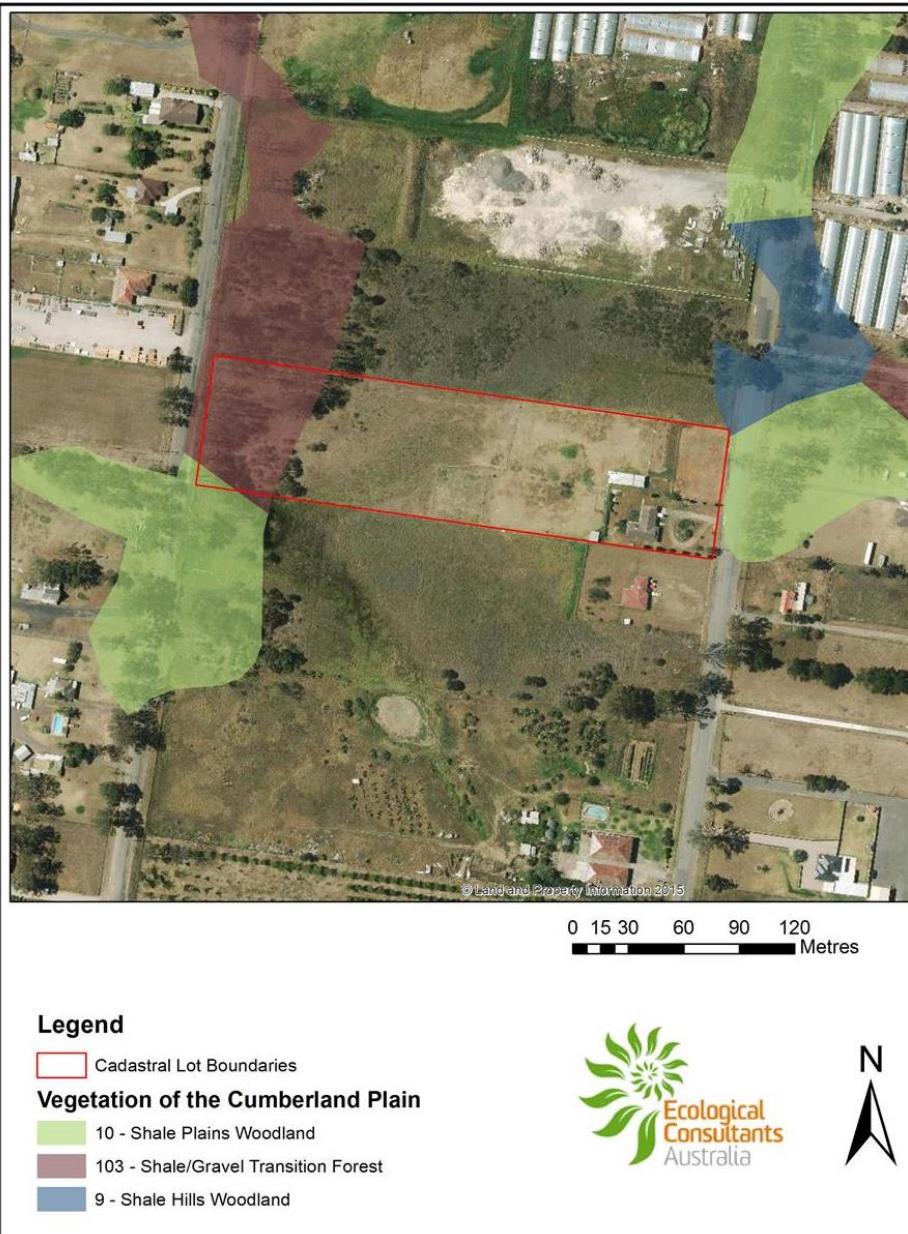
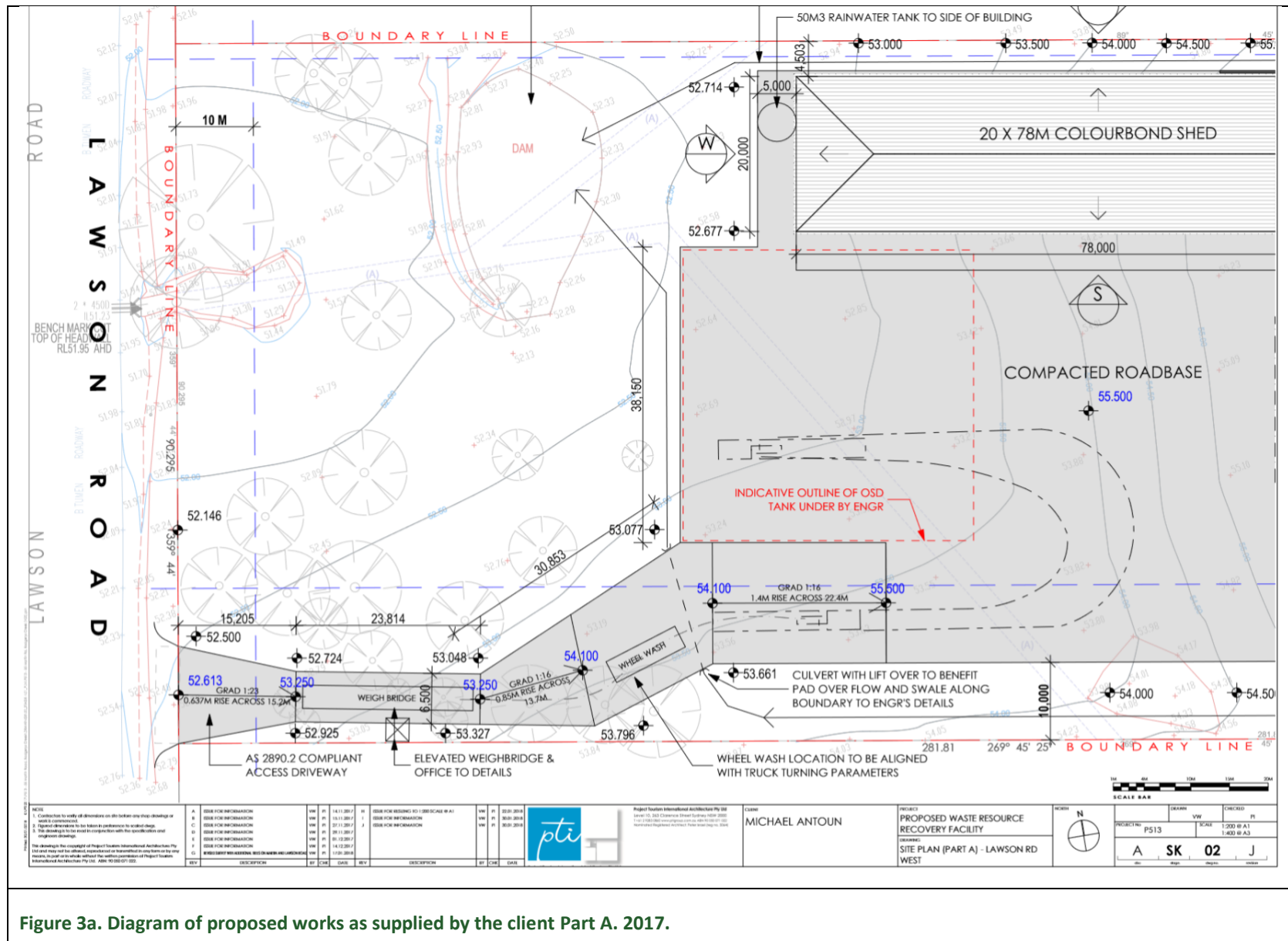
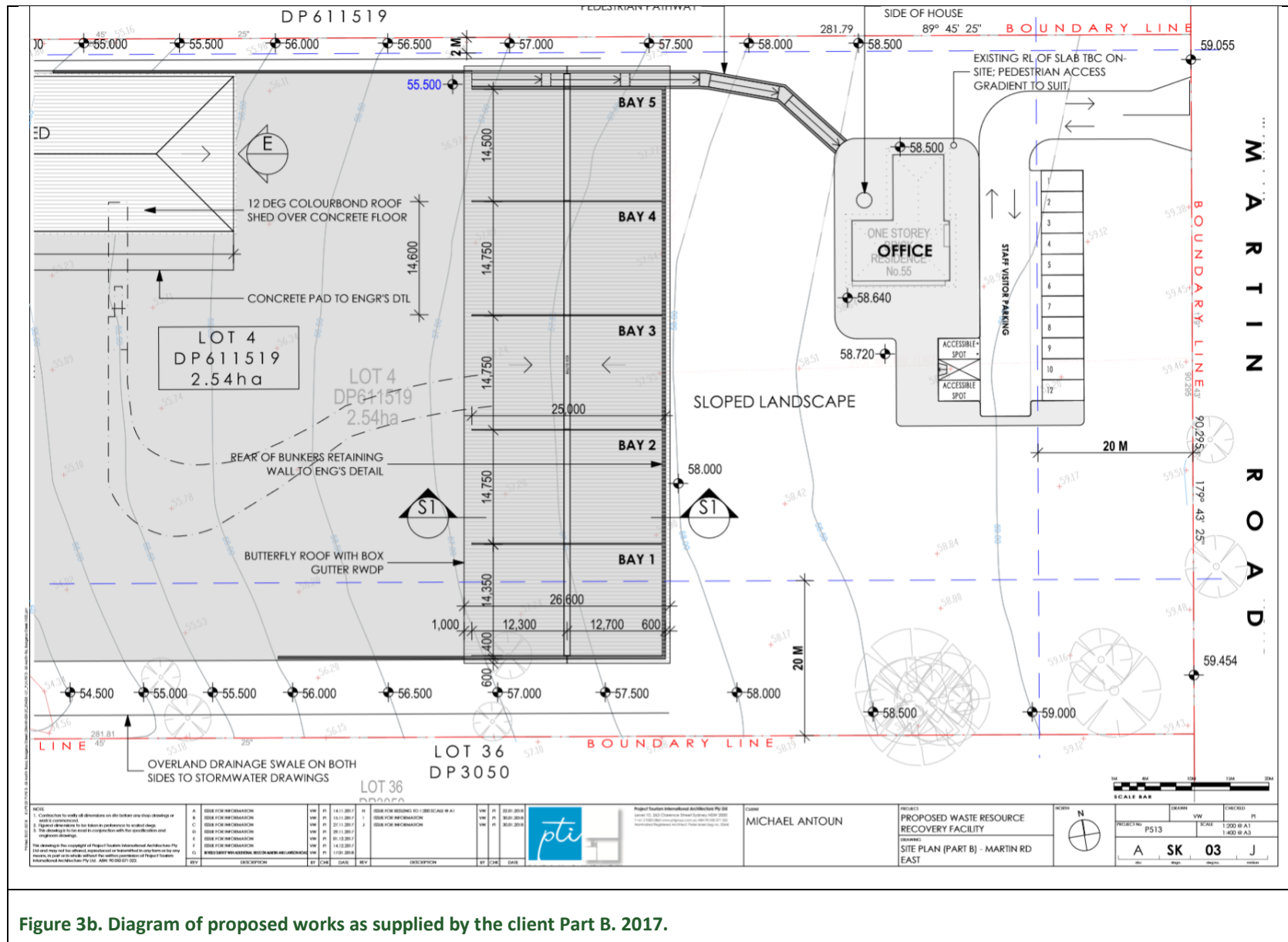


Figure 2. Habitat Map. Source: SixMaps October 2017.





3 Methods

3.1 Site Inspections

Nicholas Yu assessed the site on the 27th of October 2017 at 10am-11am and on the 23rd of November 2017 from 4pm. Weather was fine and sunny during time of visit. During site visits, notes and photos were taken of the important vegetation types, flora and fauna present. Due to the small area of proposed impacts, detailed or systematic surveys were not performed. Surveys were general and opportunistic in nature and were performed by traversing the site. Surveys included a single vegetation survey and a general habitat survey in which fauna habitat resources were identified.

3.2 Previous studies

Bionet, previous studies and the author's knowledge of the local area, were used to determine the possible occurrence of endangered ecological communities and threatened plant species on-site. The Bionet records accessed cover a 10km² area extending from the site and include recordings from 1993 to the present day.

Records from the following databases were collated and reviewed:

- Atlas of NSW Wildlife (Bionet). New South Wales, Office of Environment and Heritage (OEH).
- NSW Threatened Species Information (OEH).
- PlantNET (The Royal Botanic Gardens and Domain Trust 2014).
- Protected Matters Search Tool of the Australian Government Department of the Environment (DoE) for matters protected by the Cwlth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Other sources of biodiversity information:

- Relevant vegetation mapping, including:
 - Vegetation Information System, VIS Mapping (OEH).
 - Native Vegetation of the Sydney Metropolitan CMA Area, Sydney Metropolitan (CMA, 2009).

The following reports were also reviewed:

- Glenyss Laws 2018, Arboriculture Impact Assessment Report for 55 Martin Road, Arborist report by Glenyss Laws, Beecroft NSW 2119.
- Liverpool City Council, website and records.
- Office of Environment and Heritage and National Parks & Wildlife Service documents and mapping were also consulted.

3.2.1 Arborist report findings

Summary from Glenyss Laws Arborist Report:

Seventeen (17) individual and a closely aligned group of six (6) trees were assessed in preparing the preliminary report.

- Trees 1 & 2 the two trees fall within the footprint of the proposed driveway and weighbridge. The specimens are over mature with a short useful life expectancy, their removal should not be a constraint to the proposal.
- Trees 3, 4 & 5 are setback sufficiently that no encroachment of the TPZ is proposed.
- Tree 6 has a calculated TPZ of 5.3m. The proposed weighbridge is an elevated prefab unit which sits above ground, is offset at 1.5m and within the 2.4m SRZ. Compaction will be required to provide a solid base for the structure, soil compaction is one of the most damaging effects upon a trees root system. The proposal constitutes a major encroachment and will significantly shorten the trees life expectancy.
- Trees 7, 8, 9 & 10 are allocated a high retention value, the proposed wheel wash and driveway falls within the footprint of the four trees.
- Tree 11 a 5.4m TPZ and 2.6m SRZ applies. The specimen is offset 1.5m to the proposed wheel wash and equates to a major encroachment of approximately 32% of the TPZ.
- Tree 12a a 6.6m TPZ is estimated, the specimen is setback 5.5m to the proposed driveway of compacted road base. The proposal is a minor an acceptable encroachment under Clause 3.3.2 of AS4970, at approximately 3.5% of the TPZ.
- Trees 12 – 14 appear to be setback sufficiently that no encroachment of the TPZ is proposed.
- Tree 15 is allocated a high retention value, a 9.2m TPZ applies. The staff visitor parking area is setback at approximately 10.5m subsequently no incursion of the TPZ occurs. Tree 15 can be retained and protected.
- Tree 16 is allocated a high retention value, a 9.8m TPZ applies. The proposed staff visitor carpark is setback at approximately 8.5m and equates to a minor and acceptable encroachment under Clause 3.3.2 of AS4970 of approximately 3.5%. Tree 16 can be retained and protected.
- Tree 17 is a closely aligned cluster of six remnant trees allocated a high retention value, the six trees are located within a horse paddock bounded by electrified fencing, as access was restricted DBH and DRB were estimated. The proposed staff visitor parking area falls within the footprint of one specimen and within the SRZ of the remaining five trees. The proposal is a major encroachment upon the six trees. To bring the design to an acceptable tolerance it will be necessary to redesign the staff visitor parking area and maintain a minimum 8.4m offset to the most northern tree in the cluster identified as T17F.

The trees on the northern boundary adjoining the existing dam did not form part of the onsite brief/meeting. It is expected a change to the groundwater regime will be created with the removal of the dam and installation of an overland drainage swale. The works will potentially impact the ground water flow within the rootzone of the group of remnant trees on the northern corner of the Lawson Rd frontage.



Figure 4. Canopy Cover south-western boundary. Source: Glenyss Laws Consulting Arborist



Figure 5. Trees 15-17 on Martin Rd frontage. Source: Glenyss Laws Consulting Arborist.

See Arborist report for complete list of trees surveyed on site in Appendix I.

Table 1. Trees proposed for Removal. Source: Glenyss Laws January 2018.

Tree No.	Species Name	Common Name	Comments
1	<i>Eucalyptus moluccana</i>	Grey Box	To accommodate wheel wash and Driveway. Modifications to the initial proposal for the wheel wash and visitor parking have been made in order to retain other trees.
2	<i>Eucalyptus tereticornis</i>	Forest Red Gum	
6	<i>Eucalyptus tereticornis</i>	Forest Red Gum	
7	<i>Eucalyptus tereticornis</i>	Forest Red Gum	
8	<i>Eucalyptus tereticornis</i>	Forest Red Gum	
9	<i>Eucalyptus tereticornis</i>	Forest Red Gum	
10	<i>Eucalyptus tereticornis</i>	Forest Red Gum	
11	<i>Eucalyptus species</i>		

4 Flora

The purpose of the flora work was an investigation to determine the flora composition of the site, particularly vulnerable and endangered species. It also included an assessment of the flora as habitat. Furthermore, an assessment of potential impact of the development with a determination of native ground and shrub was conducted.

4.1 Methods

Nicholas Yu assessed the site on the 27th of October 2017 at 10am-12am and on the 23rd of November 2017 from 4pm. Weather was fine and sunny during time of visit. During site visits, notes and photos were taken of the important flora. Bionet was also used to determine the threatened fauna and endangered populations, which have been recorded within 10km of the site since 1993.

4.2 Threatened Plant Species

A total of 970 flora species have been recorded within 10km of the study site according to BioNet records. Of these, 10 species are listed as vulnerable or endangered under state and/or commonwealth legislation (see Table 3 below). The vulnerable and endangered species that were focused on during site assessments, and within the surrounding bushland are shown in Table 3 below.

Table 2. Threatened Plant Species observed in previous ecological surveys within a 10km radius since 1993. Source: NSW OEH Bionet 2018.

Family	Scientific Name	Common Name	NSW status	Comm. status	Records
Apocynaceae	<i>Marsdenia viridiflora</i> <i>subsp. viridiflora</i>		E2		18
Fabaceae (Faboideae)	<i>Dillwynia tenuifolia</i>	Dillwynia tenuifolia, Kemps Creek	E2,V,P		43
Fabaceae (Faboideae)	<i>Dillwynia tenuifolia</i>		V,P		437
Fabaceae (Faboideae)	<i>Pultenaea parviflora</i>		E1,P	V	40
Fabaceae (Mimosoideae)	<i>Acacia pubescens</i>	Downy Wattle	V,P	V	9
Lobeliaceae	<i>Hypsela sessiliflora</i>		P,3	X	7
Myrtaceae	<i>Callistemon linearifolius</i>	Netted Bottle Brush	V,P,3		1
Proteaceae	<i>Grevillea juniperina</i> <i>subsp. juniperina</i>	Juniper-leaved Grevillea	V,P		111
Proteaceae	<i>Grevillea parviflora</i> <i>subsp. parviflora</i>	Small-flower Grevillea	V,P	V	12
Proteaceae	<i>Persoonia nutans</i>	Nodding Geebung	E1,P	E	7
Thymelaeaceae	<i>Pimelea spicata</i>	Spiked Rice-flower	E1,P	E	4

Note: E = Endangered, V = Vulnerable, P = Protected, and * = Possibly occurring but not definitive.

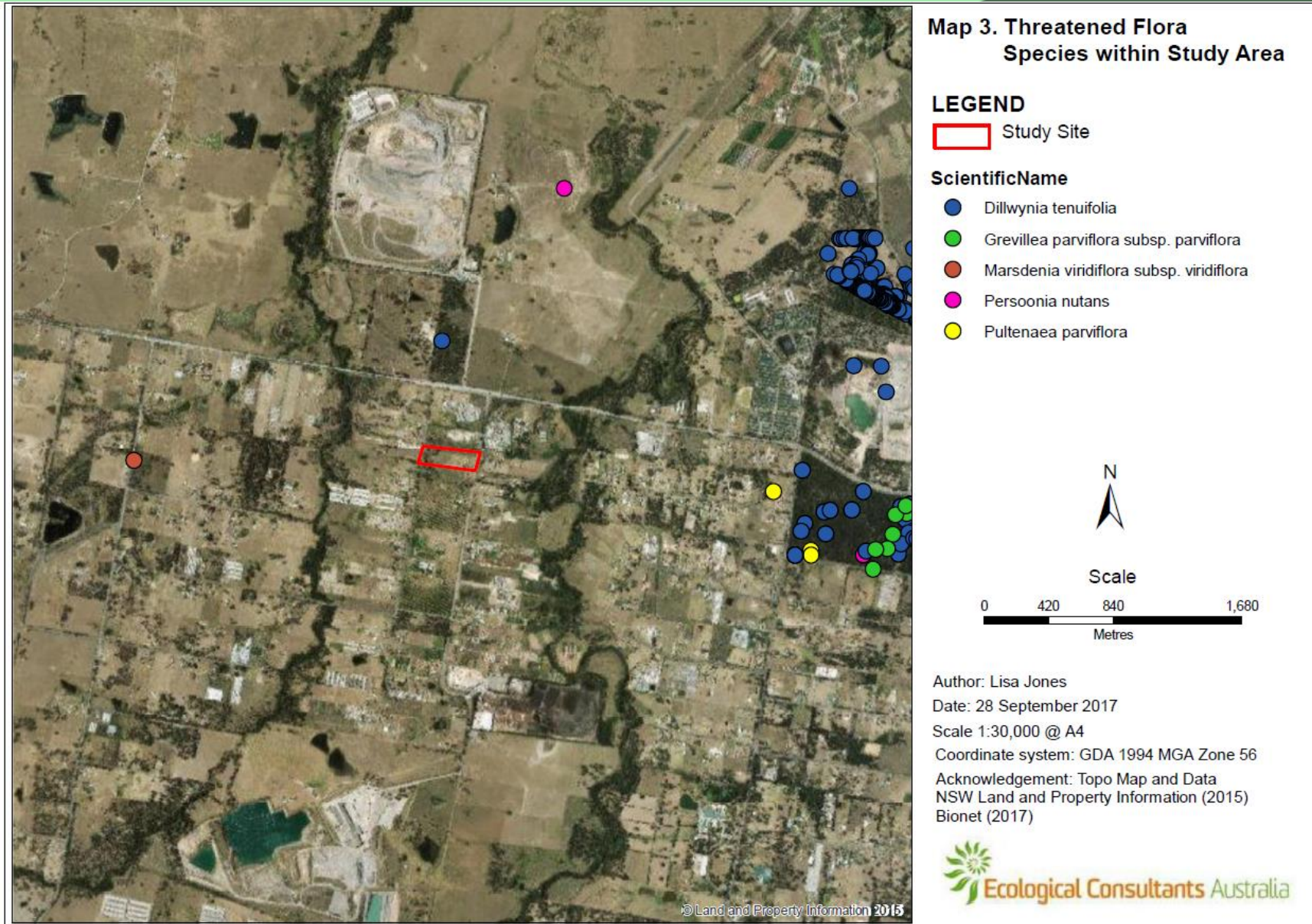


Figure 6. Bionet Mapping

Likelihood of occurrence

The habitat suitability is a broad categorisation used to indicate the potential for a species to occur within the study area. It is based on expert opinion and implies the relative value of a study area for a particular species. See Appendix II for rationale of likelihood of occurrence.

4.2.1 Threatened plant species findings

No threatened plant species were found during site assessments.

4.3 Ecological Endangered Communities

4.3.1 CEEC and EEC findings

As outlined in Figure 2 and via the two site visits, the vegetation at the western end of the site is indicative of Shale Plains Woodland, also Identified as Cumberland Plain Woodland a Critically Endangered Ecological Community (CEEC) under the BC Act 2016 and Critically Endangered under the EPBC Act 1999.

4.4 Flora Findings from Site Investigations

4.4.1 Observed Flora

A list of native flora was compiled for flora in the proposed development area and surrounding remnant bushland. See Table 4 for native species in these areas.

Table 3. Native flora recorded on site.

Scientific Name	Common Name	NSW status	Comm. status
<i>Bursaria spinosa</i>	Native Blackthorn	*	*
<i>Einadia hastata</i>	Berry Saltbush	*	*
<i>Eucalyptus moluccana</i>	Grey Box	*	*
<i>Eucalyptus tereticornis</i>	Forest Red Gum	*	*
<i>Juncus usitatus</i>	Common Rush	*	*
<i>Typha orientalis</i>	Broad-leaved Cumbungi	*	*

Note: P = Protected, E=Endangered. * = this plant does not have a NSW or Commonwealth status. Individually, these species are not Endangered or Protected, but they are part of an Ecological Community, Shale Gravel Transition Forest, which has a conservation status in NSW of Endangered and a Commonwealth status of Critically Endangered.

The following species (in Table 5 below) have been identified to be currently occurring within the site and have potential to spread to construction work areas or areas of disturbed soils. Construction areas and disturbed soils should be monitored during and post works for the spread of other small herbaceous and grassy weeds.

Current and future disturbance to the site may create environments favourable for weeds. Thus, it is important that bush regeneration takes place within the site to offset damages from construction related disturbance and the associated risk of weed growth and invasion and to maintain SPGF EEC diversity of flora and fauna habitat.

Table 4. Non-native Plant Species recorded on site and legislative grading.

Scientific Name	Common Name	WoNS	Legal Requirements*
<i>Araujia sericifera</i>	Moth Vine		
<i>Bromus catharticus</i>	Praire Grass		
<i>Chloris gayana</i>	Rhodes Grass		
<i>Conyza bonariensis</i>	Flaxleaf Fleabane		
<i>Lonicera japonica</i>	Japanese Honeysuckle		
<i>Lycium ferocissimum</i>	African Boxthorn	Yes	Prohibited on Dealings Must not imported into the State or sold
<i>Onopordum acanthium</i> <i>subsp. acanthium</i>	Scotch Thistle		
<i>Opuntia stricta</i>	Common Prickly Pear	Yes	Prohibited on Dealings Must not imported into the State or sold
<i>Passiflora edulis</i>	Common Passionfruit		
<i>Pennisetum clandestinum</i>	Kikuyu Grass		
<i>Rumex obtusifolius</i>	Broadleaf Dock		
<i>Sida rhombifolia</i>	Paddy's Lucerne		
<i>Sonchus oleraceus</i>	Common Sowthistle		
<i>Taraxacum officinale</i>	Dandelion		
<i>Verbena bonariensis</i>	Purpletop		

Note: Noxious Weeds Act 1993 was repealed by the Biosecurity Act 2015 as of 2017. As such there are no weed classifications, instead:

All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is practicable.

Additional legal requirements are outlined in table 5.

Weeds classed as WoNS (Weeds of National Significance) have been agreed by Australian governments based on an assessment process that prioritised these weeds based on their invasiveness, potential for spread and environmental, social and economic impacts. Two weeds on site were categorized as a WoNS.

Weeds listed as a Noxious weed and WoNS should be managed on site to preserve the ecological value and function on PSGF EEC.

See Recommendations and Appendix III for removal techniques for key weeds.

4.4.1 Vegetation communities

Flora vegetation such as canopy species *Eucalyptus moluccana* and *Eucalyptus tereticornis* are within the boundaries of the site. This indicates that CEEC Shale Gravel Transition Forest (western side of the site near Lawson Road) and a small area (<30m²) of Shale Plain Woodland (SPW), also considered to be CPW, is present. The mid-storey and groundcover species are absent, and these strata are dominated by exotic vegetation. A Test of Significance (7-Part test) has been conducted to assess the impacts of proposed works on this community.

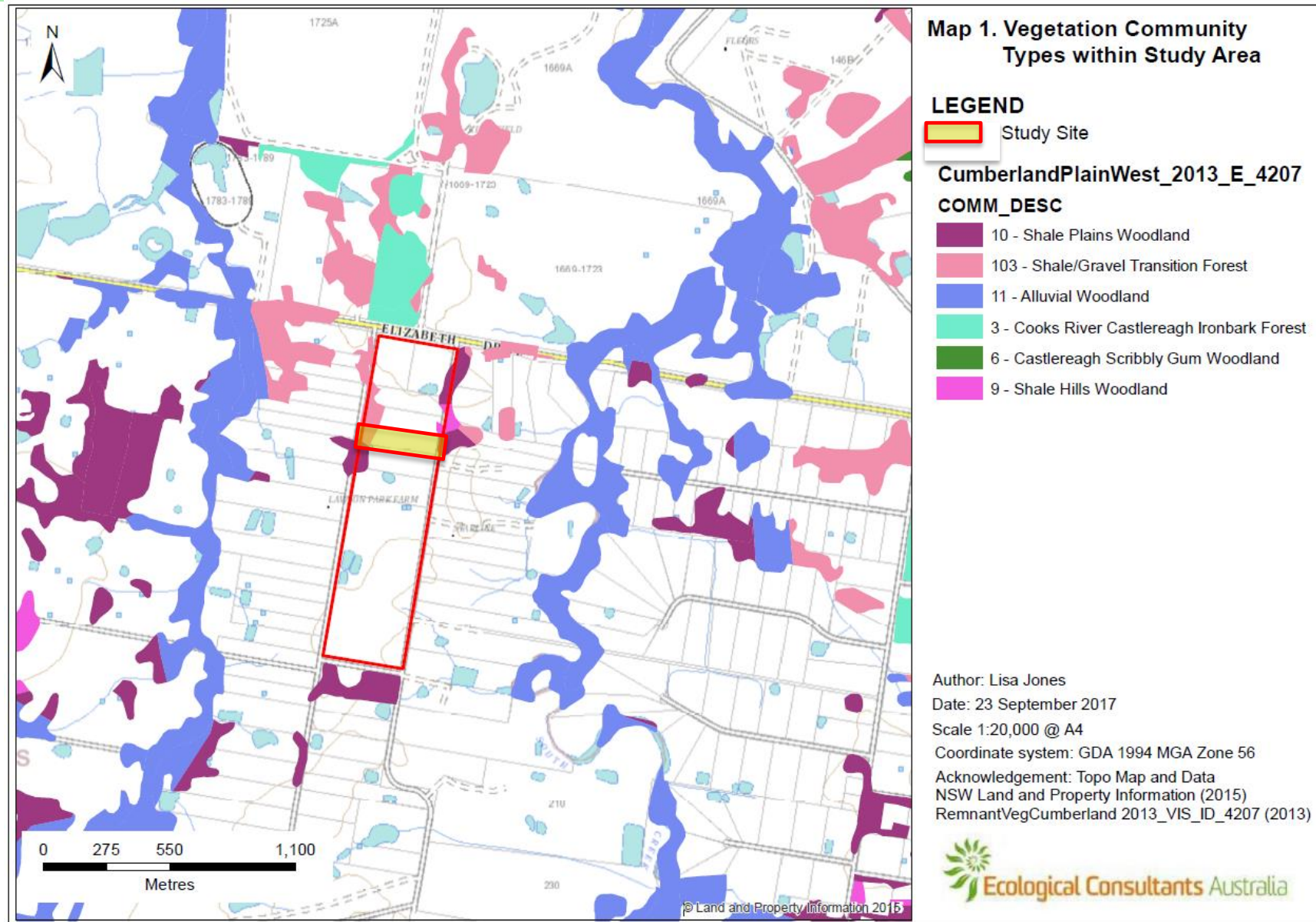


Figure 7. Bionet Mapping

4.4.2 Disturbances to Flora

Remnant Bushland zone

Remnant Bushland on-site is restricted to a group of canopy trees on the western end of the site and these are regrowth from prior clearing. This vegetation community is often present, however, as soil seed stock and appropriate management can bring back a diversity of CP species. Hence the cluster of trees to be retained on the western boundary is being considered as bushland as are trees within 10m of this patch. Work in similar areas has shown that thermal weeding (flame weeding) stimulates the regrowth of native species. Thermal weeding can be done in a safe manner and has been used successfully in other parts of western Sydney in CPW.

Currently the vegetation of the remnant bushland zone is in poor condition due to the high ratio of exotic species to native species and the relatively low native species richness – and this being restricted to canopy species.

Dominant weeds in this area include African Boxthorn and Kikuyu Grass. Other ground layer exotics include Purpletop and Rhodes Grass.

Notable weeds

Two exotic species are listed as WoNS under the EPBC Act 1999:

- African Boxthorn
- Common Prickly Pear

Other environmental weeds found on-site include:

- Moth Vine
- Prairie Grass
- Rhodes Grass
- Flaxleaf Fleabane
- Japanese Honeysuckle
- Scotch Thistle
- Common Passionfruit
- Kikuyu Grass
- Broadleaf Dock
- Paddy's Lucerne
- Common Sowthistle
- Dandelion
- Purpletop

The growth and spread of these species must be managed in accordance with measures specified in local management plans (as per Biosecurity Act).

Tree Removal

Eight trees are proposed for removal to accommodate the wheel wash and driveway (T1, T2, T7, T8, T9 and T10). These consist of two Grey Box (*Eucalyptus moluccana*) and four Forest Red Gums (*Eucalyptus tereticornis*). The canopy on-site is already sparse, and the proposed removal will result in less canopy. Proposed planting however will, within ~ 15 years, result in more canopy on-site than that being removed. Figure 8 show the trees to be removed on the western and eastern sides of the site.

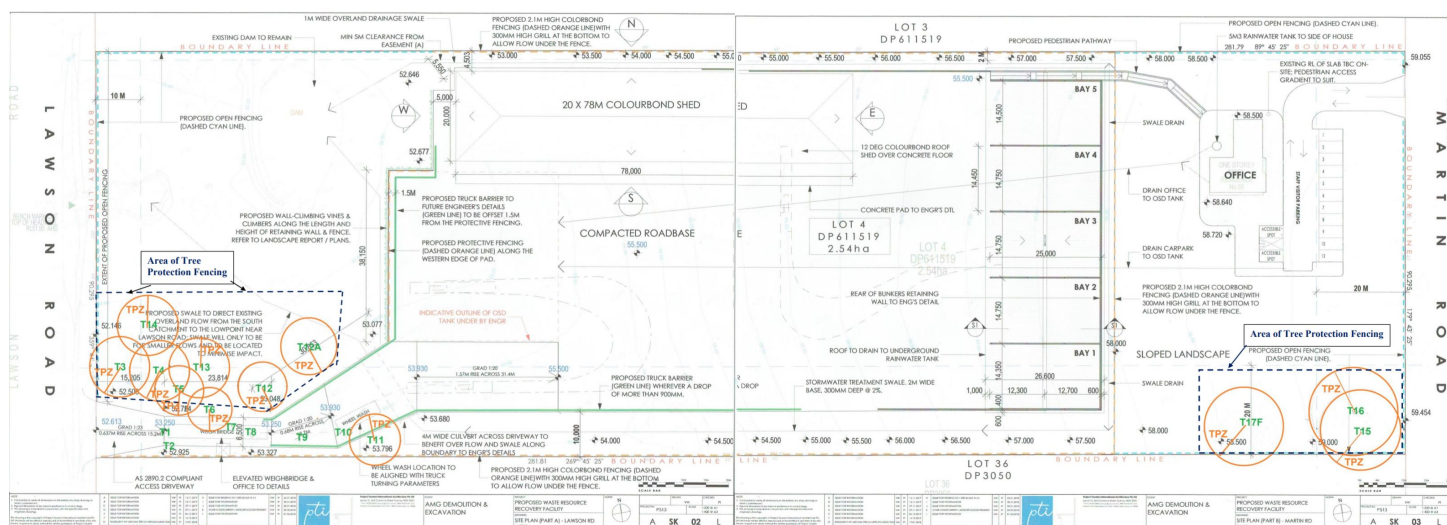


Figure 8. Arborist Survey. Source: Arborist Glenyss Laws, March 2018.

5 Fauna

5.1 Methods

Nicholas Yu assessed the site on the 27th of October 2017 morning and on the 23rd of November 2017 at from 4pm. Weather was fine and sunny during time of visit. During site visits, notes and photos were taken of the important fauna and fauna habitat present. Bionet was also used to determine the threatened fauna and endangered populations, which have been recorded within 10km of the site since 1993. Anabat recordings were conducted in the surrounding area and data used as reference for this assessment.

5.2 Threatened fauna

A total of 274 fauna species have been recorded within 10km of the study site according to BioNet records. Of these, 17 species are currently listed as vulnerable or endangered under state and/or commonwealth legislation (see Table 5). The vulnerable and endangered species to focus on-site searches for can be seen in Table 5 below highlighted in bold. This is based on likelihood of occurrence.

NB: species whose habitat doesn't occur on site have been omitted from this list – those with marginal habitat have been retained on the list.

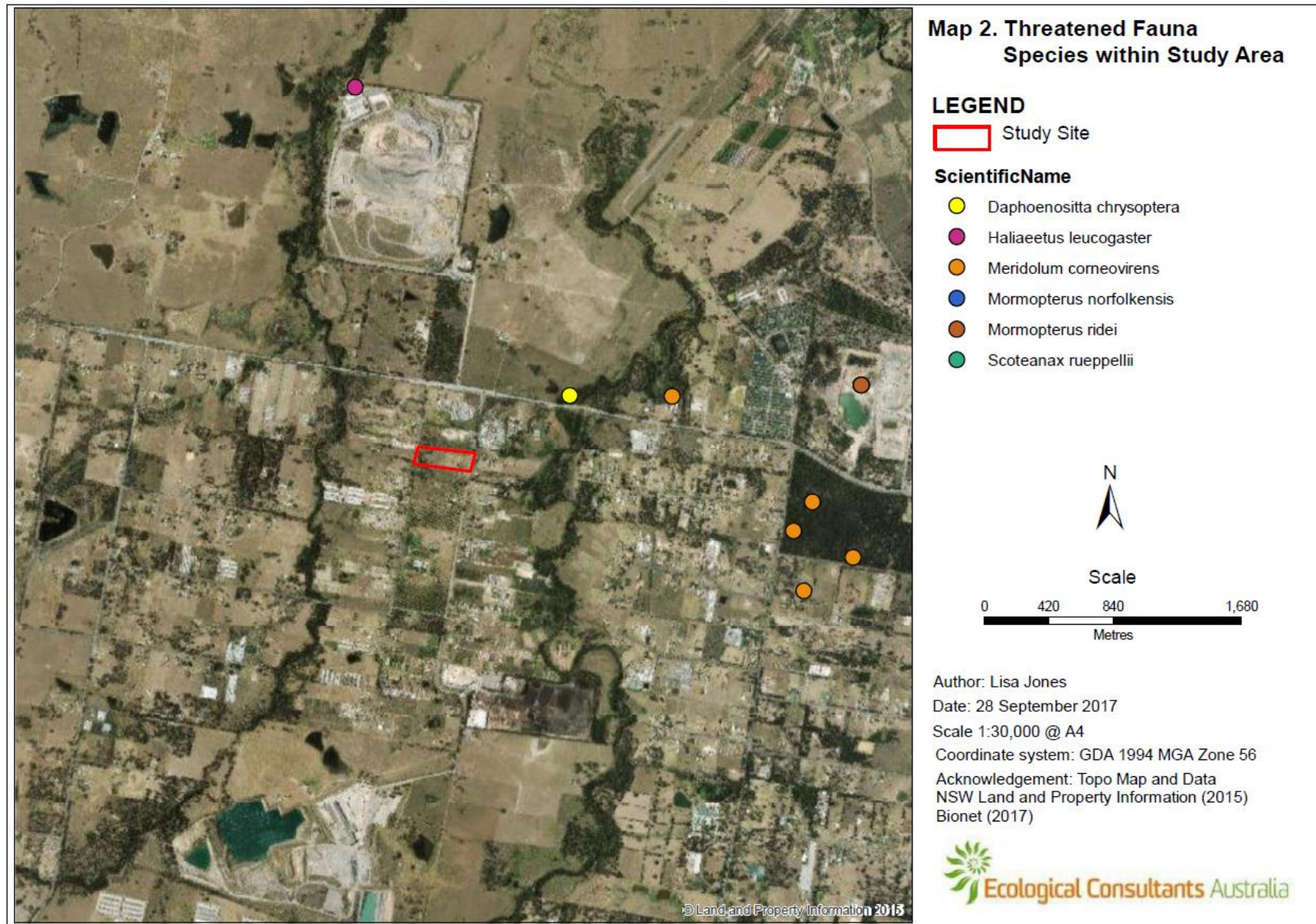
Table 5. Threatened fauna observed in previous ecological surveys within a 10km radius since 1980.

Source: NSW OEH Bionet 2017.

Class	Scientific Name	Common Name	NSW status	Comm. status	Records
Gastropoda	<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E1		174
Aves	<i>Lathamus discolor</i>	Swift Parrot	E1,P,3	CE	1
Aves	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V,P	C	2
Aves	<i>Hieraaetus morphnoides</i>	Little Eagle	V,P		9
Aves	<i>Daphoenositta chrysoptera</i>	Varied Sittella	V,P		5
Aves	<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V,P		9
Mammalia	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V,P	V	20
Mammalia	<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V,P		1
Mammalia	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V,P		9
Mammalia	<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V,P		6
Mammalia	<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V,P		13
Mammalia	<i>Myotis macropus</i>	Southern Myotis	V,P		9
Mammalia	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V,P		5
Aves	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V,P,3		1
Aves	<i>Ninox strenua</i>	Powerful Owl	V,P,3		1

Note: E = Endangered, V = Vulnerable, P = Protected. Species in **bold** have been identified as having appropriate habitat present on-site.

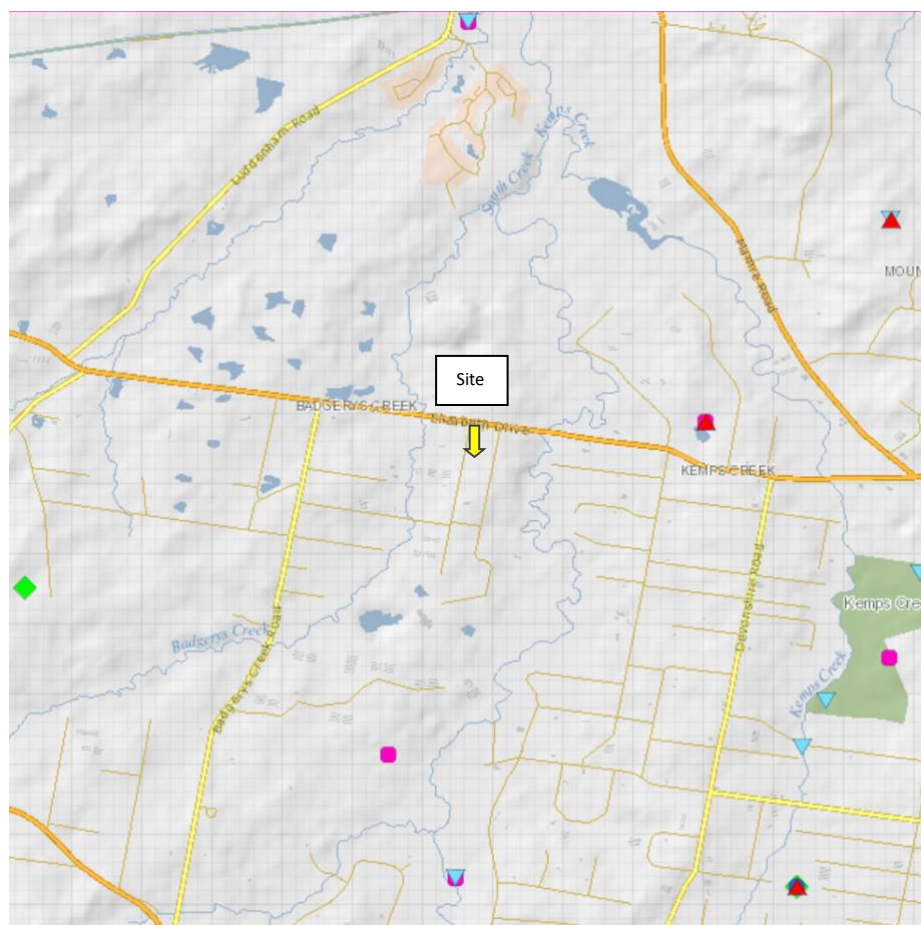
Figure 8. Bionet Mapping



Likelihood of occurrence

The habitat suitability is a broad categorisation used by ECA to indicate the potential for a species to occur within the study area. It is based on expert opinion and implies the relative value of a study area for a particular species.

During the survey, none of the above threatened species were observed on-site. However, other habitat types including foraging habitat and refugee habitat was present on the site for Microbat species. Threatened Grey-headed Flying-foxes and Eagles have been recorded within 10km and the site (and surrounding open area) provides for Little Eagles to get prey (rabbits). Sea Eagles are less likely to take prey from the land. No nesting trees were located on-site or near-by.



☒ Eastern Freetail-bat (*Mormopterus norfolkensis*)



☒ Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)



☒ Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)



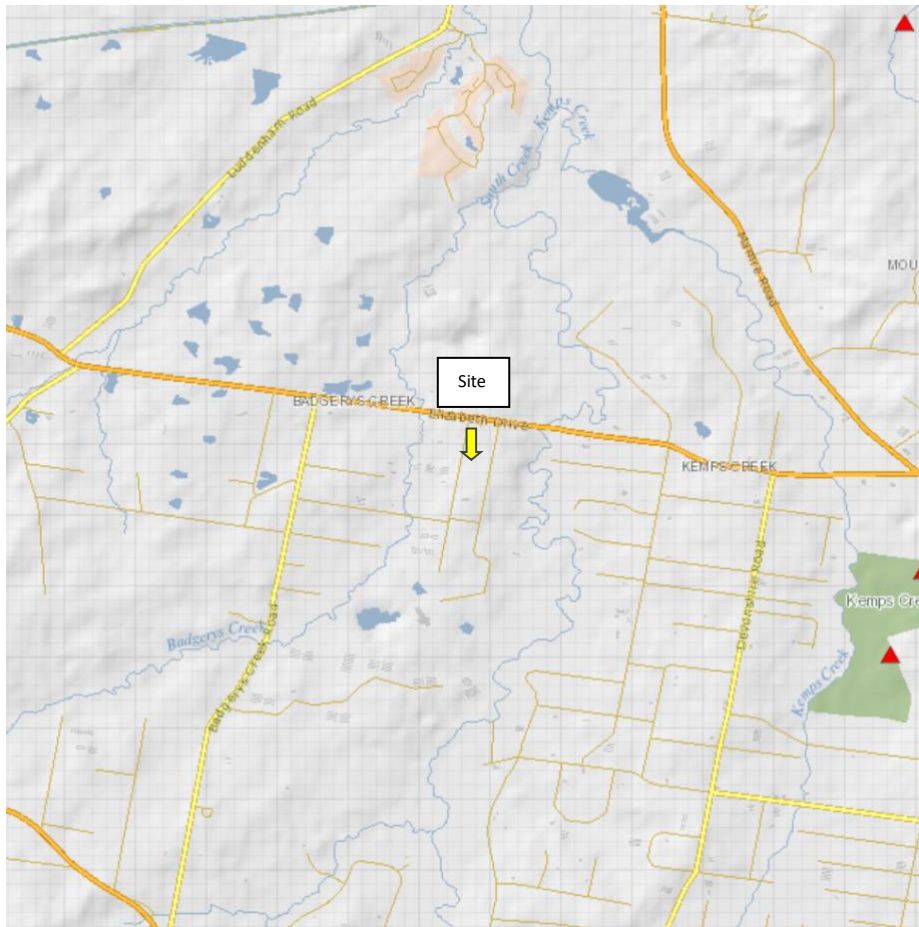
☒ Southern Myotis (*Myotis macropus*)



☒ Greater Broad-nosed Bat (*Scoteanax rueppellii*)



Figure 9. Endangered microbat sightings on Bionet in relation to site location. Source OEH 2018.



☒ Grey-headed Flying-fox (*Pteropus poliocephalus*)



Figure 10. Endangered Grey-headed Flying-fox sightings on Bionet in relation to site location. Source OEH 2018.

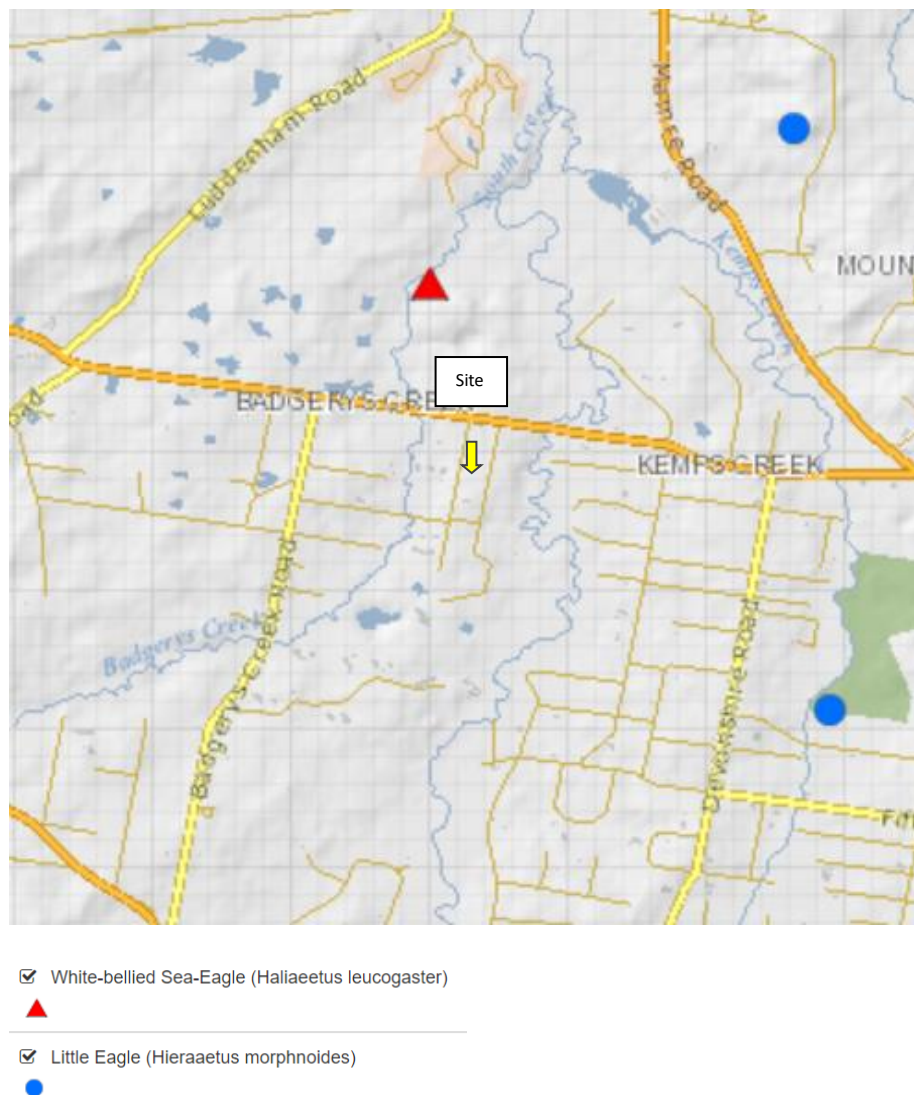


Figure 11. Endangered fauna sightings on Bionet in relation to site location. Source OEH 2018.

5.3 Endangered populations

Two endangered populations have been recorded to occur within 10km of the site since 1993. Table 6 outlines these populations.

Table 6. Endangered Populations in the LGA. Source NSW OEH Bionet 2018.

Endangered Population	Scientific Name	NSW Status	Comth. Status	No. of records
Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas.	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	E2		18

Dillwynia tenuifolia, Kems Creek	<i>Dillwynia tenuifolia</i>	E2,V,P		43
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These species were not present on site despite being in nearby bushland. A 7-Part Test is not required. However, the inclusion of threatened species in landscaping will be considered in conjunction with input from OEH.

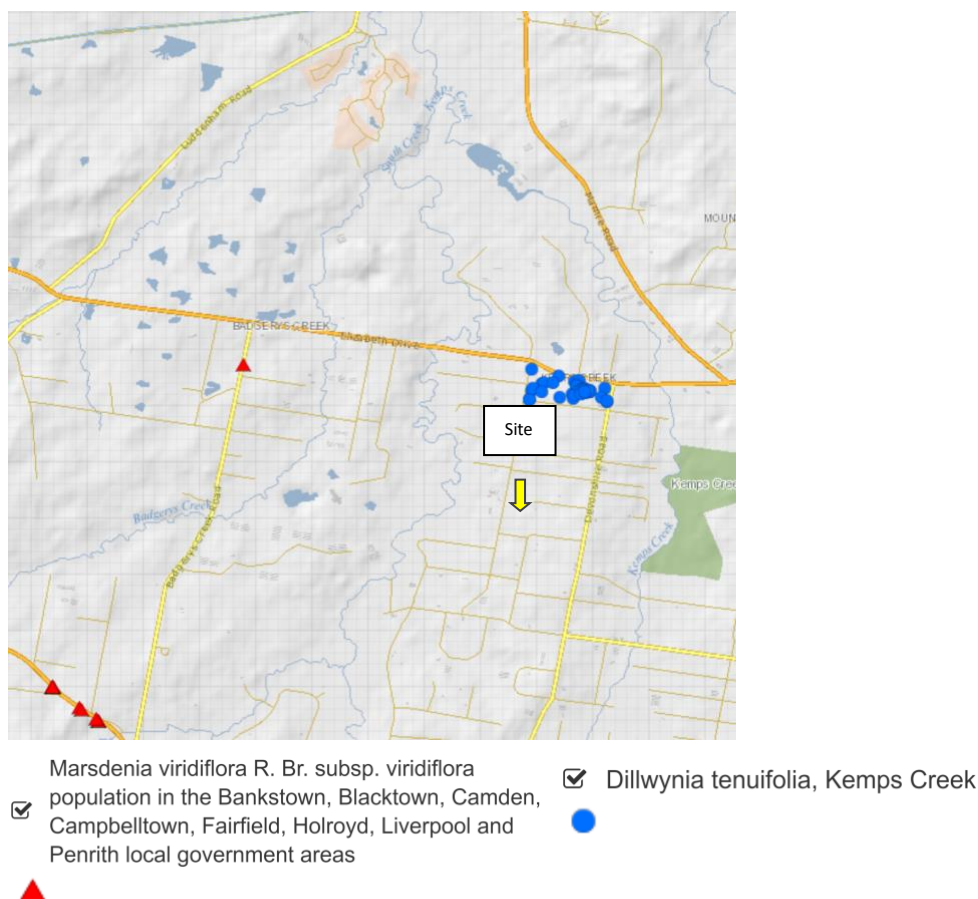


Figure 12. *Marsdenia viridiflora* and *Dillwynia tenuifolia* sightings on Bionet. Source OEH 2017.

5.4 Fauna findings from site assessment

Results of the fauna survey include the following findings. No amphibians or mammals were observed during site visits. No threatened species were recorded on site.

5.4.1 Fauna sightings

A number of fauna were observed during the site assessment, including:

Birds: Noisy Miner (*Manorina melanocephala*), Crested Pigeon (*Ocyphaps lophotes*), and Australian Raven (*Corvus coronoides*).

5.4.2 Fauna habitat

A number of potential habitat features were identified on site during the site assessment.

Flowering Eucalypts

The site contains canopy trees potentially providing foraging resources for the threatened Grey Headed Flying Fox and the Little Lorikeet. Due to the scattered nature of resources (trees) the likelihood of the trees being key habitat is low however could be a stopping point between the vegetation in the two waterways.

5.5 Habitat Corridors

Study of aerial imagery of the site and the surrounding landscape shows vegetation on-site is not directly connected with other vegetation. It could however be part of a dis-continuous corridor for aerial species (see Figure 13). Riparian zones are the closest corridors.

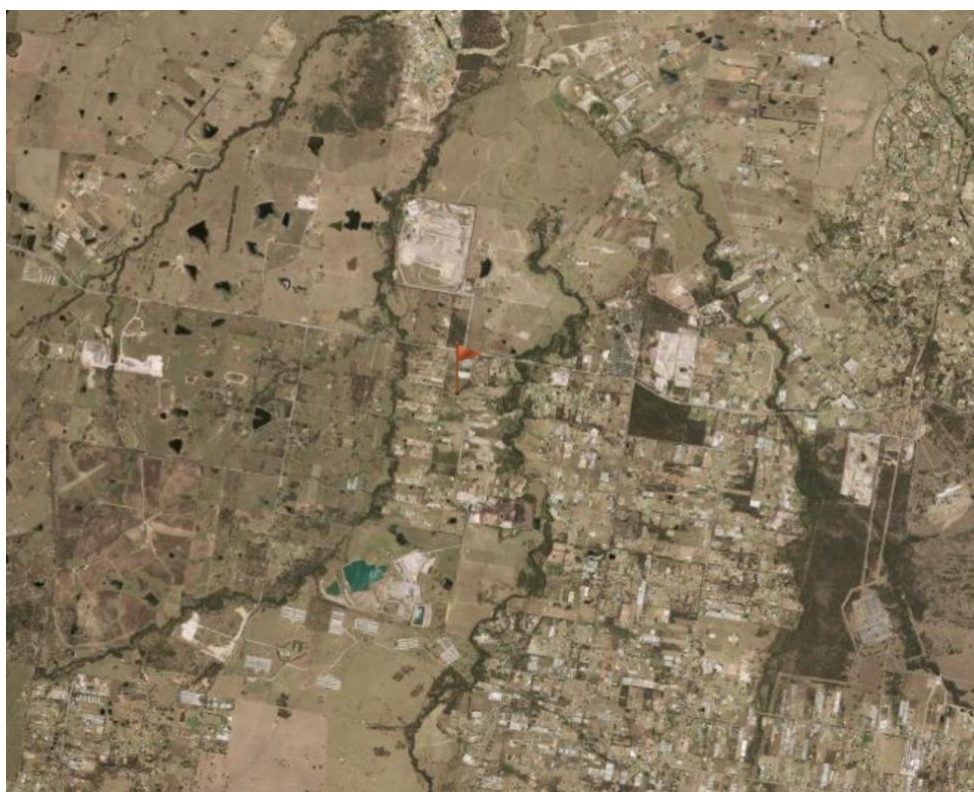


Figure 13. Green Corridor Connectivity in the wider area. Source: SixMaps 2018.

6 Impacts

6.1 Direct Impacts

6.1.1 Vegetation disturbance and loss

Development of a waste resource and recovery facility with associated parking and the retaining of the existing dwelling are expected to result in minor direct impacts to vegetation:

- Vegetation will be cleared from areas within the footprints of driveways and building envelopes. Native vegetation here is trees which will be offset by planting. Other vegetation (non-native) occurring in zones for clearing include turf species and weeds.
- Trees will be cleared to make way for development causing minor canopy disturbance. This includes:

- *Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum).

Aims for bush regeneration and replanting works for the site will offset any damages from vegetation clearing and tree removal. Figure 14 below shows the trees on the southern-western boundary, Lawson Rd frontage where removal of eight trees will take place.



Figure 14. Canopy Cover south-western boundary. Source: Glenyss Laws Consulting Arborist.

6.1 Indirect Impacts

The proposed actions will result in the direct loss of 7 existing canopy trees – tree loss can result in indirect impacts affecting species or communities.

6.1.1 Loss of Breeding Opportunities

Works in the site may result in temporary-reduced breeding opportunities for locally occurring native species including amphibians, reptiles, birds, mammals and invertebrates due to site disturbance.

6.1.2 Soil disturbance and compaction

The removal of vegetation and trees can result in soil disturbance. Soil compaction could occur from machinery use. Soil compaction in non-built upon areas is to be avoided and not to occur within the trees to be retained (see also Arborist Report).

6.1.3 Weed growth and invasion

Weed species may arise within the direct works zone and surrounding remnant bushland through soil disturbance or by being brought in as seed on work machinery, tools, equipment and worker clothes (e.g. boots). Soil disturbance combined with the elevated nutrients and increased light exposure may result in increased weed growth, aggravated by the high abundance of weeds present pre-works.

6.1.4 Introduction of pathogens

The introduction of pathogens may occur into the site, and surrounding remnant bushland, via machinery, tools, equipment and worker clothing (e.g. boots). Diseases to watch out for include Phytophthora (also known as Root Rot – type of water mold) and Myrtle Rust (*Puccinia psidii* – type of fungus). See Appendix for methods to control selected pathogens.

6.1.5 Construction Noise

The proposed actions may result in a large amount of construction noise which may result in minor disturbance to sensitive fauna in the local canopy and adjacent bushland nearby. Construction disturbance may also result in fewer aerial fauna species frequenting the site for the duration of works.

6.2 Assessment of Significance (7-part tests) Summary

See Appendix V for full 7-Part Tests.

Cumbeland Plain Woodland

Cumberland Plain Woodland endangered ecological community was identified onsite. The Proposal involves the clearing of five scattered remnant trees, however overall, there will be a net increase in ground midstory and canopy species from this endangered ecological community.

Cumberland Plain Land Snail

The Cumberland Plain Land Snail occupies dry woodlands and forests that occur on the Cumberland Plain, sheltering under leaf litter, logs, urban refuse and decaying matter. Where possible this snail will burrow into loose soil. The Cumberland Plain Land Snail is a detritus feeder and is often found feeding on fungi. Breeding is related to climatic conditions, this species being dependent on precipitation for breeding opportunities. Even though the Cumberland Plain Land Snail has not been identified onsite, any possible habitat should be retained and proposed works in the bush regeneration area should include enhancement of this habitat.

Mircobats

Threatened Microbat species (Eastern Freetail-bat, Eastern False Pipistrelle, Eastern Broad-nosed Bat, Eastern Bentwing-bat and Southern Myotis) were identified as having potential foraging and roosting habitat within the site. Proposed trees to be removed do not contain hollows, but they do contain flaking bark used as roosting habitat for microbat species. These trees may contain marginal foraging habitat for species which feed on insects in or above the canopy. This habitat may be disturbed during proposed works. Two microbat nest boxes are to be installed within the site.

Grey-headed Flying-Fox

The threatened Grey-headed Flying-Fox (*Pteropus poliocephalus*) was identified as having potential marginal habitat within the site, although insignificant impact due to actions of removal of Grey Box (*Eucalyptus moluccana*) and Forest Red Gums (*Eucalyptus tereticornis*) trees, since these would only be considered to be used as marginal and not foraging habitat.

7 Recommendations

7.1 Mitigation Measures

7.1.1 Delineation of work areas

During construction, impacts to the site and adjacent vegetation should be minimised by the delineation of works zones. Access to the site would be best restricted to small passageways avoiding native vegetation to prevent soil disturbance in general and in particular damage to native vegetation. Access will be restricted to disturbed open areas and in accordance to Arborist report in a line with tree protection measures.

7.1.2 Vegetation clearing control measures

Most of the vegetation planned for clearing (areas within the footprints of driveways and building envelopes) are trees, turf and weeds. In this case, no vegetation clearing control measures are necessary other than tree removal. Refer to Arborist report.

7.1.3 Tree Protection

Tree protection will be consistent with the Arborist report by Glenyss Laws January 2018. Main trees to be managed are trees within close proximity to building works NB: see final arborist report for details of works and tree numbers.

7.1.4 Landscaping, bush regeneration and planting

Bush regeneration and landscaping will occur within the designated areas shown below. See Landscaping Plan for specifics.



Figure 15. Proposed weed management, bush regeneration and landscaping zones. Source SixMaps 2018.

7.1.5 Weed Removal Techniques

Weed removal proposed for the site will consist of hand removal techniques, manual/mechanical removal using bush regenerator tools and thermal (flame) weeding. This approach will reduce the amount of herbicide used and reduce the amount of off-target damage through spot on application. Key targeted weed species will include those listed as 'Noxious' under Northern Beaches Council and exotic plants classed as an environmental weed.

Noxious weeds present on site should be controlled in accordance with the Noxious Weeds Act (1993). Flame weeding will target annual weeds such as Fleabane (*Conzysa* sp.) and perennial grasses such as *Paspalum dilatatum*.

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 III for further details.

7.1.6 Native Seed Collection

Any native trees or shrubs that is being removed for the construction works should be checked for seeds during removal works. If seeds are present, they should be collected and used on-site or donated to an appropriate group for reuse.

7.1.7 Fauna refuge zone

The area of vegetation in the remnant bushland should be treated as a fauna refuge zone with limitations to access by people, machinery and the storage or stockpiling of tools or materials for the duration of the works. A temporary visual barrier and/or signage could be installed to raise awareness of the existence of a fauna refuge zone.

7.1.8 Preservation of Habitat

It is recommended that habitat specified in Section 6.3.2 be maintained and preserved. This includes:

- Retention of logs and tree stumps should be kept to maintain refugee habitat values.
- Retention of aquatic habitat including seaweed for intertidal species should be kept to maintain estuary foreshore habitat.
- Retention of Eucalyptus species should be kept to maintain foraging resources for threatened Grey Headed Flying Fox and the Little Lorikeet.

7.1.9 Nest boxes



Although it is not critical, installation of two nest box designed for microbats should be added to the site to replace potential loss of roosting habitat.

Image from: nestboxes.com.au

7.1.10 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.



Phytophthora infected vegetation. (Image by Rasbak, licensed under the Creative Commons Attribution-Share Alike 3.0 Unported, 2.5 Generic, 2.0 Generic and 1.0 Generic license.)



Myrtle Rust generally infects new leaf growth. (Image by John Tann, licensed under the Creative Commons Attribution 2.0 Generic license.)

7.1.1 Vertebrate Pests

Vertebrate pests (cats, dogs, foxes) would not be considered to be a significant problem at the site and no actions are suggested for their control.

8 Monitoring and Project Reviews

Environmental monitoring should be carried out by a qualified Ecologist or Natural Area Specialist once per year for the first 2 years to determine whether environmental performance targets have been met. Site assessors should spend 2 hours at the site performing qualitative and opportunistic surveys to assess site condition. A brief report should then be prepared for submission within the following week.

The following criteria must be monitored at each site visit:

- **Weed ratio targets:** Weed biomass must not exceed 10% of total vegetation biomass in Zone 1 and 5% in Zone 2.
- **Noxious weeds presence:** No noxious weeds present onsite across any zone.
- **Retained Vegetation condition:** Areas of healthy bush are still in an undisturbed state with weed presence adhering to the ratios recommended above.
-

9 Conclusions

- Following the Landscaping Plan will see an increase in the Cumberland Plain Woodland endangered ecological community through planting and bush regeneration.
- Two microbat nest boxes to be installed onsite.
- No significant impact on endangered ecological communities or threatened species due to proposed works.
- Ongoing maintenance of environmental and ecological actions is required.

10 References

- NSW Department of Primary Industries 2017, Weeds of National Significance, NSW WeedWise, viewed 3 May 2017, available online at:
<http://weeds.dpi.nsw.gov.au/WeedListPublics/CategoryResults?showImages=True&categoryId=1&pageTitle=Weeds%20of%20National%20Significance>
- Office of Environment and Heritage 2016, *Little Lorikeet - profile*, site accessed on 20 April 2017, available online at: <http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=20111>
- Office of Environment and Heritage 2016, *Superb Fruit-Dove (Ptilinopus superbus)*, site accessed on 20 April 2017, available online at:
<http://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10709>
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<http://www.environment.nsw.gov.au/determinations/PittwaterSpottedGumForestEndComListing.htm>
- Office of Environment and Heritage 2001, *Grey-headed Flying-fox - profile*, site accessed on 20 April 2017, available online at:
<http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10697>
- Sydney Metro Catchment Management Authority (SMCMA), 2009, Native Vegetation of the Sydney Metropolitan CMA Area, Sydney Metropolitan. Sydney Metropolitan Catchment Management, Sydney Metro Catchment Management Authority.

11 Appendix

11.1 Appendix I – Arborist Tree Summary Table

Tree Survey Notes

Tree No	Tree Species	Age Class	DBH (mm)	DRB (mm)	Tree Height (M)	Crown Width (M)	Crown Condition	Crown Class	STARS	ULE	Root Zone/ Defects/ Services	Comments
1	<i>Eucalyptus moluccana</i> (Grey Box)	O	230	290	10	5	2	D	1	3	Gr/-/-	Over mature specimen with short useful life expectancy.
2	<i>Eucalyptus moluccana</i> (Grey Box)	O	190	220	7	4	1	C	1	4	Gr/-/-	Declining canopy density with less than 20% live foliage. Over mature specimen with short useful life expectancy.
3	<i>Eucalyptus moluccana</i> (Grey Box)	O	540	540	15	11	2	C	1	3	Gr/-/-	Over mature specimen with short useful life expectancy.
4	<i>Eucalyptus tereticornis</i> (Forest Red Gum)	M	560	590	16	10	3	C	1	2	Gr/-/-	Exhibits fair vigour, good condition, free of major above ground defects.
5	<i>Eucalyptus tereticornis</i> (Forest Red Gum)	M	430	490	16	8	3	C	1	2	Gr/-/-	Exhibits fair vigour, good condition, free of major above ground defects.
6	<i>Eucalyptus tereticornis</i> (Forest Red Gum)	M	440	430	15	8	3	C	1	2	Gr/I/-	Forms 2 x leaders at 3.5m reaction wood evident within leader union.
7	<i>Eucalyptus tereticornis</i> (Forest Red Gum)	M	250	310	12	5	3	C	1	2	Gr/-/-	Exhibits fair vigour, good condition, free of major above ground defects.
8	<i>Eucalyptus tereticornis</i> (Forest Red Gum)	M	270	300	12	5	3	C	1	2	Gr/-/-	Free of major above ground defects.
9	<i>Eucalyptus tereticornis</i> (Forest Red Gum)	M	470	530	14	10	3	C	1	2	Gr/-/-	Free of major above ground defects
10	<i>Eucalyptus tereticornis</i> (Forest Red Gum)	M	540	590	14	10	3	C	1	2	Gr/-/-	

Tree No	Tree Species	Age Class	DBH (mm)	DRB (mm)	Tree Height (M)	Crown Width (M)	Crown Condition	Crown Class	STARS	ULE	Root Zone/ Defects/ Services	Comments
11	<i>Eucalyptus species</i>	M	Est 450	Est 550	10	9	3	C	1	2	Gr/-/-	Access hindered due lack of ground maintenance, dense thickets of weeds including blackberries. Dimensions estimated only.
12	<i>Eucalyptus tereticornis</i> (Forest Red Gum)	M	460	570	10	10	3	C	1	2	Gr/-/-	
12A	<i>Eucalyptus species</i>	M	300 & 450	650	12	12	3	C	1	2	Gr/-/-	Access hindered due lack of ground maintenance and dense weeds/blackberries. Dimensions estimated only.
13	<i>Eucalyptus tereticornis</i> (Forest Red Gum)	O	Est 550	Est 650	15	12	3	C	1	3	Gr/T/-	Access hindered due dense weeds including thickets of blackberries. Dimensions estimated only. 50-60% canopy density of fair to low vigour.
14	<i>Eucalyptus tereticornis</i> (Forest Red Gum)	M	Est 550	Est 650	14	14	3	C	1	2	Gr/-/-	
15	<i>Eucalyptus moluccana</i> (Grey Box)	M	770	920	24	14	Low 3	C	1	2	Gr/-/-	
16	<i>Eucalyptus tereticornis</i> (Forest Red Gum)	M	820	880	22	12	3	C	1	2	Gr/-/-	
17 x 6	Group of 6 x <i>Eucalyptus moluccana</i> and <i>Eucalyptus tereticornis</i>	M	Est 350-700		6 - 18	3 - 12	3	C	1	2 - 3	Gr/-/-	Access restricted due to electrified fencing. Dimensions estimated only.

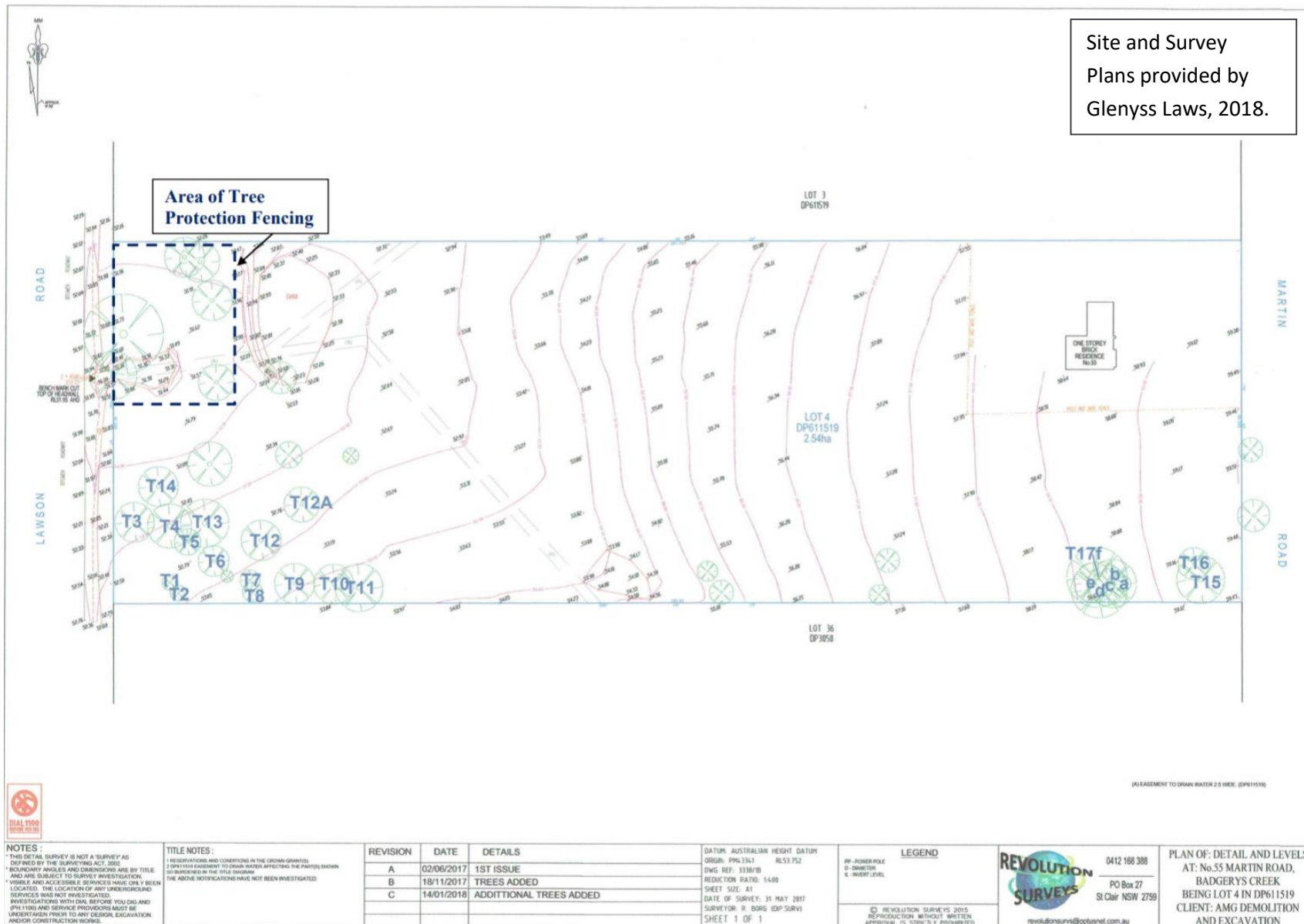
Trees in **Green** assessed with a high landscape value coupled with a medium to long ULE are allocated a high priority for retention.

Trees in **Blue** are assessed as less critical for retention, their retention should be a priority with removal considered if all design options have been exhausted & adversely affecting the proposal.

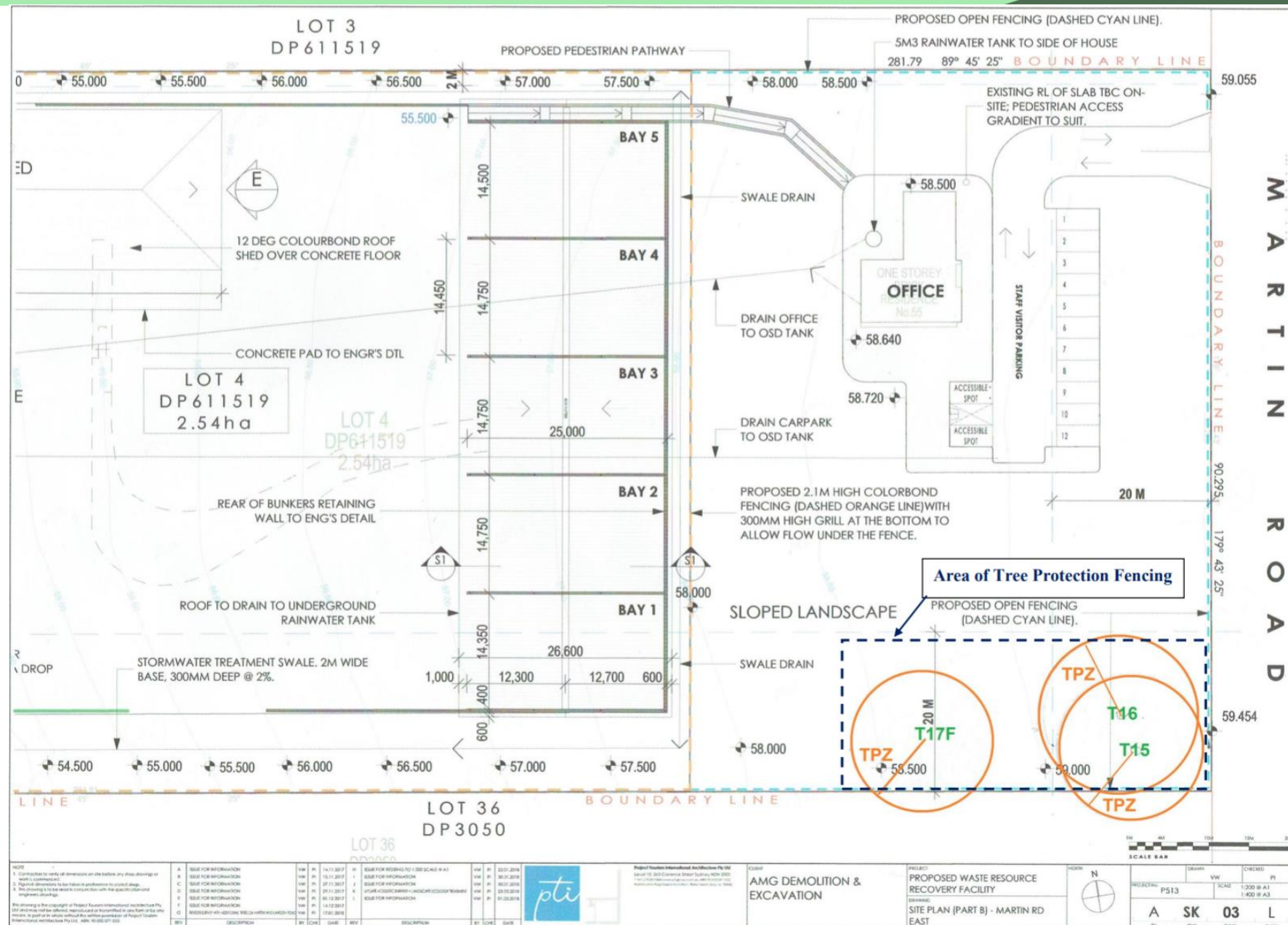
Trees in **Pink** are of low retention value, nor require special works or design modifications to be implemented.

Tree in **Orange** are considered hazardous, in irreversible decline or environmental weed species and recommended for removal irrespective of development.

11.2 Appendix II – Tree Survey












11.3 Appendix III – Key Weed Removal Methods

Physical removal

Technique	Method	Equipment
Hand Removal 	<p>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.</p> <p>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.</p>	<p>Tools: Gloves, Rakes, Knife and</p> <p>Weed Bags</p>
Crowning 	<p>Plants that possess rhizomes or bulbs might not respond to various removal techniques and may need to be treated with crowning.</p> <p>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</p> <p>Soil disturbance is to be kept to a minimum when using this technique.</p>	<p>Tools: Knife, mattock, trowel, impervious gloves, and all other required P.P.E.</p>
Cut and Paint Stems 	<p>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.</p> <p>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.</p> <p>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.</p>	<p>Tools: loppers, secateurs, pruning saw, herbicide applicator/sprayer, impervious gloves, Roundup® Biactive Herbicide and all other required P.P.E.</p>

<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>

Spot Spraying	<p>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.</p> <p>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.</p>	<p>Tools: protective clothing, safety glasses, herbicide sprayer, impervious gloves, Herbicide, and all other required P.P.E.</p>
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Flame Weeding

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

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*. Flame weeding is also effective in killing persistent weeds like Mother of Millions.

Best results are obtained when follow up weed control is undertaken 4-6 weeks after treatment. In addition, weed control should be conducted periodically after that for example to control weeds over a period of a year it is likely that between 3-5 applications will be necessary, depending on rainfall and the extent of the weed seed bank. This method is most effective on young annual weeds and least effective on older perennial weeds. In some cases, control of perennial weeds will be ineffective however this depends on the species present and its age.

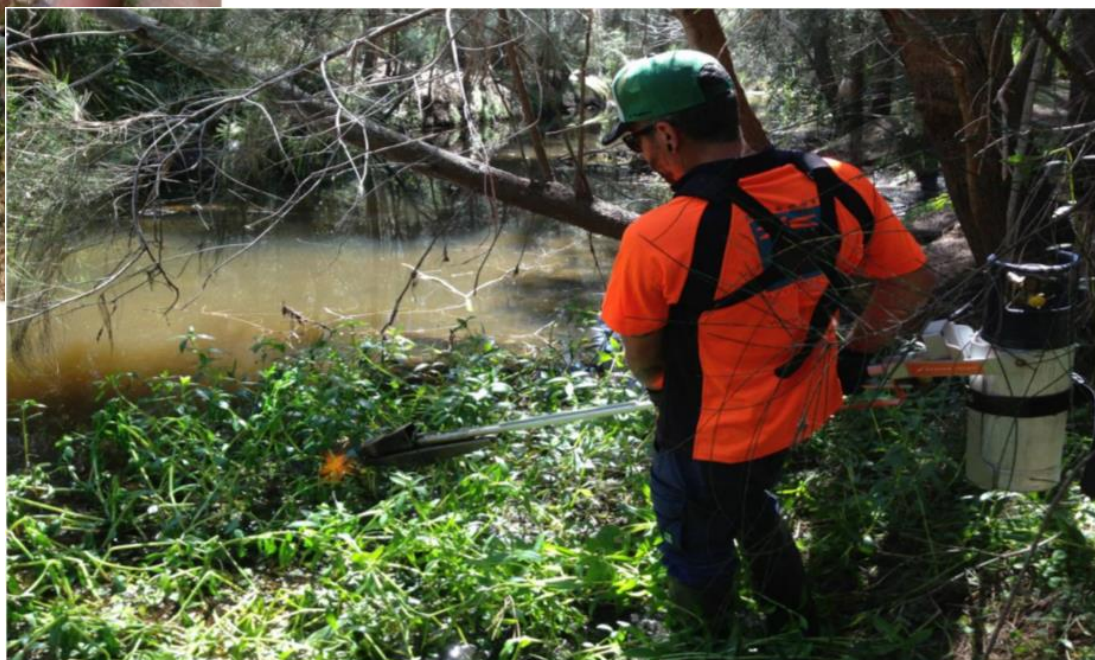
FLAME WEEDER – ECO BURN

Case Study: Weed
Mgt and Eco-burn
Glenorie in the
Hills Shire Council



Images provided by Dragonfly
Environmental

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



11.4 Appendix IV – 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.

Contact Hornsby Bushcare if you require any refills or replacements of your Phytophthora Kits on 9484 3677 or bushcare@hornsby.nsw.gov.au

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.

11.5 Appendix V – Test of Significance

11.5.1 Cumberland Plain Woodland

Cumberland Plain Woodland was listed as an Endangered Ecological Community under the Threatened Species Conservation Act 1995 in June 1997 (NSW Scientific Committee 1997). Since this listing, a large volume of new data and analyses have become available. In addition, a nomination to change the status of Cumberland Woodland to Critically Endangered status has been received. This Determination addresses additional information now available in accordance with current listing criteria under the Threatened Species Conservation Regulation 2002. Cumberland Plain Woodland is the name given to the ecological community in the Sydney Basin bioregion associated with clay soils derived from Wianamatta Group geology, or more rarely alluvial substrates, on the Cumberland Plain, a rain shadow area to the west of Sydney's Central Business District.

“...Reduce the extent of an ecological community...”

Five scattered remnant trees will be removed, however overall, there will be a net increase in ground midstory and canopy species from this endangered ecological community.

“...Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines...”

The vegetation onsite is already fragmented and isolated, within the proposed works there will be a net increase in ground midstory and canopy species from this endangered ecological community.

“...adversely affect habitat critical to the survival of an ecological community...”

No habitats considered critical to CPW occur within, or in close proximity to the Study Area.

“...modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns...”

The construction will not have an impact on the remnant CPW within the Study Area. While there are no defined water courses onsite, there are naturally occurring wet spots after rain. These damp habitats are being retained and integrated with stormwater management.

“...cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora and fauna harvesting...”

The proposed works will not cause a substantial change in the species composition. Five scattered remnant trees will be removed, however overall, there will be a net increase in ground midstory and canopy species from this endangered ecological community.

“...cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:...”

“...assisting invasive species that are harmful to the listed ecological community, to become established...”

The proposed works are not likely to assist invasive species that are harmful to the CPW, it is expected that the landscaping and bush regeneration works will contribute to clearing of weeds and increase in ground midstory and canopy species from this endangered ecological community.

“...causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community...”

The proposed works are not expected to further increase the levels or mobilisation rates of any existing pollutants, fertilisers, or other chemicals.

“...interfere with the recovery of an ecological community...”

The Proposal involves the clearing of five scattered remnant trees, however overall, there will be a net increase in ground midstory and canopy species from this endangered ecological community. The action proposed will not interfere with any planned recovery actions of CPW vegetation by state or local government, nor are there any conservation agreements on the land.

11.5.2 Cumberland Plain Land Snail

The Cumberland Plain Land Snail occupies dry woodlands and forests that occur on the Cumberland Plain, sheltering under leaf litter, logs, urban refuse and decaying matter. Where possible this snail will burrow into loose soil. The Cumberland Plain Land Snail is a detritus feeder and is often found feeding on fungi. Breeding is related to climatic conditions, this species being dependent on precipitation for breeding opportunities.

The Cumberland Plain Land Snail does not require a large area to maintain a locally viable population. Surveys have found that, within very short distances (up to 2m), the populations are highly structured and after a distance of 350m the populations are random. Home range areas for this animal are therefore expected to be in the order of 5m to 10m. Little is known about the life cycle of this snail, but it is believed that this species lives for around two to three years, being sexually mature at the end of its first year. Threats to the occurrence of this species include clearing of bush and urban expansion.

As areas of suitable habitat are cleared, the Cumberland Plain Land Snail continues to become displaced, isolated, fragmented and locally extinct. The Cumberland Plain Land Snail's current known distribution is in an area roughly bounded by Cattai (to the north), Picton (to the south), Prospect Reservoir (to the east) and Yarramundi (to the west).

Even though the Cumberland Plain Land Snail has not been identified onsite, any possible habitat should be retained and proposed works in the bush regeneration area should include enhancement of this habitat.

11.5.3 Microbats

Five species of microbat were assessed as having the potential to occur within the study area based on Bionet records. The following species have the potential to occur in the site or surrounding bushland:

- Eastern Freetail-bat (*Mormopterus norfolkensis*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Little Bentwing-bat (*Miniopterus australis*)
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*)
- Southern Myotis (*Myotis macropus*)



All of the recorded species are considered to be highly mobile and would be likely to be accessing the site occasionally or opportunistically as foraging habitat across a landscape of fragmented habitat. Although these species have differing habitat requirements, they have been assessed together as the trees to be removed would be considered marginal habitat for all five species.

7-Part Test

- a) *in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction*

The trees that may need to be removed were not observed to be bearing hollows suitable for tree roosting microbat species including the Eastern Freetail-bat, although some of the trees proposed for removal do have folding bark which serves as roosting habitat during certain times of the year.

The proposed actions would be expected to have a lesser impact upon cave dwelling species including the Large-eared Pied Bat, Little Bentwing-bat, Eastern Bentwing-bat and the Southern Myotis. Trees do not comprise breeding habitat for these species and would not impact their life cycles. The Eastern Bentwing Bat, Little Bentwing-bat and the Southern Myotis have relatively higher recorded sightings within a 10km surrounding the site (Bionet, 2018). This indicates that the site may be used frequently for foraging resources by these species and that the proposed actions would not impact the life-cycles of cave dwelling species.

- b) *in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction*

There are no endangered populations of any of the five species in the surrounding areas. The proposed actions are likely to have little adverse effect on the life cycles or persistence of local populations.

- c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

N/A

- (ii) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

N/A

d) *in relation to the habitat of a threatened species, population or ecological community:*

- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed*

The proposed actions involve the removal of native mature trees which do not contain hollows, although they do contain flaking bark used for marginal roosting habitat for microbat species. In that case, these trees may contain both marginal foraging and roosting habitat for species which feed on insects in or above the canopy. Having this in mind, it is recommended to install two (2) microbat boxes onsite.

- (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action*

The proposal will not result in the creation of any barriers to the movement of these highly mobile, aerial species. The available habitat on site will not become fragmented or isolated from other areas of habitat as a result of the proposed developments.

- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

The habitat being removed or modified is not significant towards the long-term survival of the species as it is considered to be marginal habitat, only to be used occasionally or opportunistically.

- e) *whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

Critical habitat has not yet been defined for the species in this area.

- f) *whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

A recovery plan/threat abatement plan has not yet been prepared for microbat species. The Office of Environment and Heritage (OEH) have identified priority actions for species recovery (see www.environment.nsw.gov.au). The proposed action does not defy the objectives of the threat abatement plans of cave or tree-roosting species as it does not involve the removal of hollow bearing trees which are advised to be retained within the landscape.

- g) *whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The proposed actions do not constitute part of a key threatening process and will not increase the impact of threatening processes in the foreseeable future.

Conclusion

Insignificant impact due to removal of trees, although there is potential for both marginal foraging and roosting habitat onsite, therefore it is recommended to install two (2) microbat boxes.

11.5.4 Grey-headed Flying-Fox (*Pteropus poliocephalus*)

Species Description

TSC-V

Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Can travel up to 50 km to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.



7 Part-Test

- a) *in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction*

Proposed developments are unlikely to have an adverse effect on the life cycle of this threatened species' viable population or bring it at risk of extinction. The trees that may need to be removed are Grey Box (*Eucalyptus moluccana*) and Forest Red Gums (*Eucalyptus tereticornis*) which may be providing temporary foraging resources. However, the removal of these trees is not likely to highly impact the life cycle of the species in a way that it could place the species at risk of extinction.

- b) *in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction*

There are no endangered populations of this species in the surrounding areas. The proposed actions are likely to have little adverse effect on the life cycles or persistence of local populations.

- c) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:*

- (i) *is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

N/A

- (iii) *is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

N/A

- d) *in relation to the habitat of a threatened species, population or ecological community:*

- (i) *the extent to which habitat is likely to be removed or modified as a result of the action proposed*

The proposed actions involve the removal of Grey Box (*Eucalyptus moluccana*) and Forest Red Gums (*Eucalyptus tereticornis*) trees. These trees may contain marginal foraging habitat for species. Due to the lack of connectivity to denser vegetation, it would be unlikely that this species would frequently use the trees for foraging.

- (ii) *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action*

The proposal will not result in the creation of any barriers to the movement of these highly mobile, aerial species. The available habitat on site will be not become fragmented or isolated from other areas of habitat as a result of the proposed developments.

- (iii) *the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,*

The habitat being removed or modified is not significant towards the long-term survival of the species as it is considered to be marginal habitat, only to be used occasionally or opportunistically.

- e) *whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),*

Critical habitat has not yet been defined for the species in this area. The Australian government is currently working to understand and define critical foraging habitat for these flying foxes

- f) *whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,*

A Draft Recovery Plan has been prepared for this species (see <http://www.environment.gov.au/>). The proposed actions will work in accordance with the management objectives or actions of the recovery plan.

- g) *whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.*

The proposed actions do not constitute part of a key threatening process and will not increase the impact of threatening processes in the foreseeable future. Main key threatening processes for this species include habitat loss, disease, electrocution on power lines, climate change and heat stress.

Conclusion

Insignificant impact due to actions of removal of Grey Box (*Eucalyptus moluccana*) and Forest Red Gums (*Eucalyptus tereticornis*) trees, all of which would only be considered marginal habitat.

12 Expertise of authors

With over 20 years wetland and urban ecology experience, a great passion for what she does and extensive technical and on-ground knowledge make Mia a valuable contribution to any project.

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

Geraldene has up to date knowledge of environmental policies and frequently provides input to such works. 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.

Geraldene Dalby-Ball DIRECTOR



SPECIALISATIONS

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

CAREER SUMMARY

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

QUALIFICATIONS AND MEMBERSHIPS

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

Laura has great passion about the natural environment, sustainable development and biodiversity conservation. Laura is in her last semester of her double degree of Environmental Engineering and Science at the University of New South Wales.

Laura has valuable on-ground experience working with conservation organisations in different parts of the world, as well as contributing to environmental educational projects. Laura has participated in educational talks focused on ecological and sustainability matters and currently volunteers for organisations around the globe to help raise awareness, promote sustainable living and natural protection.

Laura has attended fundamental courses and workshops such as Sustainability in Construction; Environmental Frameworks, Law and Economics; Applied Geotechnics and Engineering Geology; and Contaminant Transport. Laura participated as one of the leading members of the Environmental Committee at her University in Colombia organising various campaigns promoting environmental awareness.

Laura has also prepared two theses, one on Orica's Botany Industrial Park Groundwater Clean-up Plan based on remediation technologies for contaminated land and

Laura Conde-Barona ENVIRONMENTAL ENGINEER INTERN



SPECIALISATIONS

- Creative and sustainable solutions in environmental engineering, particularly in waterways and wetlands, sustainable design and development.
- Engineering and environmental project management focusing on creating environmental and social outcomes.
- Engaging others in environmental protection and sustainability.

CAREER SUMMARY

- **Environmental Consulting Internship**, Ecological Consultants Australia, 2018 present
- **Marine Turtle Internship Program**, Conflict Island's Conservation Initiative, 2017

QUALIFICATIONS AND MEMBERSHIPS

- **Bachelor of Environmental Engineering and Marine Science**, University of New South Wales (Expected June 2018)
- **Study Abroad Program in Science**, University of New South Wales (2015)
- **Initiated Bachelor's Degree in Environmental Engineering and Biology**, Universidad de los Andes, Bogotá, Colombia (Transferred to UNSW in 2016)
- **Practicing member** Australian Herpetological Society
- Emergency First Response Certificate (2016)
- PADI Rescue Diver (2016)