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Vegetation Management Plan

521 The Northern Road LONDONDERRY



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SUMMARY

Fraser Ecological Consulting has been contracted by Elf Mushroom Farm to prepare a Vegetation Management Plan for 521 The Northern Road Londonderry (Lot 138 DP 752037) for the construction of a mushroom farm (approved modification MP 08_0255 MOD 2).

This plan has been done in accordance with Condition 20 (i) of the consent. It also addresses the review undertaken by the NSW Department of Energy, Environment and Science comments on Post Approval draft Vegetation Management Plan for Elf Mushroom Farm – 521 The Northern Road Londonderry - MP08-0255 MOD 2 dated 8/9/20.

A majority of the subject site comprises cleared land with remnant Castlereagh Scribbly Gum Woodland and Castlereagh Swamp Woodland trees which are listed as an Endangered Ecological Community under the NSW *Biodiversity Conservation Act 2016*. The areas of native vegetation proposed for removal are considered to be in poor condition. Intact and better quality Castlereagh Woodland will be retained and conserved within the Conservation Area which is the focus area for this plan. The Conservation Area comprises 4.8ha and includes the 25m Asset Protection Zone that extends off the rear of the approved building.

Targeted flora and fauna surveys were undertaken to ensure a more informed assessment of the potential impacts of the 25m asset protection zone, acoustic wall and general construction impacts. Threatened plant species recorded in this area included *Dillwynia tenuifolia* and *Persoonia nutans* which are both listed under the NSW *Biodiversity Conservation 2016* (refer to Section 4.4).

Recommendations for APZ establishment have been made in this report that will ensure that the APZ could be established without requiring the removal of any of these plants. The low-lying threatened plants occur within the drip zone of smooth-barked 'Hard-leaved Scribbly Gum' (*Eucalyptus scelerophylla*) trees that are considered ideal to retain within an APZ compared to rough-barked species when retained with a discontinuous canopy. The location of all trees approved for removal have been identified and mapped.

The location of weed infestations have been mapped. The dominant weed species occurring on-site are:

- *Eragrostis curvula ssp. curvula* (African Lovegrass)
- *Bidens Pilosa* (Cobblers Pegs)
- *Opuntia stricta* (Prickly Pear)
- *Arauja sericeifera* (Moth Vine)
- *Rubus fruticosus* (Blackberry)

The control of African Lovegrass and Blackberry will be the priority weeding for this VMP as it outcompetes native species. Successful weed control of this species requires follow up after the initial efforts. This means looking for and killing regrowth or new seedlings. Using a combination of control methods is usually more successful. The best method for controlling African Lovegrass it is to:

- control mature plants year round, with extra effort in spring before flowering
- look for flushes of seedlings after rain when temperatures are over 10°C (most seeds germinate in autumn and spring) and kill the seedlings before they are six weeks old
- keep looking for new plants each year as some seed remains viable for up to 17 years.
- consider an ecological burn

In general, weed control from areas of high resilience to low resilience, upper slope to lower slope in accordance with the 'Bradley Method' (Buchanan 1989) shall be undertaken in 3 stages described as primary, secondary and maintenance weeding. Weed control techniques including hand removal and herbicide application have been

described in detail and have been recommend for particular species of concern including woody weeds, small hand pull-able plants and those with underground reproductive structures.

Recommendations for noxious and environmental weed control have been provided. All works shall be undertaken by a qualified and experienced bush regeneration company.

No revegetation works are proposed as it is highly like that weed control and bush regeneration efforts will assist in natural regeneration from the native soil seedbank.

This plan will be implemented for an initial intensive works period of 5 years. The plan shall be implemented in perpetuity in accordance with the conditions of consent ideally by way of a positive covenant on title of the property.

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1. Site characteristics and development proposal

1.1 Background

The approved modification (MP 08_0255 MOPD 2) to the Mushroom Farm Site is as follows:

Modification:	MP 08_0255 MOD 2: modification to the Mushroom Farm Site only to: • increase the main building footprint from 400m by 79m to 460m by 200m (total GFA of 88,178m²) • increase the number of growing rooms from 55 to 66 • integrate the proposed workshop, loading dock, spent substrate store, office and reception and spent compost drying area into the reconfigured main building • increase parking spots from 55 to 123 car spaces • increase the amount of fill required from 100,000m³ to 113,000m³ • decrease the operation workforce from 165 to 113 workers at full capacity
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The approved development consent that enacts the requirements for this Vegetation Management Plan (VMP) are as follows:

Vegetation Management Plan

- 20(ii) The Proponent shall prepare and implement a Plan for the Vegetation Management Area to the satisfaction of the Secretary. This plan must be prepared in consultation with ~~QEH~~ EESG by a suitably qualified and experienced expert/s whose appointment has been approved by the Secretary. The plan must:
- (a) be submitted to and approved by the Secretary ~~for approval~~ prior to the commencement of construction on the Mushroom Farm site;
 - (b) identify all vegetation that is present within the vegetation management area (as shown in Appendix 5);
 - (c) include the recommendations of the 'Addendum Flora and Fauna Assessment 521 The Northern Road Londonderry' dated 7 July 2015 and prepared by Fraser Ecological Consulting;
 - (d) include details of the mechanism that will be used to ensure that the vegetation within the area is protected in perpetuity;
 - (e) describe the management measures that will be implemented to maintain and enhance the vegetation within the area over time, including fencing of *Dillwynia tenuifolia* and *Persoonia nutans*. This should also include management measures aimed at ensuring that the implementation and management of the APZ protects the *Dillwynia tenuifolia* and *Persoonia nutans*;
 - (f) provide details of all trees scheduled for removal noting that trees to be felled with a Diameter at Breast Height (DBH) of 30cm or greater, once felled, are to be sawn into 2-6m lengths and relocated into the proposed conservation area identified in Appendix 5; and
 - (g) include a detailed weed condition map as a baseline from which site rehabilitation/management can be measured.

Note: all vegetation rehabilitation work is to be supervised by an appropriately qualified and experienced person with minimum qualifications of TAFE Certificate III in Bush Regeneration or Conservation and Land Management - Natural Area Restoration and 4 years bush regeneration experience.

- (m) Schedule 4 – Specific Environmental Conditions – Mushroom Farm Site, after Condition 20(i), insert the following new condition:

Fauna Inspection

- 20(ii) Prior to the commencement of works, including the removal of any trees associated with the approved development, an inspection for resident threatened fauna (including an inspection of hollows) must be undertaken by a qualified wildlife handler/expert and any fauna found relocated.

The approved Flora and Fauna Assessment prepared by Fraser Ecological dated 15th March 2018 shall be read in conjunction with this document where background ecological information is required.

Condition 20 (i) (f) conflicts with bushfire protection requirements that permits a maximum of 29 tonnes per ha of fuel load (achieved under the natural process of decay). Therefore, adding more biomass by relocating all fallen and cut up trees (greater than 30cm in diameter) will increase the bushfire BAL and bushfire risk. Therefore, we have suggested in Section 7.4 and Section 9 that all hollow-bearing trees approved for removal are to be sawn into 3m lengths and re-located into the VMP area (rear of the building) under the supervision of the Project Ecologist.

The main mechanisms that will be used to protect the vegetation management area in perpetuity will be:

- Installation and maintenance of 1.2m high cyclone mesh fencing of the boundary of the VMP works area prior to the commencement of any construction works
- Signage placed every 100m along the VMP fencing to notify all contractors that the dumping of rubbish, storage of building materials and any other unauthorised damage to protected vegetation is liable for prosecution
- Active bushland restoration works (by qualified and experienced bush regenerators) to suppress and control invasive weeds that threaten the viability of the existing native soil seedbank and threatened plants (*Persoonia mollis* ssp. *nutans* and *Dillwynia tenuifolia*) in accordance with relevant recovery plans and best practice regeneration techniques
- Consideration of appropriate fire frequency if used as a bush regeneration technique to ensure that the seed bank of *Persoonia mollis* ssp. *nutans* and *Dillwynia tenuifolia* remains viable.
- Provision of a monitoring program whereby monitoring quadrats and reports (undertaken by the Project Ecologist) and prescribed performance criteria milestones are met. The monitoring reports are to be provided to the consent authority to ensure compliance with performance criteria targets.

The specific management measures that “will” be implemented for threatened plants (*Persoonia mollis* ssp. *nutans* and *Dillwynia tenuifolia*) are provided within Section 4.4 & 7.1. We have ensured that all recommendations are consistent with The Recovery Plan for *Persoonia mollis* ssp. *nutans* (Appendix C) and *Recovering bushland on the Cumberland Plain: best practice guidelines for the management and restoration of bushland* (DEC 2005).

It is recommended sensitive APZ establishment is undertaken without requiring the removal of any threatened plants and the retention of a hollow-bearing tree (refer to Section 6). The low-lying threatened *Dillwynia tenuifolia* plants (refer to waypoint 108 in Figure 5) occur within the drip zone of smooth-barked ‘Hard-leaved Scribbly Gum’ (*Eucalyptus scelerophylla*) that are considered ideal to retain within an APZ compared to rough-marked trees when retained as ‘islands’ of non-interlocking/discontinuous canopy.

1.2 Site characteristics

The study site is located approximately 50km north-west of the Sydney CBD within the Sydney Basin Bioregion (Figure 1).

The site is a rural allotment of approximately 22 hectares in size located on the western side of The Northern Road. The property is opposite Castlereagh Nature Reserve managed by NSW National Parks and Wildlife (NSW OEH) which located on the eastern side of The Northern Road, Londonderry (Figure 1a).

The site is currently occupied by a single storey dwelling and the surrounding area is characterised by rural living and agricultural activities.

The Conservation Area that is the focus of this plan and comprises 4.8ha (Figure 1b & 2). It includes the 25m wide bushfire Asset Protection Zone (APZ).

This plan will be implemented for an initial intensive works period of 5 years. The plan shall be implemented in perpetuity in accordance with the conditions of consent ideally by way of a positive covenant on title of the property.

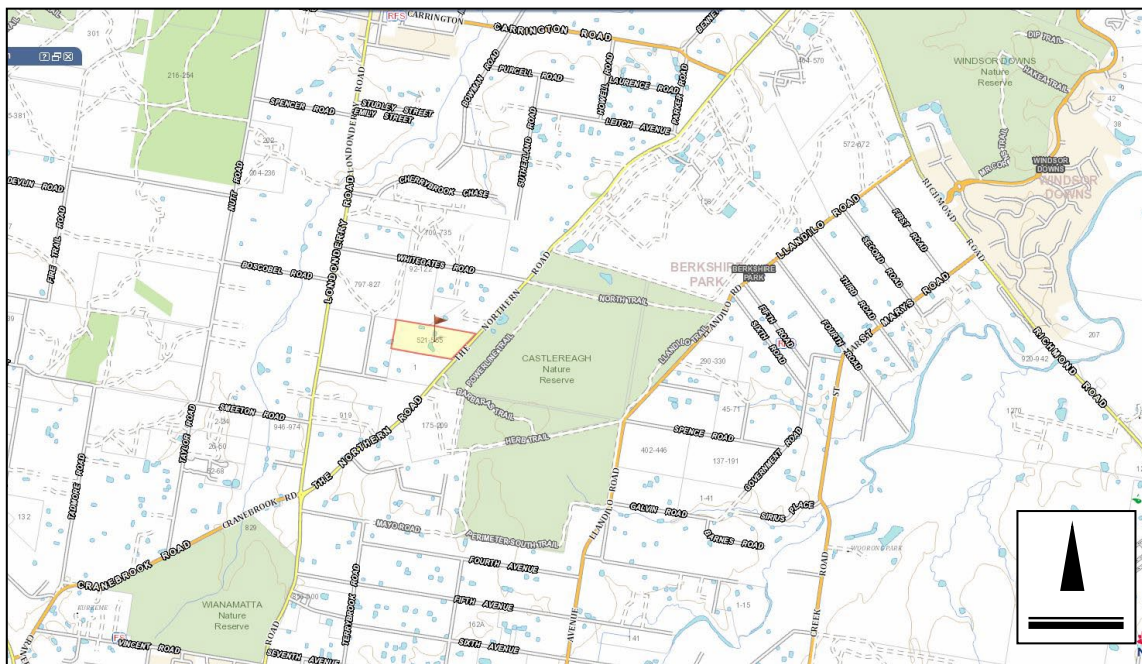


Figure 1: Aerial map of the locality site showing the site in yellow (Source: SIX Maps)



Figure 1a: Aerial map of the subject site showing building envelope (Source: SIX Maps)



Figure 1b: Location of the Conservation Area (red)

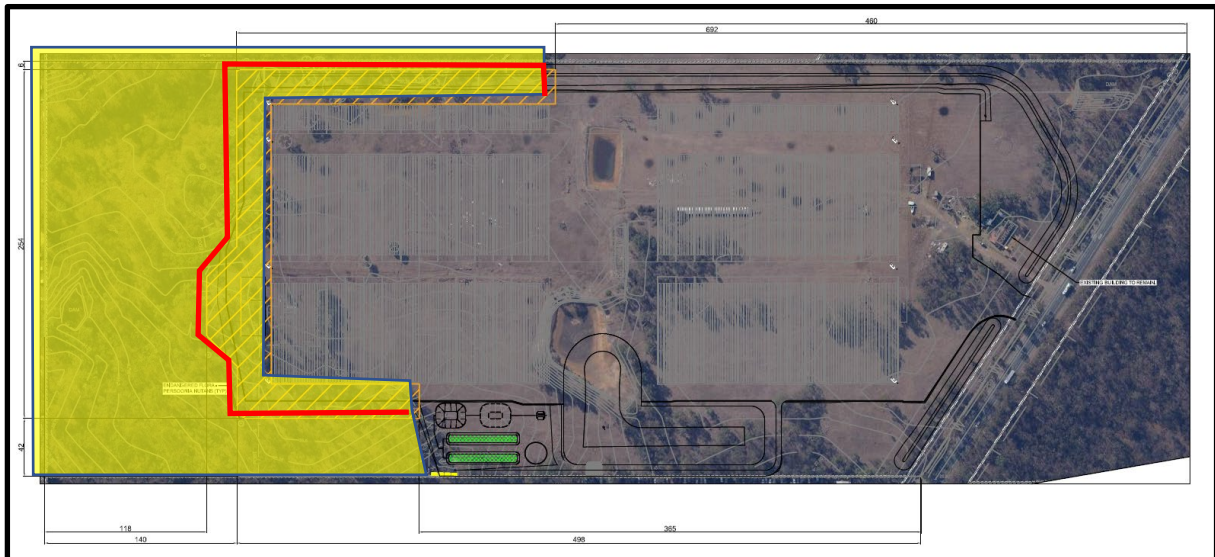


Figure 2: 4.8ha Conservation Area (yellow) in relation to the approved building envelope with the 25m APZ (shown in red)

1.3 Climate

The climate of the area is temperate with mild to hot summers and cool to cold winters. The Bureau of Meteorology summary statistics for rainfall for all years at the nearest weather station (Castlereagh Station No. 60072) is provided in Figure 3 (below). The local rainfall patterns influence the vegetation types and microhabitat present on site.

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	105.7	115.4	85.0	65.9	56.6	64.2	34.1	43.1	39.9	60.4	79.5	68.4
Median	79.0	86.8	75.6	34.1	30.5	32.2	16.8	22.0	30.0	40.8	72.5	50.4
Highest Daily	167.6	200.0	167.6	95.6	191.8	100.0	138.4	171.0	172.0	66.0	113.0	94.0

Figure 3: Bureau of Meteorology summary statistics for rainfall for Castlereagh Weather Station No. 60072

1.4 Geology

The Penrith 1:100 000 Soil landscape of the Penrith 1:100 000 map sheet (Hazelton et al 1989) produced by the NSW Office of Environment and Heritage identifies the site as being part of the Berkshire Park soil landscape. The Berkshire Park soil landscape is found on the low rises of the Tertiary geology of the Hawkesbury/Nepean River system. Soils are weakly pedal of heavy orange clays and clayey sands. These soils are often mottled. Large silcrete boulders can occur as can unstructured plastic clays. Berkshire Park soils are prone to wind erosion when cleared of vegetation.

The limitation of this soil landscape is that it has very high wind erosion if cleared and gully, sheet and rill erosion on dissected area. It is also susceptible to water logging, impermeable subsoils and low fertility (Hazelton et al 1989).

2. VMP Objectives

This report provides recommendations including:

- Protection of threatened plants in the Conservation Area in perpetuity
- Protection of CSGW in the Conservation Area in perpetuity
- Responsible establishment and management of the 25m APZ to the rear of the building
- Pre-clearing protocols for mapped trees approved for removal
- Bushland restoration techniques encouraging natural regeneration of all retained CSGW vegetation in the Conservation Area in perpetuity
- Erosion control following primary weed control (where required)
- The removal and suppression of introduced and environmental weeds
- Maintenance requirements for plan implementation for initial year period and in perpetuity

The major objective of this plan is to provide a working document to deliver successful weed management in the long term and thus enhance and protect habitat for threatened species. This is to be achieved by weed management, regeneration of the native vegetation and supplementary native plantings where appropriate. In recognition of the site's sensitive nature, the actions are also consistent with the *"Checklist for Bush Regeneration Activities in the Habitat of Threatened Species, Endangered Populations and Endangered Ecological Communities"* issued by the NSW National Parks and Wildlife Service (see Appendix 1). The plan is also in accordance with *"Bush Regeneration- Recovering Australian Landscapes"* (Buchanan 1989) and *"Bringing the Bush Back to Western Sydney"* (DIPNR and AABR 2003).

3. Methods

3.1 Desktop survey

A desktop survey is performed to ensure all relevant documentation is considered when preparing the plan. Documents surveyed include:

- Aerial photographs
- Topographic maps
- *Guidelines for the preparation of Vegetation Management Plans* (Department Infrastructure Planning and Natural Resources 2007).
- Sydney Soil Landscape Series Sheet 9130 (Chapman and Murphy 1998)

3.2 Field Surveys

A visual inspection was undertaken on the 5th July 2020 to identify and evaluate vegetation assessment including floristics, structure, extent, type and projective foliage cover, presence of weed species and other significant features were noted and recorded). All flora recorded were predominantly identified to family, genus and species level with confirmation according to *Field Guide to the Native Plants of Sydney* (Robinson, 2003), *Weeds of the south-east: an identification guide for Australia* (Richardson, 2006) and the Botanic Gardens Trust (2009) *PlantNET* flora database.

Previous flora surveys have been undertaken by the author for the approved Flora and Fauna Assessment in 2018.

4. Native and introduced vegetation recorded on-site

1. Site ecological values

4.1 Vegetation associations/ communities

The vegetation within the site comprises of a mixture of predominantly previously cleared land (grazing pastures) and patches of remnant bushland that is consistent with the NSW Office of Environment and Heritage mapping and Final Determination for **Castlereagh Scribbly Gum Woodland (CSGW)** mainly within the western portion of the site as depicted in Figure 4.

The previous assessment prepared by Kevin Mills and Associates (2009) refers to some of the remnant vegetation as **Castlereagh Swamp Woodland (CSW) Endangered Ecological Community** in the poorly drained depressions of the site mainly in the middle and eastern portion of the site.

The remnant CSGW and CSW vegetation proposed for removal includes isolated paddock trees with a highly disturbed understorey and is considered to be in poor condition. The trees include a mixture of a few older mature trees with young to sub-mature growth vegetation regenerating where grazing practices have ceased. The native under-storey species have been outcompeted by predominantly introduced pasture species.

Better quality patches of woodland occur at the rear (western portion) of the property where grazing has been activities have been prevented as result of existing fencing. These areas will be excluded from the proposed clearing activities.

The native canopy tree species recorded on site include:

- *Eucalyptus sclerophylla* (Hard-leaved Scribbly Gum) - dominant on western edges of site
- *Angophora bakeri* (Narrow-leaved Apple) – dominant on western edges of site
- *Eucalyptus eugenioides* (Thin-leaved Stringybark)
- *Corymbia gummifera* (Red Bloodwood)
- *Eucalyptus parramattensis* (Parramatta Red Gum) – lower lying water-logged soils in the north-eastern corner

The main shrub species with a sparse and patchy distribution are:

- Saplings of *Angophora bakeri*
- *Melaleuca nodosa*
- *Ozothamnus diosmifolius*
- *Kunzea ambigua*

The groundcover layer is predominantly a mixture of introduced and native species including:

- *Commelina cyanea* (Wandering Sailor)
- *Microlaena stipoides* (Weeping Grass)
- *Pratia purpurascens* (White Root)

Native groundcovers (grasses and herbs) only dominate in few locations along the southern edge of the site.



Figure 4: Broad-scale vegetation map of the property (NSW OEH 2008 - VISmap 3785). The green polygon shows the extent of intact Castlereagh Scribbly Gum Woodland. The orange area shows isolated paddock trees indicative of remnant Castlereagh Scribbly Gum Woodland (Source: SIX Maps.com)

Table 1: Plant species recorded on-site

Species name	Common name
Native	
<i>Eucalyptus sclerophylla</i>	Hard-leaved Scribbly Gum
<i>Angophora bakeri</i>	Narrow-leaved Apple
<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark
<i>Eucalyptus fibrosa</i>	Broad-leaved Ironbark
<i>Corymbia gummifera</i>	Red Bloodwood
<i>Eucalyptus parramattensis</i>	Parramatta Redgum
<i>Alternanthera denticulata</i>	Lesser Joyweed
<i>Aristida vagans</i>	Threeawn Speargrass
<i>Bursaria spinosa</i>	Sweet Bursaria
<i>Callistemon pinifolius</i>	Pine-leaved Bottlebrush
<i>Cardamine paucijuga</i>	
<i>Centipeda minima subsp. minima</i>	spreading sneezeweed
<i>Cheilanthes sieberi</i>	Rock Fern
<i>Chloris truncata</i>	Windmill Grass
<i>Commelina cyanea</i>	Wandering sailor
<i>Corymbia gummifera</i>	Red Bloodwood
<i>Cynodon dactylon</i>	Common Couch
<i>Dianella spp.</i>	
<i>Daviesia ulicifolia</i>	
<i>Dillwynia tenuifolia</i>	
<i>Echinopogon ovatus</i>	Forest Hedgehog Grass
<i>Einadia hastata</i>	Berry Saltbush
<i>Eleocharis sphacelata</i>	Tall Spike Rush
<i>Epaltres australis</i>	Spreading Nut-heads

Species name	Common name
<i>Eragrostis leptostachya</i>	Paddock Lovegrass
<i>Fimbristylis dichotoma</i>	Common Fringe-sedge
<i>Glycine microphylla</i>	Small-leaf Glycine
<i>Hardenbergia violacea</i>	False Sarsaparilla
<i>Hakea sericea</i>	
<i>Hypericum gramineum</i>	Small St John's Wort
<i>Hypoxis hygrometrica</i>	Golden Weather-grass
<i>Juncus usitatus</i>	
<i>Kunzea ambigua</i>	Tick Bush
<i>Lagineria stipitata</i>	Blue Bottle Daisy
<i>Melaleuca decora</i>	
<i>Melaleuca linariifolia</i>	Flax-leaved Paperbark
<i>Melaleuca nodosa</i>	
<i>Melaleuca thymifolia</i>	Thyme Honey-myrtle
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Grass
<i>Oxalis exilis</i>	
<i>Ozothamnus diosmifolius</i>	White Dogwood
<i>Paspalidium distans</i>	
<i>Persoonia nutans</i>	Nodding Geebung
<i>Pimelea linifolia</i>	Slender Rice Flower
<i>Pomax umbellata</i>	Pomax
<i>Potamogeton tricarinatus</i>	Floating Pondweed
<i>Pratia purpurascens</i>	Whiteroot
<i>Pteridium esculentum</i>	Bracken
<i>Rumex</i> spp.	Dock
<i>Solanum pungetium</i>	Eastern Nightshade
<i>Sporobolus creber</i>	Slender Rat's Tail Grass

Species name	Common name
<i>Urtica incise</i>	Stinging Nettle
<i>Wahlenbergia gracilis</i>	Sprawling Bluebell

4.2 Fauna habitat features

The main development impact area provides fauna habitat in the following forms:

- Seasonal foraging resources when eucalypts and other plants flower provide nectar and insect resources for mobile fauna including Grey-headed Flying Fox, possums, gliders, microchiropteran bats and a variety of woodland bird species
- marginal foraging area for owl species that may periodically roost or glean prey items such as possums from the area
- refuge and transient area for reptiles including snakes, lizards and amphibians including the intermittent drainage line occurring at the rear of the site
- potential grazing grounds for macropods

The site for the approved development does not contain a significant amount of unique habitat features in the form of habitat hollows (in trees), hollow logs and other dead wood on the forest floor, rocky outcrops, creek lines and a diverse vegetation habitat structure as the site vegetation strata is limited to predominantly cleared open paddocks and isolated paddock trees. The three dams occurring on-site provide habitat for common waterbirds, however, these habitats are not considered to provide critical breeding resources for common protected or threatened fauna.

Intact woodland occurring outside the proposed development area includes better quality fauna habitat in the form of structurally diverse vegetation strata (tree canopy, shrubs and groundcovers) with some hollow-bearing trees and fallen dead timber.

It is likely that a variety of woodland birds frequent the locality. Seasonal blossoms from flowering canopy of Myrtaceae would attract a variety of nectivores including possums, birds and threatened Grey-headed Flying Fox.

Nocturnal arboreal marsupials including Common Brushtail Possum and Sugar Gliders are likely to occasionally use the site for foraging. Reptiles likely to occur include a variety of snakes (Red-bellied Black Snake, Brown Snake and Tiger Snake).

Section 4.4.2 shows the location of hollow-bearing trees occurring on-site. The sensitive removal of these habitat will be done in accordance with the consent approval as per described in Section 7.

The NSW Depart of Environment Energy and Science comments on Post Approval draft Vegetation Management Plan for Elf Mushroom Farm – 521 The Northern Road Londonderry - MP08-0255 MOD 2 (Refeence No. DOC20/708632) states:

Condition 20ii in the Modification of Project Approval for Fauna Inspection requires that: Prior to the commencement of works, including the removal of any trees associated with the approved development, an inspection for resident threatened fauna (including an inspection of hollows) must be undertaken by a wildlife handler/expert and any fauna found relocated.

While this condition requires an inspection is undertaken for “resident threatened fauna”, EES recommends the inspection applies to all “protected animals” under *the Biodiversity Conservation Act 2016 (BC Act)* and not just threatened fauna. Protected animals are defined in Schedule 5 of the BC

Act to include any of the following that are native to Australia or that periodically or occasionally migrate to Australia (including their eggs and young) –

- amphibians - frogs or other members of the class amphibia
- birds - birds of any species
- mammals - mammals of any species (including aquatic or amphibious mammals but not including dingoes)
- reptiles - snakes, lizards, crocodiles, tortoises, turtles or other members of the class reptilia.

As the focus of the VMP is the Conservation Area on the western portion of the site, the issue relating to the dewatering of the dams and the relocation of native fauna may need to be addressed in the Construction Environmental Management Plan rather than the VMP.

This issue has been addressed in more detail in Section 7.5.

4.3 Corridors and connectivity

The biodiversity value of corridor networks is well known. Landscapes that retain more connections between patches of otherwise isolated areas of vegetation are more likely to maintain more numerous and more diverse populations of various plant and animal species (Lindenmayer and Fischer, 2006). Conversely, a lack of landscape connectivity can have a range of negative impacts on species populations (Lindenmayer and Fischer, 2006). It is thought that if existing remnants are left to persist without sufficient immigration to maintain genetic diversity, continued losses of biodiversity are certain (Parker *et al.* 2008).

The site forms part of a local habitat corridor being continuous with mosaic patches of surrounding bushland interspersed with agricultural and rural residential development. Isolated paddock trees provide limited 'stepping stone' type connectivity for mobile groups of fauna that are likely to be seasonally transient through the area. However, the proposed loss of this habitat will **not** significantly impact upon the local population of a threatened species.

The rear (western portion) of the site contains remnant CSGW that will be retained as part of the development proposal. This vegetation is considered ecologically significant from a connectivity perspective because it comprises of CSGW Vulnerable Ecological Community type, contains recent records of threatened plant and it forms part of a broader corridor network that connects with Castlereagh Nature Reserve on the opposite side of The Northern Road.

The proposed development will **not** fragment bushland or significantly impact upon the corridor function of bushland in the locality. Intact native woodland will be retained around the western side of the development (still within the property) for a significant area that will allow the movement of fauna groups and dispersal/exchange of genetic material for plants.

The Conservation Area will function as part of the local habitat corridor and be protected and enhanced.

4.4 Threatened species

4.4.1 Threatened flora

Despite targeted surveys undertaken in June 2015 recording five (5) individuals of threatened plants – *Persoonia nutans* (Nodding Geebung), only one individual of this species was recorded during March 2018 and July 2020 surveys and this was outside the proposed APZ (Figure 5). *Persoonia nutans* is listed as Endangered under the NSW *Biodiversity Conservation Act 2016* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

64 individuals of another threatened plant – *Dillwynia tenuifolia* was recorded during the recent surveys. 15 of these plants occur within the proposed Asset Protection Zones (Figure 5). *Dillwynia tenuifolia* is listed as Vulnerable under the NSW *Biodiversity Conservation Act 2016* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Additional threatened flora surveys will be undertaken by the engaged bush regeneration contractor when baseline monitoring quadrats are undertaken at the formal commencement of this VMP (refer Section 9 – works schedule).

P. nutans – management strategies

The main threats to the survival of *P. nutans* are habitat loss and fragmentation (due to clearing for mining, and rural/residential development) and inappropriate fire regimes, particularly frequent fire. The species is also threatened by habitat degradation due to disturbance associated with unrestricted access to *P. nutans* habitat.

The frequency of disturbance, particularly fire, is of vital importance for the management and conservation of *P. nutans*. It is highly likely that too frequent disturbance, and also potentially a long-term absence of disturbance, may be detrimental to the persistence of *P. nutans*. For species killed by fire the presence of a seed bank is essential for persistence after a fire event unless propagules of the species are widely dispersed (Auld et al. 2000; Keith 1996). If fires occur at an interval too small to allow reestablishment of a soil stored seed bank following a previous fire then local extinction will occur.

The critical fire frequencies for survival of *P. nutans* have not yet been determined, although NSW NPWS (2002b) suggest > 7 year intervals and the Draft Threatened species Hazard Reduction List for the Bush Fire Environmental Assessment Code states that fire should not occur more than once every ten years in the habitat of *P. nutans*. Fires do occur within the habitat at *P. nutans* at greater than 7 year frequencies and local extinctions due to frequent fire are very likely to occur (see Section 8.2.2).

A long-term absence of fire may also be detrimental to *P. nutans* population persistence given that recruitment is likely to be largely dependent upon disturbance. However, it appears that most of the largest populations in the north of the species range burn relatively frequently. It is likely therefore that frequent rather than infrequent fire poses the greatest threat to the persistence of *P. nutans* (Section 8.2.2).

Therefore, whilst fire should be considered as a bush regeneration and management tool for this species care must be taken in the frequency as stated above. Fencing and weeding other management strategies to be employed for this species.

The Recovery Plan for this species is provided within Appendix C.

Dillwynia tenuifolia – management strategies

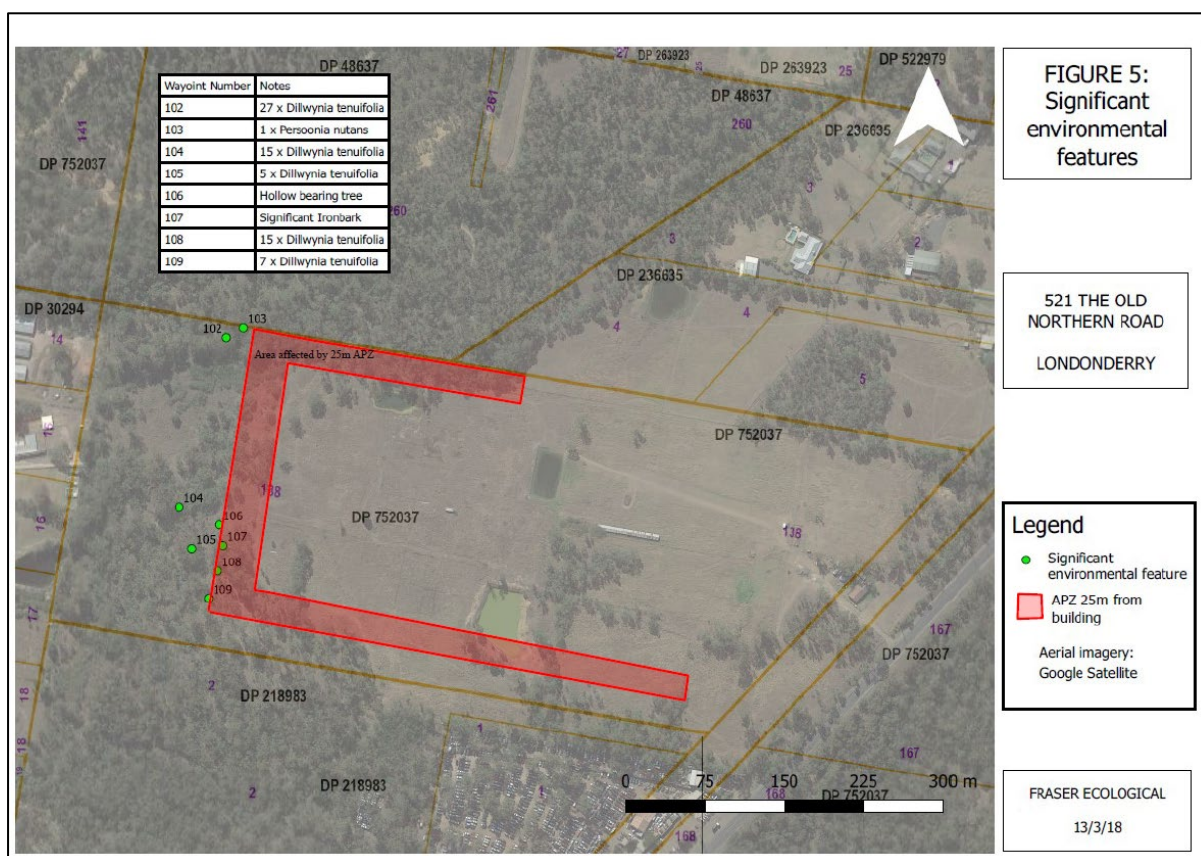
The NSW DPIE Threatened species profile website
(<https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10226>)
states:

- Flowering occurs sporadically through the year with a peak from August to March depending on environmental conditions. Pollinators are unknown. The lifespan is estimated to be 20-30 years. It is thought a minimum of 3-4 years is required before seed is produced.
- Seeds are hard coated and are persistent in the soil seed bank. Dispersal is likely to be localised and ants are the probable vectors
- Killed by fire and re-establishes from soil-stored seed.
- Abundance is influenced by past disturbance history e.g. fire. The high population densities at some recorded sites (200,000+ individuals) reflects prolific seed germination in response to fire.

The EIA guideline for this species (NPWS 2002) states:

'Threatening processes currently affecting the species include clearing, slashing, grazing, trampling and habitat modification through altered fire regime, urban runoff, weeds, rubbish dumping, indiscriminant vehicular and pedestrian access.'

Therefore, whilst fire should be considered as a bush regeneration and management tool for this species care must taken in the frequency as similarly stated above for *Dillwynia tenuifolia*. Fencing and weeding other management strategies to be employed for this species.



**Figure 5: Location of threatened flora in relation to the APZ
(note surveys were undertaken in 2018)**

4.4.2 Threatened Fauna

No indirect evidence of threatened fauna species or habitats critical to survival of a local population of threatened fauna were recorded on site. Threatened fauna recorded previously within 10km of the site that have been considered in this assessment are shown in Appendix D.

The previous Flora and Fauna Assessment prepared by Kevin Mills and Associates (2009) states that the site contains potential habitat for Endangered Cumberland Plain Land Snail. Targeted searches were specifically undertaken for this species, however, none were recorded on-site.

The proposal is unlikely to constitute a significant impact on threatened fauna species given that:

- the proposed works would only remove poor quality/marginal foraging habitat for these species
- other areas of better quality habitat will be retained immediately adjacent to within the subject site and surrounding landscape
- the proposal is not likely to fragment habitat to an extent that would prevent mobility of the local viable populations of any threatened fauna species that may potentially occur within the sub-catchment

The proposal is unlikely to significantly impact on threatened fauna listed under the NSW *Biodiversity Conservation Act 2016* and Commonwealth *Environment Protection and Biodiversity Conservation Act*

1999. The potential for this species to be present should not be discounted as a precautionary measure.



Figure 6: Hollow-bearing tree map (red circles)

Table 2: Schedule of hollow bearing trees

Way point no.	DBH	Species
604	300	<i>Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)</i>
605	300	<i>Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)</i>
606	300	<i>Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)</i>
608	330	<i>Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)</i>
609	300	<i>Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)</i>
632	330	<i>Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)</i>

***Please refer to Tree Location Plan within Section 7.2.1 and Figure 9 that shows waypoint numbers as described above**

5. Weed species and mapping

The long history of grazing has resulted in depletion of the native soil seed bank, and therefore, is considered to have low native resilience (ability of the soil seed bank to regenerate).

The paddocks and other cleared areas are dominated by introduced species that that be carefully disposed of at a dedicated green waste facility to ensure there is no spread into the Conservation Area including:

- *Setaria gracilis* (Slender Pigeon Grass)
- *Sporobolus indicus* (Parramatta Grass)
- *Pennisetum clandestinum* (Kikuyu)
- *Paspalum dilatatum* (Paspalum)
- *Sida rhombifolia* (Paddy's Lucerne)
- *Verbena bonariensis* (Purpletop)
- *Senecio madagascarensis* (Fireweed)

The existing dams contains contain a few aquatic species that should be careful disposed of during construction works including:

- *Centipede minima* (Spreading Sneezeweed)
- *Paspalum distichum* (Water Couch)
- *Potamogeton tricarlinatus* (Floating Pondweed)
- *Juncus usitatus* (Common Rush)
- *Ludwigia pepeloides* (Water Primrose) – high level threat weed under the *Biosecurity Act 2015*

The location of weed infestations/ condition mapping within the Conservation Area have been mapped (Figure 7). It will act as a baseline from which site rehabilitation/ management can be measured.

The dominant weed species occurring on-site are:

- *Eragrostis curvula ssp. curvula* (African Lovegrass)
- *Bidens Pilosa* (Cobblers Pegs)
- *Oppuntia stricta* (Prickly Pear)
- *Arauja sericeifera* (Moth Vine)
- *Senecio madagascarensis* (Fireweed)
- *Rubus fruticosus* (Blackberry)

The control of African Lovegrass will be the priority weeding for this VMP as it outcompetes native species. Successful weed control of this species requires follow up after the initial efforts. This means looking for and killing regrowth or new seedlings. Using a combination of control methods is usually more successful. The best method for controlling it is to:

- control mature plants year round, with extra effort in spring before flowering
- look for flushes of seedlings after rain when temperatures are over 10°C (most seeds germinate in autumn and spring) and kill the seedlings before they are six weeks old

- keep looking for new plants each year as some seed remains viable for up to 17 years.
- consider ecological burn

Table 2: Introduced weed species occurring on-site

Introduced species	
<i>Alternanthera pungens</i>	Khaki Weed
<i>Araujia sericifera</i>	Moth Vine
<i>Axonopus fissifolius</i>	Narrow-leafed Carpet Grass
<i>Chloris gayana</i>	Rhodes Grass
<i>Cirsium vulgare</i>	Spear Thistle
<i>Conyza</i> spp.	A Fleabane
<i>Cyperus brevifolius</i>	
<i>Datura stromonium</i>	Common Thornapple
<i>Eragrostis curvula</i> ssp. <i>curvula</i>	African Lovegrass
<i>Gamochaeta calviceps</i>	Cudweed
<i>Gomphrena celosioides</i>	Gomphrena Weed
<i>Grevillea robusta</i>	Silky Oak
<i>Heliotropium amplexicaule</i>	Blue Heliotrope
<i>Ludwigia peploides</i> subsp. <i>montevidensis</i>	Water Primrose
<i>Modiola caroliniana</i>	Red-flowered Mallow
<i>Opuntia stricta</i>	Common Prickly Pear, Smooth Pest Pear
<i>Paspalum dilatatum</i>	Paspalum
<i>Pennisetum clandestinum</i>	Kikuyu Grass
<i>Phytolacca octandra</i>	Inkweed
<i>Rubus fruticosus</i> sp. agg.	Blackberry complex
<i>Senecio madagascariensis</i>	Fireweed
<i>Setaria</i> spp.	
<i>Sida rhombifolia</i>	Paddy's Lucerne
<i>Solanum nigrum</i>	Black-berry Nightshade

<i>Sporobolus africanus</i>	Parramatta Grass
<i>Verbena bonariensis</i>	Purpletop
<i>Yucca aloifolia</i>	Yucca

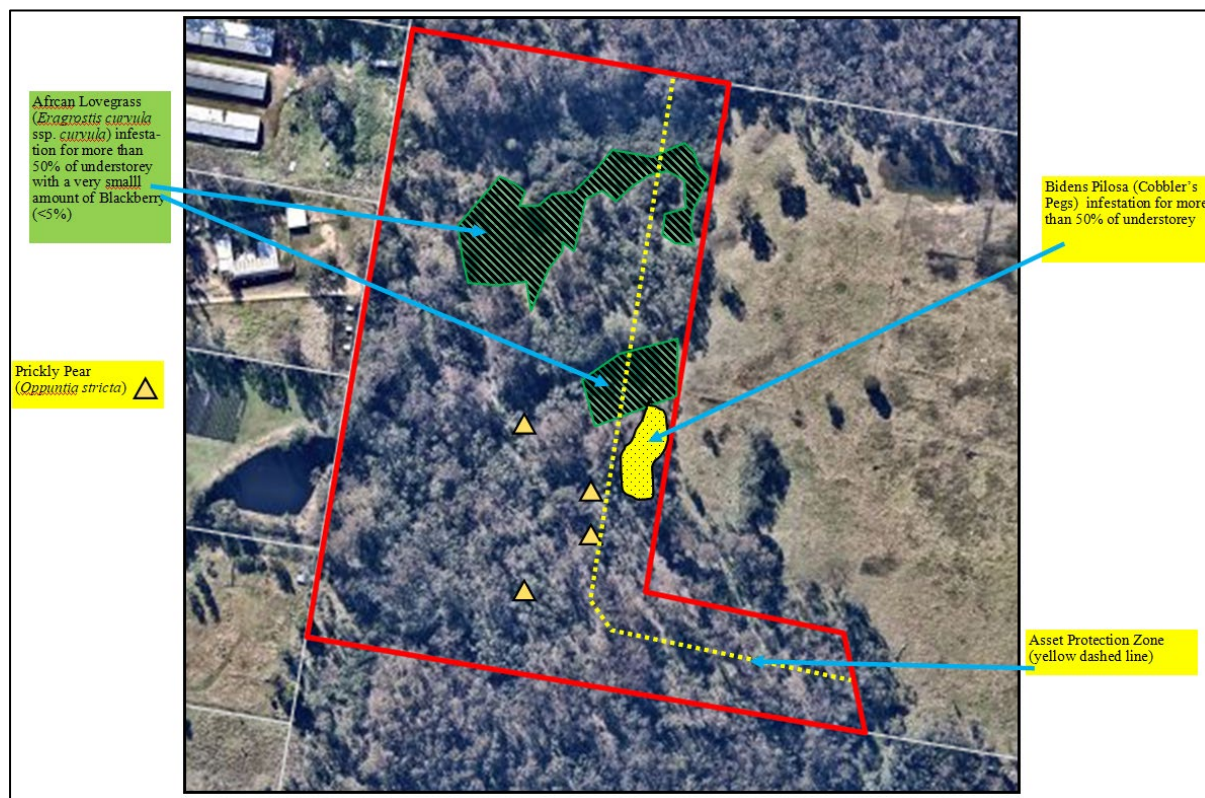


Figure 7: Weed condition map

6. Bushfire Hazard Asset Protection Zones management

The area to be managed as an Inner Protection Area (IPA) Asset Protection Zone (APZ) is shown in Figure 8 (below). It extends 25m from the rear of the building and forms part of the Conservation Area. Therefore, the APZ management is to be treated in accordance with this VMP. The APZ includes the following environmental features as discussed and mapped in the previous sections. This includes:

- Threatened plants (Figure 5)
- Hollow-bearing tree (Figure 6)
- Weed infestations (Figure 7)

Therefore, the establishment of the APZ shall be done under the direction of a suitably qualified ecologist of bush regeneration consultant to ensure there is compliance with *Planning for Bushfire Protection 2019* and the ecological objectives of this plan.

Planning for Bushfire Protection (NSW RFS 2018) states that the following requirements apply when establishing and maintaining an IPA:

"Trees:

- *canopy cover should be less than 15% (at maturity)*
- *trees (at maturity) should not touch or overhang the building*
- *lower limbs should be removed up to a height of 2m above ground*
- *canopies should be separated by 2 to 5m*
- *preference should be given to smooth barked and evergreen trees.*

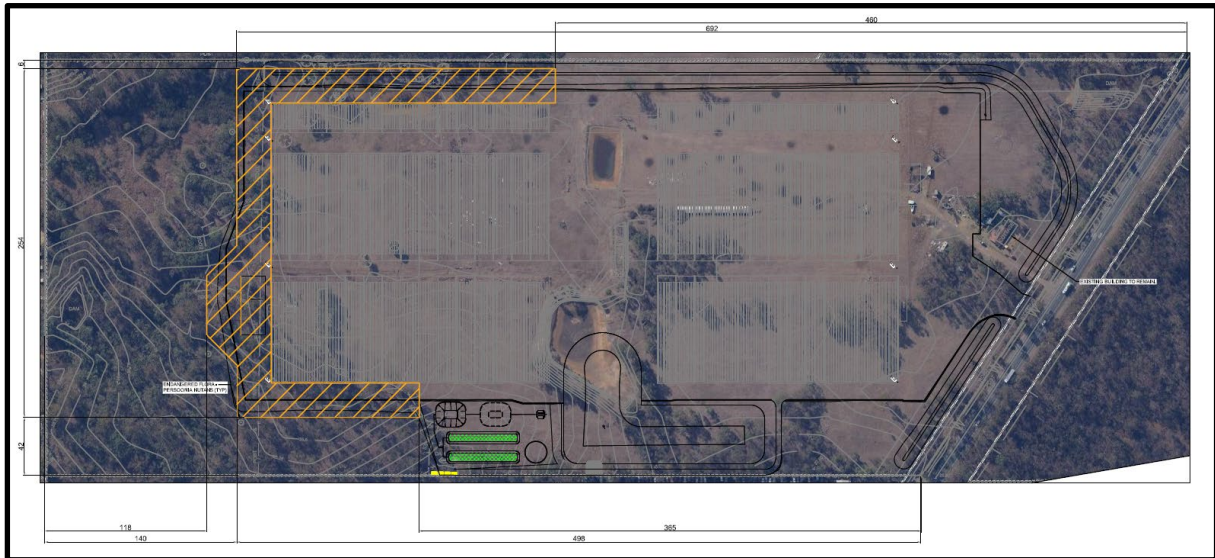
Shrubs:

- *create large discontinuities or gaps in the vegetation to slow down or break the progress of fire*
- *towards buildings*
- *shrubs should not be located under trees*
- *shrubs should not form more than 10% ground cover*
- *clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.*
- *Grass:*
- *should be kept mown (as a guide grass should be kept to no more than 100mm in height)*
- *leaves and vegetation debris should be removed."*

Therefore, in order to establish the APZ successfully priority for clearing shall be the weed infested areas. All threatened plants shall be surrounded by protective fencing and tagged by the Project Ecologist to ensure their protection. All hollow-bearing trees within the Conservation Area shall be retained as they are not located near the approved building.

The western boundary of the 25m APZ shall also be delineated by a star picket and strained wire fence with access gates where required for Conservation Area management activities. All these

works shall be certified by the Project Ecologist and included within the monitoring reports provided to the Consent Authority.



7. Management actions

The current approval is to be carried out in accordance with all policies, operational procedures and guidelines in place as part of consent conditions issued by Penrith City Council relating to environmental management or impact minimisation for construction projects.

This plan shall be formally activated from the issue of the Construction Certificate.

All works shall be undertaken by a qualified and experienced bush regeneration company and Project Ecologist for monitoring reports/ certification.

The following environmental safeguard measures have been recommended for all phases of the proposed development.

7.1 Recommendations from the Flora and Fauna Assessment prepared by Fraser Ecological(July 2015)

The Flora and Fauna Assessment prepared by Fraser Ecological dated July 2015 made the following recommendations:

1) Bushland and *Persoonia nutans* (Nodding Geebung) protection during construction

The owner will ensure the long term protection of existing better quality remnant vegetation (Castlereagh Scribbly Gum Woodland and Endangered *Persoonia nutans* plants) by providing fencing between retained areas and the proposed development to prevent degradation from livestock and other potential impacts including building and road construction.

In the longer term, this will allow natural regeneration of this bushland and the native soil seed bank to occur in perpetuity in accordance with natural ecological process, whilst facilitating adjacent proposed rural land uses.

The following activities shall not be conducted within the remnant bushland on site:

- Ripping, cultivation, trenching or mechanical removal of vegetation or earth
- The placement of fill
- Movement, stockpiling or storage of plant, materials, waste, equipment or vehicles
- Any activity likely to damage the trunk, crown or root system of the protected vegetation

It is recommended that fencing system be installed prior to the commencement of any construction works to ensure the protection of the Endangered *Persoonia nutans* plants. The location of these plants are shown on Page 24.

This is described in further detail below in Section 7.2.

2) Erosion and Sediment Control

As a precautionary measure, a silt fence will be installed and maintained to EPA/OEH best practice standards during the entire construction of the proposal. The fence will remain in situ until the ground surface has stabilised.

This is described in further detail below in Section 7.4.

3) Weed management following construction works

Weeds are to be removed and kept to a minimum within the transition area between the proposed development and retained bushland where the Endangered *Persoonia nutans* population occurs onsite.

The weed control methods shall be done in accordance with the following techniques recommended by the National Trust, NSW National Parks and Wildlife Service and Australian Association of Bush Regenerators.

Weed control from areas of high resilience to low resilience, upper slope to lower slope in accordance with the Bradley Method (Buchanan 1989) is to be undertaken in 3 stages described

This is described in further detail below in Section 7.5.

7.2 Bushland and threatened plant protection during construction

The owner will ensure the long-term protection of existing better quality remnant vegetation (Castlereagh Scribbly Gum Woodland and threatened *Dillwynia tenuifolia* and *Persoonia nutans* plants) by providing fencing around clumps or individuals of plants.

Refer to Figure 5 for the location of threatened plants.

Fencing

The fencing shall be done under the supervision and certified by the Project Ecologist to ensure it is done properly before the APZ is established and tree clearing takes place.

Permanent fencing shall also occur along the western boundary of the asset protection zone – this will prevent any materials being stored/ dumped on top of the plants. The fencing shall comprise of 1.2 cyclone mesh fencing with access gates where required.

Signage

Signage is required at entries to native vegetation management areas. The sign must state the following: “*The vegetation within bushland is protected. Activities such as firewood collection, bushrock removal, picking of native flowers and dumping of garden/ building waste are prohibited*”

Signage is required in order to inform residents, public or construction workers that the area is a native vegetation area and under protection. The sign is to be made of a durable material, be legible and permanent and a minimum A4 size (210mm x 297mm).

The signage is to be installed every 100m. Any damaged signage is to be replaced.

The following activities shall not be conducted within the remnant bushland on site:

- Ripping, cultivation, trenching or mechanical removal of vegetation or earth
- The placement of fill
- Movement, stockpiling or storage of plant, materials, waste, equipment or vehicles
- Any activity likely to damage the trunk, crown or root system of the protected vegetation

It is recommended that fencing system be installed prior to the commencement of any construction works to ensure the protection of threatened *Dillwynia tenuifolia* and *Persoonia nutans* plants.

It is recommended sensitive APZ establishment is undertaken without requiring the removal of any threatened plants and the retention of a hollow-bearing tree (refer to Section 6). The low-lying threatened *Dillwynia tenuifolia* plants (refer to waypoint 108 in Figure 5) occur within the drip zone of smooth-barked ‘Hard-leaved Scribbly Gum’ (*Eucalyptus scelerophylla*) that are considered ideal to retain within an APZ compared to rough-marked trees when retained as ‘islands’ of non-interlocking/ discontinuous canopy.

7.3 Impact Mitigation Pre-clearing and During Clearing Works

7.3.1 Pre-clearing protocols

The following condition was provided by the Consent Authority:

Fauna Inspection

20(ii) Prior to the commencement of works, including the removal of any trees associated with the approved development, an inspection for resident threatened fauna (including an inspection of hollows) must be undertaken by a qualified wildlife handler/expert and any fauna found relocated.

The pre-clearing inspections shall apply to all “protected animals” under the Biodiversity Conservation Act 2006. Any protected animals found are also relocated to appropriate nearby habitat. Any inspection and relocation of native fauna applies to all “protected animals” and it is not only limited to threatened fauna.

The forthcoming Construction Environment Management Plan (CEMP) will likely require the following mitigation measures that will also apply to the management of the Conservation Area to prevent erosion and weed spread issues. The consent condition states at all trees approved for removal that are greater than 30cm DBH are to be cut up into 2-6m lengths and translocated into the Conservation Area. This is not practical due to the large number of trees approved for removal and damage the native vegetation to be conserved. However, it is agreed that some logs shall be carefully placed there as habitat under the guidance of the Project Ecologist.

As per Table 3, a total of 104 trees with a DBH of 30cm or greater have been approved for removal.

A maximum of twenty (20) of these trees can be sawn into 2-6m lengths and appropriately relocated into the Conservation Area without increasing the bushfire BAL and bushfire risk and or damaging the native vegetation to be conserved.

As it appears that Condition 20(i)(f) can only partly be achieved on site, the remaining native trees approved for removal (with a DBH of 30cm or greater) that cannot be reused on site that prior to their removal the Proponent consults with NPWS and other relevant public authorities, local community restoration/rehabilitation groups, Landcare groups etc to determine if there is an interest for the reuse of suitable timber and root balls in habitat enhancement and rehabilitation work. This detail including consultation with the community groups and their responses has been documented in Section 7.6 and the Works Schedule (Section 9 below) and should be also documented in the CEMP.

Mitigation measures must also be implemented prior to the clearing of the remaining area of vegetation to be removed:

- All Environmental Subplans (e.g. Soil & and Water MP, Flora and Fauna MP etc.) within the CEMP must include Scope, Project Compliance Requirements, Project Targets, Control Measures Used, and Monitoring details.
- Erosion and sediment control must be detailed in an Erosions and Sediment Management Plan, including types of control, method of installation, locations, maintenance regime,

responsibilities, and stockpile storage. These may include, but are not limited to, silt fencing, vehicle shake-down, floating silt boom, and stabilisation access for machinery.

- Prior to works commencing a pre-clearance survey must be conducted by a qualified Ecologist to determine the presence of any nests, dreys or fauna using hollows. A report of findings for any required supervision of clearing works to be submitted to council.
- Areas determined not to be cleared must be marked and flagged off as “no-go” zones prior and during construction.
- Any trees marked within no-go zones are to be retained and protected. Any impacts to these trees has not been assessed in this current impact assessment. AS 4970-2009 Protection of trees on development sites, is to be followed.
- Any trees within close proximity to the works zones must be examined by an arborist prior to works to identify the Tree Protection Zone (TPZ) and the Structural Root Zone (SRZ).
- All environmentally sensitive areas must be permanently delineated from clearance areas with fencing and signage. Delineation must allow for passage of native fauna.
- All personnel must undertake environmental site inductions to highlight any and all environmental and ecological constraints within the site.
- Hygiene controls must be implemented for all vehicles and personnel entering the site.
- Phytophthora hygiene controls are provided in Appendix B
- The APZ which is to be managed as an IPA has already been cleared. The boundaries should be marked and flagged to protect the surrounding remnant intact bushland of the Conservation Area.
- Domestic animals/Livestock are to be restricted from entering the Conservation Area
- Prior to any earthworks and clearing of native vegetation commencing in the development area, any juvenile native vegetation, native seed and coarse woody debris on the ground that is proposed to be cleared and removed is translocated and re-used in the Conservation Area and the seed is used for the propagation of plants
- Any juvenile native plants that are removed from the development area should be transplanted within the Conservation Area or used in the site landscaped areas where
- plants from these plant community type (PCT) would naturally occur to conserve the local genetic diversity. The translocated plants should be maintained until established (i.e. weeding and watering).

Within one week prior to the commencement of clearing of a designated area, a pre-clearing survey of the area will be undertaken by the Project Ecologist. This measure will minimise the risk of birds and/or arboreal fauna nesting between the time of the pre-clearance survey and commencement of clearance works. During the survey, native flora and fauna that have the potential to be disturbed during clearing will be identified.

On the day of any clearing, the Project Ecologist will capture and/or remove fauna that have the potential to be disturbed as a result of clearing activities. These fauna will be relocated into the Conservation Area. All fauna handling will be carried out by licensed wildlife carers and/or ecologists.

The Project Ecologist will be present while clearing to rescue animals injured during the clearance operation. Any fauna found will be captured and relocated to the south of the electricity transmission easement and released after nightfall to minimise the risk of predation by diurnal predators. Any animals

that are inadvertently injured will be taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized.

A certificate demonstrating compliance, including details of any relocated fauna will be prepared by the Project Ecologist and submitted to the Certifying Authority and Council.

Prior to works being undertaken, all personnel working on the project will need to be inducted on the potential threatened species occurring on the subject site. If any unexpected threatened species are encountered, the following procedures should be followed:

- Stop any work in the immediate area of the threatened species, habitat or population;
- Notify the Environmental Manager, who will subsequently organise an ecologist to undertake a site inspection (if required) and provide an Assessment of Significance (5 Part Test) under Section 5A of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) to determine if the project will have a significant impact.
- The Office of Environment and Heritage (OEH); Department of Primary Industries (DPI) and/or Department of the Environment will need to be notified;
- If no significant impact is likely, recommence project works;
- If significant impact is likely then obtain approvals, licences or permits as required;
- Once approval is obtained works can recommence
- Ensure all personnel are informed of the additional encountered species

In the event of unexpected fauna encounters when an ecologist is not present on site, fauna encountered should not be handled but encouraged to self-relocate where possible. In the event of unexpected fauna injury or trapping, advice should be sought from an ecologist on appropriate follow up procedures for the situation.

Fauna handling procedure

Fauna Group	Protocol
PRE-FELLING	
All fauna	Examine tree for hollows, loose bark, dreys, and nests Loose bark should be checked for reptiles and microchiropteran bats (using crowbars and gloves) Nests and dreys are removed if safe to do so
FELLING	
All fauna	Ecologist to be present during removal of fauna habitat Trees should be soft felled where nests/hollows/dreys are present Tree should be agitated by machinery prior to felling to further encourage any resident fauna to self-relocate
POST-FELLING	
Amphibians	Searches for amphibians should be conducted in tree hollows. A torch should be used to detect animals that are deep in the hollows.
Reptiles	Searches for reptiles should be conducted under loose bark, within hollows and in and around root ball Searches for reptiles should be conducted around the head of the tree as they often fall out during felling
Birds	Nests if present are to be checked and removed Search hollows for birds. Where chicks are present they can often be heard calling.
Mammals	Searches for small mammals inside hollows. Use a torch for searching hollows Searches for microchiropteran bats in hollows and around the head of the tree as they often fall out during felling. Bats are often in torpor (sleep) and thorough searches in hollows is required
FAUNA HANDLING	
All Fauna	All individuals capable of self-relocation to a suitable alternative habitat should be allowed to do so

Fauna Group	Protocol
	Obstructions to fauna self-relocations should be removed wherever possible
Amphibians	Individuals should be placed in a plastic container with air holes, some damp soil and leaf litter. Same species together, smaller individuals no more than three per container, large species only one animal per container Use latex gloves when handling amphibians
Reptiles	Lizards should be placed in a plastic container with air holes, leaf litter and sticks. One species per container, larger species to have one animal per container. Snakes are to be handled only by trained individuals
Birds	Individuals should be placed in a covered cardboard box or empty plastic box, along with all salvageable nesting material present Microbats should be placed in calico bags/catch bags hung by the drawstring from a stick, only one species per bag, maximum of 30 bats per bag. Bags are to be kept in a dark sheltered area until individuals can be released at night, otherwise they should be placed in an accessible vacant hollow or under loose bark to hide until nightfall.
Mammals	Other mammals should be placed in a catch bag, empty plastic box or covered cardboard box depending on fauna size
RELOCATION SITE	
All fauna	Any fauna incapable of self-relocation should be relocated to remnant vegetation outside the clearing limits
Diurnal fauna	Captured fauna should either be relocated immediately or placed in a shady spot until relocation is possible
Nocturnal fauna	Captured fauna should be placed in a safe, shady area. The ecologist is to return to the relocation area after sunset to release the fauna.
Snakes	Capture and relocation of venomous snakes is to be conducted by trained snake handlers only.
FAUNA INJURY MANAGEMENT	

Fauna Group	Protocol
All Fauna	Any injured fauna are to be immediately taken to the nearest veterinary surgeon for treatment (see Veterinary Clinics) All further clearance work must cease in the absence of the ecologist.
RECORDS	
All fauna	Records on number of fauna sighted, self-relocated, captured and relocated are to be kept. Condition of individuals during capture and relocation are to be noted.

REFER TO FIGURE 9 FOR LOCATION OF NUMBERED TREES

TABLE 3: TREE NUMBERING SCHEDULE**(REFER TO FIGURE 9 FOR CORRESPONDING LOCATION MAP)****A pre-clearance survey must be conducted for all trees approved for removal**

WP Number (Figure 9)	Diameter at breast height (DBH)	Scientific & Common Name	Management Action
531	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
532	400	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
533	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
534	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
535	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
536	350	Corymbia eximea (Yellow Bloodwood)	Approved for removal
537	300	Eucalyptus punctata (Grey Gum)	Approved for removal
538	450	Eucalyptus punctata (Grey Gum)	Approved for removal
539	450	Eucalyptus punctata (Grey Gum)	Approved for removal
540	1120	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
541	340	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
542	400	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
543	350	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
544	350	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
545	450	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
546	350	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
547	350	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
548	400	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal

WP Number (Figure 9)	Diameter at breast height (DBH)	Scientific & Common Name	Management Action
549	350	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
550	350	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
551	350	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
552	400	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
553	350	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
554	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
555	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
556	320	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
557	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
558	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
559	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
560	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
561	320	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
562	350	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
563	400	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
564	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
565	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
566	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
567	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
568	400	Eucalyptus sclerophylla (Hard-leaved Scribbky Gum)	Approved for removal
569	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal

WP Number (Figure 9)	Diameter at breast height (DBH)	Scientific & Common Name	Management Action
570	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
571	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
572	320	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
573	320	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
574	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
575	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
576	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
577	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
578	330	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
579	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
580	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
581	320	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
582	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
583	320	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
584	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
585	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
586	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
587	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
588	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
589	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
590	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal

WP Number (Figure 9)	Diameter at breast height (DBH)	Scientific & Common Name	Management Action
591	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
592	400	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
593	400	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
594	350	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
595	450	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
596	450	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
597	450	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
598	1000	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
599	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
600	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
601	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
602	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
603	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
604	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Hollow-bearing tree Approved for removal Inspect for fauna before removal by Project Ecologist To be relocated into Conservation Area
605	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Hollow-bearing tree Approved for removal Inspect for fauna before removal by Project Ecologist To be relocated into Conservation Area
606	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Hollow-bearing tree Approved for removal Inspect for fauna before removal by Project Ecologist To be relocated into Conservation Area
607	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Hollow-bearing tree Approved for removal Inspect for fauna before removal by Project Ecologist To be relocated into Conservation Area
608	330	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Hollow-bearing tree Approved for removal Inspect for fauna before removal by Project Ecologist To be relocated into Conservation Area

WP Number (Figure 9)	Diameter at breast height (DBH)	Scientific & Common Name	Management Action
609	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Hollow-bearing tree Approved for removal Inspect for fauna before removal by Project Ecologist To be relocated into Conservation Area
610	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
611	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
612	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
613	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
614	400	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
615	300	Melaleuca decora	Approved for removal
616	400	Melaleuca decora	Approved for removal
617	300	Melaleuca decora	Approved for removal
618	300	Melaleuca decora	Approved for removal
619	330	Melaleuca decora	Approved for removal
620	300	Melaleuca decora	Approved for removal
621	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
622	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
623	400	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
624	400	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Approved for removal
625	400	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
626	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ
627	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ
628	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ

WP Number (Figure 9)	Diameter at breast height (DBH)	Scientific & Common Name	Management Action
629	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
630	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
631	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ
632	330	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ Hollow-bearing tree
633	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ
634	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ
635	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
636	300	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ
637	300	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ
638	320	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ
639	320	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
640	300	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ
641	300	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ
642	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ
643	300	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
644	320	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
645	300	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ
646	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ
647	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ

WP Number (Figure 9)	Diameter at breast height (DBH)	Scientific & Common Name	Management Action
648	300	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
649	300	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ
650	320	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retained as part of the APZ
651	320	Eucalyptus fibrosa (Broad-leaved Ironbark)	Approved for removal
652	330	Melaleuca decora	Approved for removal
653	330	Eucalyptus fibrosa (Broad-leaved Ironbark)	Approved for removal
654	300	Eucalyptus fibrosa (Broad-leaved Ironbark)	Retain within APZ
655	300	Melaleuca decora	Retain within APZ
656	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
657	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
658	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retain within APZ
659	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retain within APZ
660	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retain within APZ
661	500	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
662	300	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retain within APZ
663	320	Eucalyptus sclerophylla (Hard-leaved Scribbly Gum)	Retain within APZ
664	320	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
665	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
666	300	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
667	300	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ

WP Number (Figure 9)	Diameter at breast height (DBH)	Scientific & Common Name	Management Action
668	320	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
669	300	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
670	300	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
671	320	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
672	300	Eucalyptus tereticornis (Forest Redgum)	Approved for removal
673	350	Melaleuca decora	Approved for removal
674	1000	Melaleuca decora	Approved for removal
675	320	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
676	320	Angophora bakeri (Narrow-leaved Apple)	Approved for removal
677	400	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
678	200	Angophora bakeri (Narrow-leaved Apple)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
679	300	Angophora bakeri (Narrow-leaved Apple)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
680	300	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
681	300	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
682	300	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
683	300	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
684	300	Angophora bakeri (Narrow-leaved Apple)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
685	300	Angophora bakeri (Narrow-leaved Apple)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
686	330	Angophora bakeri (Narrow-leaved Apple)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing

WP Number (Figure 9)	Diameter at breast height (DBH)	Scientific & Common Name	Management Action
687	300	Angophora bakeri (Narrow-leaved Apple)	Retained as part of the APZ – may require pruning or removal if doesn't comply with APZ canopy separation requirements – consult Project Ecologist prior to clearing
688	300	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
689	300	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
690	300	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
691	320	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
692	320	Angophora bakeri (Narrow-leaved Apple)	Retain within APZ
693	300	Angophora bakeri (Narrow-leaved Apple)	Approved for removal

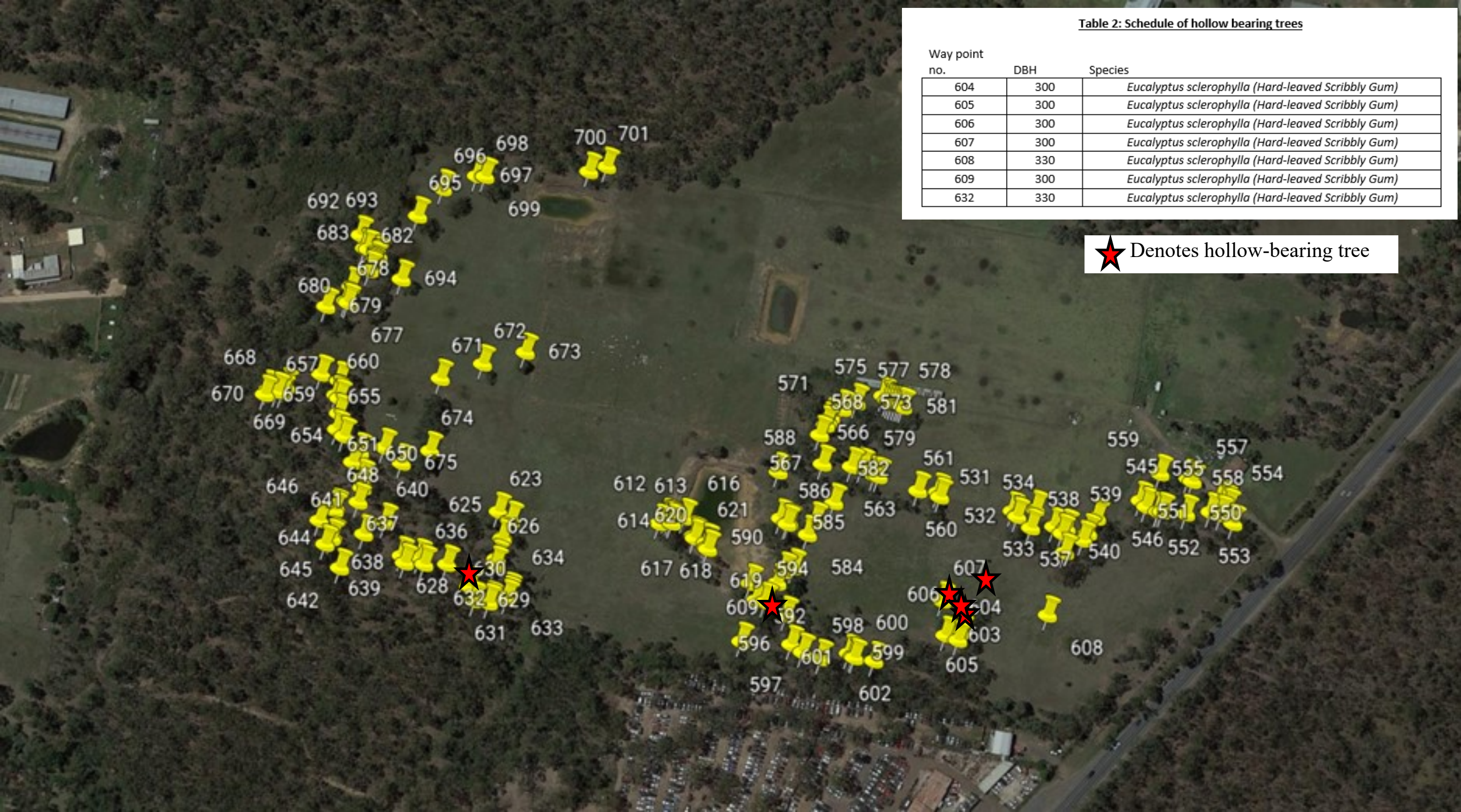


Figure 9: Mapped trees

Note: Not all trees are approved for removal—to be used for reference purposes only

7.3.3 During Construction

As such the following mitigation measures should be implemented now to prevent further erosion and weed spread issues.

These mitigation measures should also be implemented prior to the commencement of construction works for the proposed development:

Erosion and sediment controls should be implemented and maintained as per the Erosion and Sediment Management Plan.

Areas which are marked and flagged off as “no-go” zones should be maintained during construction.

Any trees marked within no-go zones are to be retained and protected. Any impacts to these trees has not been assessed in this current impact assessment. AS 4970-2009 Protection of trees on development sites, is to be followed. TPZs and the SRZs should be maintained for trees within proximity of the works zones.

All environmentally sensitive areas must be permanently delineated from construction areas with fencing and signage. Delineation must allow for passage of native fauna. All personnel should undertake environmental site inductions to highlight any and all environmental and ecological constraints within the site.

Hygiene controls should be implemented for all vehicles and personnel entering the site.

Phytophthora hygiene controls are provided in Appendix B.

The marking and flagging of the 25m APZ boundaries should be maintained to protect the surrounding remnant intact bushland

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7.3.2 During Clearing

The following mitigation measures should be implemented now to prevent further erosion and weed spread issues:

- Erosion and sediment controls should be implemented and maintained as per the Erosions and Sediment Management Plan.
- Areas which are marked and flagged off as “no-go” zones should be maintained during construction.
- Any trees marked within no-go zones are to be retained and protected. Any impacts to these trees has not been assessed in this current impact assessment. AS 4970-2009 Protection of trees on development sites, is to be followed.
- TPZs and the SRZs should be maintained for trees within proximity of the works zones.
- All environmentally sensitive areas must be permanently delineated from impacted areas with fencing and signage. Delineation must allow for passage of native fauna.
- All personnel should undertake environmental site inductions to highlight any and all environmental and ecological constraints within the site.
- Hygiene controls should be implemented for all vehicles and personnel entering the site. Phytophthora hygiene controls are provided in Appendix B.

The marking and flagging of the APZ boundaries should be maintained to protect the surrounding remnant intact bushland.

- Felled trees are to be placed within the Conservation Area where practical, particularly those with hollows.
- Any hollow sections of wood which have already been removed should be salvaged and either placed in the remaining areas of bushland or used to make natural nest boxes which can be installed within the site.
- A qualified Ecologist should be on present on site. If an animal is identified and at risk during construction works, works should not continue until the animal has been rescued. If the animal is injured a qualified carer should be contacted by either ringing Sydney Metro Wildlife on 02 9413 4300 or WIRES on 1300 094 737.

7.3.4 Post-construction

The following mitigation measures should be implemented post construction:

- Bush regeneration within the adjacent remnant bushland is recommended to increase habitat quality for native ground cover species
- Bush regeneration is also required to address new weed infestations that are likely to arise after construction.
- All environmentally sensitive areas must be permanently delineated from the development area.
- Delineation must allow for passage of native fauna.
- Domestic animals/ livestock are to be restricted from entering the Conservation Area
- Landscaping works are to be outside the Conservation Area and do not include Environmental Weeds

Weed removal by a qualified and experienced bush regeneration company over the 5 VMP period will need to be undertaken as follows:

- **Autumn and Winter:** minimum of one visit per season
- **Spring and Summer:** minimum of two visits per season

Maintenance works will involve weed removal works. No revegetation works are proposed.

The following recommended program of work phases would be aimed at providing a management framework for enacting threatened plant protection, maintenance, monitoring and review works reasonably required for the conservation of threatened species:

Pre-construction works phase

Pre-construction works refers to all site preparation activities prior to the commencement of construction works on site. These works would include tagging of all threatened plants by an ecologist, on-site consultation with bushfire consultant about APZ establishment works to clearly identify what vegetation is required to be retained and removed. Includes installation of signage to notify contractors of the presence of threatened plant species and what actions are not permitted within the APZ.

Construction works phase

Construction works refers to the period during which earthworks and construction of buildings, roads and other facilities and services are being installed. It is during this period that the protection of remnant vegetation is critical to minimising accidental loss of trees or associated vegetation. It is also during this phase that the APZ is established. Hollow-bearing trees that have been approved for removal are to be cut up into 3m lengths and re-located into the VMP area. The APZ works would be

undertaken by a qualified and experienced bush regeneration company under the supervision of the project ecologist.

Primary restoration works phase

Primary restoration works, as defined under this VMP, include the completion of primary and secondary weed control and protective fencing. Practical completion of the primary restoration phase is determined by the project ecologist at which point all primary restoration actions need to have been completed. Should there be a delay in the completion of works, for any reason, then the construction works phase may be extended.

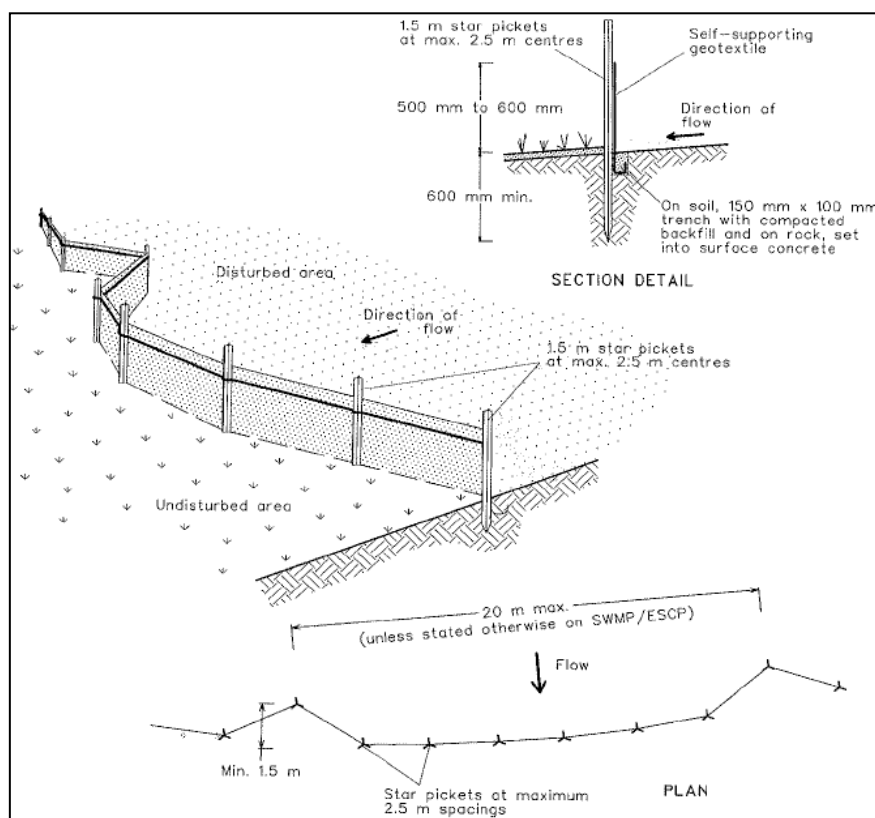
Post construction works phase

Post construction works essentially consist of maintenance activities, unless further contingency works are identified by the project ecologist for auditing purposes. Maintenance will be undertaken by a bush regeneration crew for a minimum of five (5) years post completion of primary restoration works. Includes provision of monitoring reports to the certifying authority.

All staff undertaking weed removal are to be supervised by a qualified bush regeneration supervisor with a minimum five (5) years full time experience and a minimum TAFE Certificate Level II Bush Regeneration qualifications and / or a degree in Natural Areas Management or the equivalent.

7.4 Erosion and Sediment Control

All erosion and sediment controls (i.e. geotextile sediment fence and straw bales) shall be in place before any works begin so as to protect the remnant bushland and native fauna habitat. Techniques used for erosion and sediment control on building sites are to be adequately maintained at all times and must be installed in accordance with Council guidelines. All techniques shall remain in proper operation until all development activities have been completed and the site fully stabilised. This condition must be complied with during building work.



7.5 Weed Control

Weed control is important to reduce fuel loads within the 25m APZ and stop environmental weeds from invading areas of bushland within Conservation Area.

No revegetation works are proposed as it is highly likely that weed control and bush regeneration efforts will assist in natural regeneration from the native soil seedbank.

Recommendations for APZ establishment have been made in this report that will ensure that the APZ could be established without requiring the removal of any of these plants. The low-lying threatened plants occur within the drip zone of smooth-barked 'Hard-leaved Scribbly Gum' (*Eucalyptus scelerophylla*) trees that are considered ideal to retain within an APZ compared to rough-barked species when retained with a discontinuous canopy. The location of all trees approved for removal have been identified and mapped.

The location of weed infestations have been mapped (Figure 7 refer to previous Section 5). The dominant weed species occurring on-site are:

- *Eragrostis curvula* ssp. *curvula* (African Lovegrass)
- *Bidens Pilosa* (Cobblers Pegs)
- *Oppuntia stricta* (Prickly Pear)
- *Arauja sericeifera* (Moth Vine)
- *Rubus fruticosus* (Blackberry)

The control of African Lovegrass and Blackberry will be the priority weeding for this VMP as it outcompetes native species. Successful weed control of this species requires follow up after the initial efforts. This means looking for and killing regrowth or new seedlings. Using a combination of control methods is usually more successful. The best method for controlling African Lovegrass it is to:

- control mature plants year round, with extra effort in spring before flowering
- look for flushes of seedlings after rain when temperatures are over 10°C (most seeds germinate in autumn and spring) and kill the seedlings before they are six weeks old
- keep looking for new plants each year as some seed remains viable for up to 17 years.
- consider an ecological burn

Weed control is to be undertaken in 3 stages described below:

1) Primary weed control: The first step. Targets primary weeds but does not remove all weeds as the soil will be eroded (DEC 2005). Areas identified with the greatest resilience (e.g. around the base of remnant trees) should be cleared first to encourage regeneration from the soil seed bank. Involves getting rid of larger debris and raking up areas of invasive creepers. All non-exotic woody material is to be retained as fauna habitat and used as temporary terracing for planting works on steeper slope.

2) Secondary weed control: Intensive follow up weeding straight after primary weeding and treating weed seedlings as they germinate (Buchanan 1989). The weeds progress is monitored and some are allowed a month or two of annual weed growth before they are treated. Sites in good condition require little follow-up while others in worse condition require more effort.

3) Maintenance weeding: Maintain and controlling low weed levels ensuring new weeds that have moved into the area or have had the chance to germinate are eliminated.

Weed Management Techniques

Weeds are to be progressively removed in accordance with the following techniques recommended by the National Trust, NSW National Parks and Wildlife Service and Australian Association of Bush Regenerators.

Bush regeneration techniques are described as a guide to infer their intended performance. These techniques are to be implemented by a qualified and experienced bush regeneration company. The use of trained personnel will ensure correct plant identification, work methods and compliance with required Occupational Health and Safety standards.

Woody Weeds Removal Techniques

1) Cut and Paint

This technique involves cutting the weed (using chainsaw, bush/ pruning saw, secateurs or loppers) at the base of the stem and immediately painting them.

- Make a horizontal cut close to the ground using secateurs, loppers or a bush saw; and
- Immediately apply herbicide to the exposed flat stump surface.

Considerations:

- Cuts should be horizontal to prevent herbicide from running off the stump, sharp
- angle cuts are hazardous;
- Herbicide must be applied immediately before the plant cells close (within 30
- seconds) and translocation of herbicide ceases;
- If plants re-sprout, cut and paint the shoots after sufficient regrowth has occurred; and
- Stem scraping can be more effective on some woody weeds.

2) Stem Injection

- At the base of the tree drill 10mm diameter holes at a 45 degree angle into the
- sapwood;
- Fill each hole with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

3) Frilling

- At the base of the tree make a cut into the sapwood with a chisel or axe;
- Fill each cut with herbicide immediately; and
- Repeat the process at 5 cm intervals around the tree.

Considerations:

- Plants should be actively growing and in good health;
- Deciduous plants should be treated in spring and autumn when leaves are fully formed;
- For multi-stemmed plants, inject or chip below the lowest branch or treat each
- stem individually; and
- Herbicides must be injected immediately before plant cells close (within 30
- seconds) and translocation of herbicide ceases.

Small Hand-Pullable Plants Removal Techniques

1) Hand Removal

- Remove any seeds or fruits and carefully place into a bag;
- Grasp stem at ground level, rock plant backwards and forwards to loosen roots

- and pull out; and
- Tap the roots to dislodge any soil, replace disturbed soil and pat down.

Considerations:

- Leave weeds so roots are not in contact with the soil e.g. Rafted in a dedicated area, composted in dedicated bin or removed from the site via green waste bin.

Vines and Scramblers Removal Techniques:

1) Hand Removal

- Take hold of one runner and pull towards yourself;
- Check points of resistance where fibrous roots grow from the nodes;
- Cut roots with a knife or dig out with a trowel and continue to follow the runner;
- The major root systems need to be removed manually or scrape/cut and painted with herbicide; and
- Any reproductive parts need to be bagged.

2) Stem Scraping

- Scrape 15 to 30 cm of the stem with a knife to reach the layer below the bark/outer layer; and
- Immediately apply herbicide along the length of the scrape.

Considerations:

- A maximum of half the stem diameter should be scraped. Do not ringbark;
- Larger stems should have two scrapes opposite each other; and
- Vines can be left hanging in trees after treatment.

Weeds with Underground Reproductive Structures Removal Techniques

1) Hand Removal of Plants with a Taproot

- Remove and bag seeds or fruits;
- Push a narrow trowel or knife into the ground beside the tap root, carefully loosen the soil and repeat this step around the taproot;
- Grasp the stem at ground level, rock plant backwards and forwards and gently pull removing the plant; and

- Tap the roots to dislodge soil, replace disturbed soil and pat down.

2) Crowning

This technique is useful when the weed may regenerate from root material left in the soil.

- Remove and bag stems with seed or fruit;
- Grasp the leaves or stems together so the base of the plant is visible;
- Insert the knife or lever at an angle close to the crown;
- Cut through all the roots around the crown; and
- Remove and bag the crown.

Herbicide Treatment – Stem Swiping

- Remove any seed or fruit and bag; and
- Using a herbicide applicator, swipe the stems/leaves.

Considerations:

- Further digging may be required for plants with more than one tuber;
- Some bulbs may have small bulbils attached or present in the soil around them
- which need to be removed;
- It may be quicker and more effective to dig out the weed;
- Protect native plants and seedlings; and
- For bulb and corm species the most effective time to apply herbicide is after
- flowering and before fruit is set.
- Exotic vegetation should be removed and stockpiled in a clear area away from adjoining bushland. This stockpile should be removed from the site at a convenient time. As part of the regular maintenance of the restored area any regrowth of the exotic plant species should be removed and disposed of appropriately.

Use of Herbicides

Herbicides are required for use with the cut and paint technique to control woody weeds and spraying exotic herbs and grasses.

IMPORTANT NOTE: Herbicides can cause serious environmental harm if not used properly and enter waterways.

Herbicides should not be applied 0 to 12 hours prior to rain occurring. This reduces the herbicides effectiveness as well as being transported in runoff to creek lines and waterways. An advantage of herbicide use is the low time taken to spray weeds as compared to physically removing them, particularly for large infestations of weeds.

The use of herbicides should be considered when:

- There are small areas of dense weeds with few or no native plants to protect;
- There are large areas of weeds;
- The weeds are growing too rapidly for physical removal; and
- The weeds are located in areas with a high potential for erosion if vegetation is removed.
- The success of each treatment must be evaluated by the operator after a set period of time

*****An ecological burn for burning of African Lovegrass and stimulating regeneration of the remnant soil seedbank if it can be organised and approved by the local RFS. This would best be done before the construction works commence.**

7.6 Dam dewatering protocols

The NSW Depart of Environment Energy and Science comments on Post Approval draft Vegetation Management Plan for Elf Mushroom Farm – 521 The Northern Road Londonderry - MP08-0255 MOD 2 (Refecence No. DOC20/708632) states:

Condition 20ii in the Modification of Project Approval for Fauna Inspection requires that:

Prior to the commencement of works, including the removal of any trees associated with the approved development, an inspection for resident threatened fauna (including an inspection of hollows) must be undertaken by a wildlife handler/expert and any fauna found relocated.

While this condition requires an inspection is undertaken for “resident threatened fauna”, EES recommends the inspection applies to all “protected animals” under *the Biodiversity Conservation Act 2016 (BC Act)* and not just threatened fauna. Protected animals are defined in Schedule 5 of the BC Act to include any of the following that are native to Australia or that periodically or occasionally migrate to Australia (including their eggs and young) –

- amphibians - frogs or other members of the class amphibia
- birds - birds of any species
- mammals - mammals of any species (including aquatic or amphibious mammals but not including dingoes)
- reptiles - snakes, lizards, crocodiles, tortoises, turtles or other members of the class reptilia.

As the focus of the VMP is the Conservation Area on the western portion of the site, the issue relating to the dewatering of the dams and the relocation of native fauna may need to be addressed in the

Construction Environmental Management Plan rather than the VMP.

Therefore, the Construction Environmental Management Plan shall include the following measures:

7.6.1 Licensed ecologist on-site during dewatering

A qualified ecologist will be present on-site during the entire dewatering to ensure that appropriate action can be taken with regard to care and relocation of all **protected and threatened** fauna residing in the dam.

The ecologist will hold the required licences to undertake the work. Relevant licences include:

- NSW Animal Ethics Licence
- NSW Fisheries Licence
- NSW Scientific Licence

A Fisheries Licence permits translocation of native fish species captured as a result of dewatered dams, to the nearest suitable water system within the greater Sydney region and Hawkesbury-Nepean Catchment. Therefore, additional translocation licences for native fish are not required.

A separate licence may be required from the NSW National Parks and Wildlife Service (NPWS) if relocation of turtles is not specified in the DA conditions of consent.

7.6.2 Fauna Handling Protocols

It is recommended that fauna, in particular eels, are relocated immediately after capture. All dewatering works must cease while the fauna are being relocated until the ecologist returns to the dam dewatering site. In the event they are encountered, any captured pest species are to be humanely euthanized in a manner consistent with the *Prevention of Cruelty to Animals Act 1979* and the carcasses disposed in an appropriate manner to prevent any potential contamination of soil or water bodies.

During the dewatering process, the ecologist is to record:

- Number of each species of native fauna removed from the dam;
- Relocation point of recorded native fauna; and
- Number and species of pests euthanized.

The protocols for fauna handling and translocation are to be explained to all persons working on the dewatering activities. The protocols identify the procedures that should be undertaken if fauna are detected during dewatering. If any fauna are detected, works should cease to enable the ecologist to safely and humanely capture fauna for appropriate relocation (native fauna) or euthanasia (introduced/pest species or sickly natives). Fauna are not to be handled or removed in the absence of the ecologist.

The ecologist will be equipped with holding tanks for fish and eels, buckets for turtles and frogs, 12v aerator, and a suitable vehicle for transportation of aquatic fauna between capture and release locations.

7.6.3 Transport Protocols

All aquatic fauna will be relocated to release sites in large plastic tanks by vehicle. Fish and eels will be transported in a container filled with water from the capture location. Frogs and turtles will be transported in a shaded bucket with a small amount of water present to prevent overheating. All transported water will be aerated using either 12v battery operated aerators, or via compressed air through a regulator. Water from the capture site will be disposed onto grass at the release site through a filter to prevent release of carp eggs.

All fauna will then be handled into the release site. There are no aquatic diseases known from the study area. Fish, frogs, or turtles that show evidence of diseases will be euthanized and send off for identification of disease prior to release of any additional fauna from the capture location. A description of the specific requirements for handling different types of fauna is detailed below.

Amphibians

Amphibians found in the dams are to be handled by hand. Rubber/latex gloves are not to be used as they can dry the skin of the amphibians. Hands should be wet utilising water from the dam prior to handling any amphibians. Captured individuals should be placed in a plastic container with air holes, some damp soil and leaf litter. Same species are to be placed together, smaller individuals no more than three per container, large species only one animal per container. Refer to Appendix C for amphibian specific protocols.

Turtles

Scoop nets are to be utilised to capture large vertebrate fauna such as turtles, and captured individuals are to be transferred into plastic buckets containing water from the dam for relocation. Turtle shells will be wiped down with a sponge to remove any Carp eggs that may be attached. Any injured turtles will be taken to a local veterinary service for treatment.

Eels and Native Fish

All eels and native fish present will be scooped out of the dams using dip nets and landing nets. All eels and native fish will be transferred to a vehicle based holding tank for transportation to the release site. Any injured eels/native fish or sickly individuals will be euthanized using the same lethal overdose of anaesthetic procedure as outlined below for introduced fish.

Introduced Fish

All introduced fish are to be euthanized onsite, and transported offsite appropriately. All Carp and large fish will be euthanized using an anaesthetic (such as Aquí-S) as recommended by the Department of Primary Industries (DPI 2014). Small fish such as *Gambusia holbrooki* will be euthanized using ice slurry with a 1:1 mix of crushed ice and water. All introduced fish carcasses will be disposed of appropriately as directed by NSW Environment Protection Agency (EPA) and DPI – Fisheries.

7.5.4 Post dewatering measures

To prevent dams from refilling following rain, the dam will be filled in using adjacent backfill and a small channel created upslope of the dam location to prevent refilling during rain. Any dam that fills during rain will need to be dewatered again using the methods described in this document.

In addition, Fraser Ecological recommends that the pump inlet must be attached to a float to prevent disturbance of the silt base of the dams. The pump inlet must be fitted with a 4mm mesh filter suitable to prevent small fauna from entering the pump inlet. The water level at each dam will be monitored daily until the dam is reduced to a depth of 1m whereby fauna capture is feasible.

Provisions to protect frogs and tadpoles (and other fauna) during the dewatering process of any coffer dams or the clearing of screens should include:

- discharging water into a bunded or screened site to fauna to be rescued
- pumps and screens must be of a suitable capacity and size, and pump velocities slow enough, to allow fauna to escape during the dewatering process.

There is no seasonal restriction to the timing of dewatering. It is recommended however that the following environmental conditions are avoided during dam dewatering of small dams, and also the final stages of large dams:

- Daytime temperatures above 35°C whereby the water within the capture location may overheat; or
- During rainfall events of more than 20mm in a 24 hour period; or
- The 3 days prior to a predicted rain even of more than 50mm of rain within a 72 hour period.

A brief report detailing the dewatering actions would be provided that includes:

- The location of the dam dewatered;
- Details of the pre-clearing surveys and results.
- Details of the dewatering process including time, date, location, procedures used.
- The quantum and species of native fauna relocated;
- The quantum and species of euthanized fauna;
- The quantum and species of injured native fauna taken to veterinary services;
- An ongoing tally of all fauna released at each relocation site to date;
- The date of dewatering and environmental conditions;
- Persons involved in dewatering.
- The number of tadpoles of each species of frog collected from each work area.
- The number of tadpoles of each species of frog released at each of the relocation site/s.
- Qualifications of the ecologist undertaking the work.

7.7 Consultation with NPWS and other relevant public authorities, local community restoration/rehabilitation groups, Landcare groups

The consent condition states at all trees approved for removal that are greater than 30cm DBH are to be cut up into 2-6m lengths and translocated into the Conservation Area. This is not practical due to the large number of trees approved for removal and damage the native vegetation to be conserved. However, it is agreed that some logs shall be carefully placed there as habitat under the guidance of the Project Ecologist.

As per Table 3 (in Section 7.2.21), a total of 104 trees with a DBH of 30cm or greater have been approved for removal.

A maximum of twenty (20) of these trees can be sawn into 2-6m lengths and appropriately relocated into the Conservation Area without increasing the bushfire BAL and bushfire risk and or damaging the native vegetation to be conserved.

As it appears that Condition 20(i)(f) can only partly be achieved on site, the remaining native trees approved for removal (with a DBH of 30cm or greater) that cannot be reused on site that prior to their removal the Proponent consults with NPWS and other relevant public authorities, local community restoration/rehabilitation groups, Landcare groups etc to determine if there is an interest for the reuse of suitable timber and root balls in habitat enhancement and rehabilitation work.

This detail including consultation with the community groups and their responses has been documented in Section 7.6 and the Works Schedule (Section 9 below) and should be also documented in the CEMP.

Simply selling the leftover fallen trees as firewood shall be a very last consideration as the felled trees still have habitat value.

Where removed trees can't be relocated into Conservation Area and if there no interest by NPWS or others to reuse the timber offsite it is suggested mulch from the removed native trees is used in the site landscaping areas to restrict weed growth and retain soil moisture .

Please refer to Appendix B for previous consultation with EESG about the preparation of this VMP.

7.8 Reference Points for VMP monitoring

Reference points should be established before vegetation management begins.

Monitoring visits shall occur every 6 months from the commence of the 5 year VMP period.

The locations of these points may be marked permanently on the ground by iron stake, rock cairn or similar, or the location simply recorded by GPS.

Once established, standard photographs should be taken before this plan is implemented and then again immediately before submitting each progress report. The aim of the reference photographs is to provide a pictorial record that will aid in the judgement of the effectiveness of the vegetation management strategies.

The rehabilitation actions identified in this VMP are to be monitored by a suitably qualified and experienced bush regenerator or ecologist. Monitoring should occur throughout the entire contract period. No revegetation works is proposed.

The main objective of the monitoring program is to evaluate the effectiveness of the weed management program, to determine if adequate natural regeneration is occurring. If, after monitoring, it is deemed that the weed eradication techniques are ineffective, then the plan can be altered at any time to reduce the weed biomass.

Native species richness and cover abundance for groundcovers, shrubs and canopy species and weed cover abundance can be measured quantitatively within a quadrat. Quadrat data collected prior to works commencing forms the baseline for monitoring performance criteria. Data collected is to include native species richness and cover abundance and also weed distribution.

One monitoring quadrat is to be provided for each 0.5 ha area of the VMP management area. When baseline surveys are undertaken by the engaged bush regeneration contractor permanent monitoring quadrat locations shall be set up, GPS marked and provided on a map.

Each quadrat should be a minimum 20x20m in size. Where appropriate a nested quadrat may be provided to reduce survey effort. Trees and shrubs should be measured over the entire area, while ground covers will be measured within a smaller quadrat nested within the large quadrat.

Additional quadrats may be required at any critical stage inspection to demonstrate compliance with performance criteria.

At a minimum the following information is to be included within monitoring reports:

- the time period for which the report relates to;
- date and times of site visits and summary of works completed on the site at each visit (maintenance log);

- the qualifications and experience of contractors;
- certification of seed and local provenance stock;
- a table totalling person hours for each task undertaken on site;
- methods of weeding undertaken and chemicals used;
- numbers of local provenance tubestock planted or methods of assisted natural regeneration techniques used to support the germination of natives in disturbed areas;
- photo and/or monitoring results and an analysis of these against performance criteria;
- details regarding threatened entities found on site, their persistence (or survival) and any specific actions required to be undertaken; and
- a statement as to the efficacy of the VMP works in achieving the aims and objectives and any adjustments that may be required.

General performance criteria:

- commencement of all tasks outlined in the plan or evidence of planning for their implementation
- primary and follow up (secondary) weeding needs to be undertaken at the appropriate time, in this case, if primary weeding (spraying, cut and paint) is undertaken now, then autumn and spring would be an appropriate time to follow up if necessary. Extensive primary weeding may be totally negated if follow up weeding is not undertaken or inappropriate control is implemented.
- no adult seeding woody weeds present by the end of the 5 year period no evidence of seeding annual weeds present across the site
- evidence that existing weed patches have been contained and are not spreading
- the site is to be maintained in a tidy order and kept free of waste litter
- All priority weeds listed under the Biosecurity Act to be less than 2% cover by the end of each maintenance period and other weeds to be less than 4% by the end of each maintenance period.
- No encroachment of exotic grasses lawn beyond management zone boundary.

The formal monitoring program will start immediately after initial baseline quadrat station have been set up and the release of the Construction Certificate and continue for a period of up to five years. Progress reports will be provided to Council / PCA every 6 months.

These progress reports shall be in the form of the template provided overleaf. Photographs and the corresponding photo location provided in the following pages could also be used for reference points.

Progress report template for vegetation management works

1.	Date of plan approval:
2.	Tick report interval from date of council consent ☐ 6 month ☐ 1 Year ☐ 1.5 years ☐ 2 years ☐ subsequent
3.	Weed cover (%): Fine fuel levels:
4.	Major weeds:
5.	Regeneration success: Attach quadrat monitoring data as specified in Section 7.7 <i>One monitoring quadrat is to be provided for each 0.5 ha area of the VMP management area. When baseline surveys are undertaken by the engaged bush regeneration contractor permanent monitoring quadrat locations shall be set up, GPS marked and provided on a map.</i> <i>Each quadrat should be a minimum 20x20m in size. Where appropriate a nested quadrat may be provided to reduce survey effort. Trees and shrubs should be measured over the entire area, while ground covers will be measured within a smaller quadrat nested within the large quadrat.</i>
6.	Threatened plant monitoring: <i>The number of threatened Persoonia nutans and Dillwynia tenuifolia plants shall be tagged and their location documented on a map by the Project Ecologist. This data shall be provided in attached sheet with every monitoring report.</i>

8. Performance measures

Maintenance effort must meet the following criteria:

1. commencement of all tasks outlined in the plan or evidence of planning for their implementation
2. primary and follow up (secondary) weeding needs to be undertaken at the appropriate time, in this case, if primary weeding spraying, cut and paint) is undertaken now, then autumn and spring would be an appropriate time to follow up if necessary. Extensive primary weeding may be totally negated if follow up weeding is not undertaken or inappropriate control is implemented.
3. no adult seeding woody weeds present by the end of the initial 5 year period and no evidence of seeding annual weeds and high level threat weeds (*Biosecurity Act 2015*) to be below 5% cover for each monitoring period
4. evidence that existing weed patches have been contained and are not spreading.
5. All threatened plants (*Persoonia mollis* ssp. *nutans* and *Dillwynia tenuifolia*) have been protected and the population has shown a 5% increase in abundance as a result of weed management and bush regeneration techniques
6. the site is to be maintained in a tidy order and kept free of waste litter

Post 5 year VMP work obligations:

The aims of this section of the report is to give the land-owner guidance on how to adhere to their responsibilities under the *Biosecurity Act 2015* and to reduce weed infestations in perpetuity for the Conservation Area

Based on the monitoring report results corrective actions must be implemented where performance targets are not on track or past the 5 year VMP period.

Table 4 (below) details corrective actions for potential management issues which may be identified during the monitoring stage. Corrective actions must be provided in the monitoring report when required either during or after the 5 year VMP period.

Table 4: Post 5 year corrective actions for potential ongoing management issues

Management Issue	Corrective Action
Weed cover exceeding targets by 10% or more.	Increase weed control visits by a qualified bush regenerator. Frequency of visits to be determined by a qualified ecologist or bush regenerator to meet performance measures.
Ineffective sediment fencing or in disrepair	Repair existing fencing. Add additional fencing where required to ensure no sediment is entering drainage lines, bushland or stormwater.
Threatened plant survival rate below 80%	Threatened plant survival rate to be maintained at 80% or higher. If not greater than a remedial action strategy plan will be required and the this VMP will need to be updated to adapt accordingly.

9. Works schedule

This plan will be implemented for an initial intensive works period of 5 years. **The plan shall be implemented in perpetuity in accordance with the conditions of consent ideally by way of a positive covenant on title of the property.**

Phase	Activity	Details	Timing
1. Engage qualified and experienced bush regeneration company to undertake the works specified in this plan and engage Project Ecologist for certification works and APZ establishment	Weeding Monitoring/ reporting	As per Section 7	YEAR 1 With a month of the issue of the Construction Certificate
2. Establish photo monitoring points	Photographic record	Establish photographic reference points	YEAR 1 One month after the issue of the Construction Certificate
3. Threatened species protection	Fencing installation	Under the direction of the Project Ecologist	YEAR 1 Before any clearing works
4. APZ establishment and threatened plant protection	Establish the APZ as per Section 6. Protected threatened plants as per Section 7.2.1	Ensure the fence delineating the APZ from the remainder of the APZ is established. Project Ecologist to ensure fencing around threatened plants established and tag exactly which trees are to be retained	YEAR 1 Before any clearing works

Phase	Activity	Details	Timing
		and pruned with the APZ	
5. Pre-clearing tree inspection	Ensure all trees are inspected as per Section 7.2.1	Ensure all trees as inspected as per Section 7.2.1. All trees are to be inspected pre-clearing for native fauna, nests, dreys, loose bark and hollows. Habitat and fauna to be carefully relocated to the Conservation Area where practical and not forming a bushfire hazard.	YEAR 1 Before any clearing works
6. Consult with NPWS and other regarding leftover felled trees	Consultation with NPWS and other relevant public authorities, local community restoration/rehabilitation groups, Landcare groups	As it appears that Condition 20(i)(f) can only partly be achieved on site, the remaining native trees approved for removal (with a DBH of 30cm or greater) that cannot be reused on site that prior to their removal the Proponent consults with NPWS and other relevant public authorities, local community restoration/rehabilitation groups, Landcare groups etc to determine if there is an interest for the reuse of suitable timber and root balls in habitat enhancement and rehabilitation work.	YEAR 1 Before any clearing works
7. Relocate felled trees as habitat into Conservation Area	As per Table 3, a total of 104 trees with a DBH of 30cm or greater have been approved for removal. Twenty felled trees to be re-located in Conservation Area	A maximum of twenty (20) of these trees can be sawn into 2-6m lengths and appropriately relocated into the Conservation Area without increasing the bushfire BAL and bushfire risk and or damaging the native vegetation to be conserved.	YEAR 1 During any clearing works
8. Dam dewatering	Ensure aquatic fauna is protected as per Section 7.5	A qualified ecologist will be present on-site during the entire dewatering to ensure that appropriate action can be taken with regard to care and relocation of all protected and threatened fauna residing in the	YEAR 1 Before any clearing works

Phase	Activity	Details	Timing
		dam.	
9. Primary weed control	Weed management	Hand pull and chemically control weeds. Prioritise African Lovegrass and Blackberry. Minimum of 200 person hours.	YEAR 1 Within 3 months of the issue of Construction Certificate
10. Secondary weed control	Soil and erosion protection	Apply mulch or similar to exposed soils. Any mulch to be used shall be from felled trees that could not be re-used as habitat or accepted by NPWS and other groups as per Section 7.6	YEAR 1 Within 6 weeks of primary weeding
	Weed management	Weed herbaceous and woody weeds using techniques appropriate to the species and scale of outbreak. Prioritise African Lovegrass and Blackberry. Minimum of 180 person hours.	
		Monitoring photos from standard locations to be taken.	
		Appropriate responses to weeds formulated according to status of rehabilitation works.	
		Inspection report provided to Council	
11. Maintenance weeding	Weed management (after more intensive primary and secondary weeding completed)	On a quarterly basis – weed management using techniques appropriate to the species and scale of outbreak. Prioritise African Lovegrass and Blackberry. Frequency of weeding works will depend upon season of the year (i.e. higher weed growth likely to occur in warmer months).	Year 1-5 (commencing within 2 months of secondary weeding completion) Autumn and Winter: minimum of one visit each

Phase	Activity	Details	Timing
		Autumn = minimum of 80 hours per year (one visit per season) Winter = minimum of 80 hours per year (one visit per season) Spring = minimum of 120 hours per year (two visits per season) Summer = minimum of 120 hours per year (two visits per season)	season Spring and Summer: minimum of two visits each season
12. Monitoring reports	Monitoring reports as per Section 7.5	Provided to Council or PCA every 6 months. Undertaken by Project Ecologist.	YEAR 1-5 Every 6 months
13. Final reporting	Ecologist Certification	Project ecologist to provide final report to determine if the objectives and performance criteria of the plan have been met	At the end of 5 year VMP life

***** The VMP Schedule of Works shall be amended and the whole VMP revised in the event of an unpredicted impacts and their consequences**

Table 1: Timing of VMP works

	Whilst awaiting issue of Construction Certificate				TIMING OF OPERATION / MAINTENANCE																				Responsibility
	2020				YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5				
	1st quarter	2nd quarter	3rd quarter	4th quarter	1st quarter	2nd quarter	3rd quarter	4th quarter	1st quarter	2nd quarter	3rd quarter	4th quarter	1st quarter	2nd quarter	3rd quarter	4th quarter	1st quarter	2nd quarter	3rd quarter	4th quarter	1st quarter	2nd quarter	3rd quarter	4th quarter	
Engage Bush Regenerator and Project Ecologist																									Property Owner/Project Manager certified by Project Ecologist
Site Meeting & Inductions - address WH&S issues																									Property Owner/Project Manager
Erect sediment fencing along boundary of Conservation Area and APZ																									Landscaper or Construction contractor certified by Project Ecologist
Fencing installation (threatened plants)																									Landscaper or Construction contractor under direction of Project Ecologist
Dam dewatering																									Construction contractor under direction aquatic ecologist
Baseline Survey and establish VMP monitoring points. Includes Ecologist to determine the presence of any nests, dreys or fauna using hollows																									Bush Regenerator or Project Ecologist
Consultation with NPWS and other organisations to re-use fallen timber as habitat																									Property Owner/Project Manager/ Landscaper or Construction contractor
Vegetation clearing																									Civil works contractor under direction of Project Ecologist. It is important the Project ecologist is always present on site during the vegetation clearing.
Relocation felled timber to Conservation area Tree hollows should be relocated and installed the same day they are removed.																									Civil works contractor under direction of Project Ecologist. If compensatory hollows are not installed in the Conservation Area prior to vegetation clearing, it is important the tree hollows are relocated on the same day as they are removed to ensure hollow dependent fauna are not impacted.
Primary weeding																									Bush Regenerator
Secondary weeding																									Bush Regenerator
Weed maintenance																									Bush Regenerator
Monitoring Reports																									Bush Regenerator or Project Ecologist

10. References

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APPENDIX A: RELEVANT QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Alex Fraser (Fraser Ecological Consulting) has over 20 years experience in ecological assessment and on-ground bushland restoration management. Previous work roles include ecological consulting with Parsons Brinckerhoff (large infrastructure), NPWS (biodiversity surveys), NSW Department of Environment and Climate Change (SIS DGRs) and Hornsby Shire Council (residential and light industrial development) have focussed primarily on ecological survey, development assessment, project management and policy development for consent authorities. Alex also has practical experience in landscape construction, bushland restoration and property management. A full list of flora and fauna assessments previously undertaken can be provided upon request.

Professional Affiliations include the Australian Association of Bush Regenerators, Ecological Society of Australia, Royal Zoological Society of NSW, Birds Australia, Australasian Bat Society, Urban Feral Animal Action Control Group (Sydney North Councils), Surfrider Foundation & Fred Hollows Foundation.

Relevant qualifications and training:

Bachelor of Applied Science – Coastal Resource Management (Honours) Southern Cross University

Certificate 3 Natural Area Restoration (Ryde Horticultural College)

Chemcert (Department of Natural Resources)

Chainsaw Cross Cutting Techniques (Ryde Horticultural College)

Certificate 3 Vertebrate Animal Pest Control (NSW DPI, Orange)

Senior First Aid (St. Johns Ambulance Australia)

Project Management 'the hard and soft skills' (NPWS- 2004)

Frog, Bat and Reptile: species identification and survey skills (Forests NSW)

Certificate 3&4 Japanese language proficiency (The Japan Foundation)

Advanced Open Water SCUBA diver (PADI Australia)

State Rail Contractor Safety Awareness (State Rail Authority)

NPWS Scientific Licence (NSW Office of Environment and Heritage)

Accredited assessor under Biodiversity Assessment Methodology (BAM)

Certificate 3 in Natural Area Restoration (Ryde Horticultural College, TAFE)

Practising member of NSW Ecological Consultants Association

APPENDIX B: PREVIOUS CONSULTATION WITH EESG





Our ref: DOC20/708632

Senders ref: MP08-0255 MOD 2

Mr Alex Fraser
Fraser Ecological

Dear Mr Fraser

Subject: EES comments on Post Approval draft Vegetation Management Plan for Elf Mushroom Farm – 521 The Northern Road Londonderry - MP08-0255 MOD 2

Thank you for your email of 20 August 2020, requesting advice on the post approval draft Vegetation Management Plan (VMP) for MP08-0255 MOD 2.

The Environment, Energy and Science group (EES) has reviewed the draft VMP and provides its recommendations and comments in Attachment A.

If you have any queries regarding this matter, please do not hesitate to contact Janne Grose, Senior Conservation Planning Officer on 02 8837 6017 or at janne.grose@environment.nsw.gov.au

Yours sincerely

A handwritten signature in black ink that reads 'S. Harrison'.

08/09/20

Susan Harrison

**Senior Team Leader Planning
Greater Sydney Branch
Environment, Energy and Science**

CC Emma Butcher, Planning and Assessment Group

Subject: EES comments on Post Approval draft Vegetation Management Plan for Elf Mushroom Farm – 521 The Northern Road Londonderry - MP08-0255 MOD 2

The Environment, Energy and Science Group (EES) has reviewed the following documents:

- Vegetation Management Plan – 521 The Northern Road Londonderry – 17 August 2020 (VMP)
- Project Approval – MP08-0255 – Elf Substrate Plant and Elf Mushroom Farm Project - 11 January 2012
- Modification of Project Approval MP08-0255 MOD 2 – modification to the Mushroom Farm site – 4 November 2019

and provides the following comments.

It is noted, Condition 20(i) of the Modification of Project Approval MP08-0255 MOD 2 requires that the VMP must be prepared in consultation with EES.

4.2 Fauna Habitat Features

Section 4.2 refers to three dams occurring on site which provide habitat for common waterbirds (page 17) and Figure 8 indicates the dams will be impacted by the approved building. It is not clear if other native fauna potentially use the dams (such as frogs and tortoises) and if an inspection of the dams is proposed to be undertaken prior to the commencement of the works/dewatering and removal of the dams and whether it is intended for a licensed wildlife carer and/or ecologist to be present during dewatering of the dams to relocate tortoises etc to appropriate nearby habitat. Condition 20ii in the Modification of Project Approval for Fauna Inspection requires that:

Prior to the commencement of works, including the removal of any trees associated with the approved development, an inspection for resident threatened fauna (including an inspection of hollows) must be undertaken by a wildlife handler/expert and any fauna found relocated.

While this condition requires an inspection is undertaken for “resident threatened fauna”, EES recommends the inspection applies to all “protected animals” under the *Biodiversity Conservation Act 2016* (BC Act) and not just threatened fauna. Protected animals are defined in Schedule 5 of the BC Act to include any of the following that are native to Australia or that periodically or occasionally migrate to Australia (including their eggs and young) -

- amphibians - frogs or other members of the class amphibia
- birds - birds of any species
- mammals - mammals of any species (including aquatic or amphibious mammals but not including dingoes)
- reptiles - snakes, lizards, crocodiles, tortoises, turtles or other members of the class reptilia.

As the focus of the VMP is the Conservation Area on the western portion of the site, the issue relating to the dewatering of the dams and the relocation of native fauna may need to be addressed in the Construction Environmental Management Plan rather than the VMP.

7.2.1 Pre-clearing protocols

Fauna Inspection

Section 7.2.1 of the VMP refers to Condition 20(ii) for Fauna Inspection and includes as a Mitigation Measure that “prior to works commencing a pre-clearance survey must be conducted by a qualified Ecologist to determine the presence of any nests, dreys or fauna using hollows. A report offindings for any required supervision of clearing works to be submitted to council”.

As noted above, Condition 20(ii) requires an inspection be undertaken for “resident threatened fauna” but EES recommends the inspection applies to all “protected animals” under the BC Act and that any protected animals found are also relocated to appropriate nearby habitat. It is recommended the VMP clarifies this that any inspection and relocation of native fauna applies to all “protected animals” and it is not only limited to threatened fauna.

Translocation of trees removed

Condition 20(i)(f) in the Modification of Project Approval requires that all trees approved for removal with a Diameter at Breast Height (DBH) of 30cm or greater, once felled are to be sawn into 2-6m lengths and relocated into the Conservation Area.

The VMP indicates Condition 20(i)(f) conflicts with bushfire protection requirements that permits a maximum of 29 tonnes per ha of fuel load (achieved under the natural process of decay) as it would add more biomass by relocating all sawn trees (greater than 30cm in diameter) and would increase the bushfire BAL and bushfire risk (section 1.1). It also indicates the relocating of these felled trees is not practical due to the large number of trees approved for removal as relocation would damage the native vegetation to be conserved (section 7.2.1). The VMP indicates it has suggested in Section 7.4 and Section 9 that all hollow-bearing trees approved for removal are to be sawn into 3m lengths and re-located into the Conservation Area under the supervision of the Project Ecologist (section 1.1). This reference to Section 7.4 appears to be a typing error and needs to be amended as Section 7.4 relates to weed control. It is noted however that Section 7.2.2 (During Clearing) includes a mitigation measure that “felled trees are to be placed within the Conservation Area where practical, particularly those with hollows”.

The VMP needs to state the total number of trees (with DBH of 30cm or greater) that have been approved to be removed and how many of these trees can be sawn into 2-6m lengths and appropriately relocated into the Conservation Area without increasing the bushfire BAL and bushfire risk and or damaging the native vegetation to be conserved.

As it appears that Condition 20(i)(f) can only partly be achieved on site, it is suggested for the remaining native trees approved for removal (with a DBH of 30cm or greater) which can't be reused on site that prior to their removal the Proponent consults with NPWS and other relevant public authorities, local community restoration/rehabilitation groups, Landcare groups etc to determine if there is an interest for the reuse of suitable timber and root balls in habitat enhancement and rehabilitation work. This detail including consultation with the community groups and their responses should be documented in the VMP and CEMP. It is recommended the VMP includes this as an additional mitigation measure.

Mitigation Measures

Section 7.2.1 lists mitigation measures that must also be implemented prior to the clearing of the remaining area of vegetation to be removed and one of these measures is:

- All environmentally sensitive areas must be permanently delineated from clearance areas with fencing and signage. Delineation must allow for passage of native fauna.

It is noted that Section 7.2.4 (Post Construction) includes a Mitigation Measure that “Domestic animals/Livestock are to be restricted from entering the Conservation Area” (page 42) but it is not clear why this measure would not apply to pre-clearing (i.e. Section 7.2.1).

EES suggests the following additional measures are included:

- Prior to any earthworks and clearing of native vegetation commencing in the development area, any juvenile native vegetation, native seed and coarse woody debris on the ground that is proposed to be cleared and removed is translocated and re-used in the Conservation Area and the seed is used for the propagation of plants
- Any juvenile native plants that are removed from the development area should be transplanted within the Conservation Area or used in the site landscaped areas where

plants from these plant community type (PCT) would naturally occur to conserve the local genetic diversity. The translocated plants should be maintained until established (i.e. weeding and watering).

Table 3 - Tree Numbering Schedule

Table 3 identifies trees “approved for removal” and those that are to be retained. Table 3 only requires trees 604-609 to be inspected for fauna before removal. No other trees are identified in Table 3 as requiring inspection for native fauna prior to their removal. It is not clear why only six trees are proposed to be inspected for fauna when Table 3 indicates that 106 trees have been approved to be removed. According to Table 2, trees 604-609 in Table 3 which are listed for fauna inspection are hollow bearing trees apart from tree 607. Table 2 also includes Tree No. 632 as a hollow bearing tree but Table 3 does not identify it for inspection.

Section 7.2.1 includes a mitigation measure that “Prior to works commencing a pre-clearance survey must be conducted by a qualified Ecologist to determine the presence of any nests, dreys or fauna using hollows” (page 28). Nests and dreys could be found in any of the 106 trees to be removed.

To ensure there is no confusion it suggested Table 3 includes a note that a pre-clearance survey must be conducted for all trees approved for removal

It is recommended Table 3 also specifically identifies which are the hollow bearing trees and it includes a comment that for each hollow-bearing tree approved for removal that these are to be re-located into the Conservation Area.

7.2.2 During Clearing

Where removed trees can’t be relocated into Conservation Area and if there no interest by NPWS or others to reuse the timber offsite it is suggested mulch from the removed native trees is used in the site landscaping areas to restrict weed growth and retain soil moisture and this is included as a mitigation measure.

7.2.4 Post Construction

The VMP notes maintenance will be undertaken by a fully qualified bush regeneration crew for a minimum of five (5) years post completion of primary restoration works. Details need to be included in Section 7.2.4 on:

- the proposed frequency / number of proposed maintenance visits to the site per year over the 5-year period, especially during warmer months when weed growth is more prolific
- what the maintenance will entail (e.g. watering, weed removal; replacement of any plant losses).

Section 7.5 refers to “planting of tube stock from local provenance”. If tubestock is proposed to be planted, details are required on the frequency of maintenance watering

It is noted the Works Schedule in Section 9 indicates weed maintenance is to occur on a quarterly basis but the table which outlines the Timing of Operation/Maintenance only appears to show that four maintenance visits are proposed in Year 1 and then after this only two maintenance visits are proposed for each following (i.e. for Years 2-5). The VMP needs to clarify the frequency/ number of maintenance visits (see page 56).

The areas in the Conservation Areas that have been cleared of weeds should be regenerated. Where required, these areas should be revegetated with native trees, shrubs and groundcover species of local provenance from the relevant native plant community that occurs in the Conservation Area.

7.5 Reference Points for VMP Monitoring

The VMP notes monitoring should occur throughout the entire contract period. It is suggested details are included on the frequency of monitoring visits to the site. It indicates the monitoring program will continue for a period of two years, however as maintenance is to be undertaken for a minimum of 5 years EES recommends that the monitoring/progress reports continue for 5 years as well.

Section 7.5 notes that if planting is required then this too will be supervised by the contract bush regenerator or ecologist and it refers to “planting of tube stock from local provenance”. The VMP should include:

- procedures to demonstrate how plants and seed of local provenance are to be obtained and used
- details on native plant species proposed to be planted; the planting densities - demonstrate the planting densities and plant species are representative of the vegetation communities in its natural state/unmodified condition in this locality.

It is suggested mitigation measures are included in the VMP in relation to the planting of local native provenance species including:

- Any plants used in revegetating the Conservation Area must all be sourced from local provenance. Local provenance plants are grown from seed collected from plants growing at the site, near to and in similar environmental conditions as the planting site, which gives new plants the best chance of survival.
- Seed/propagation material must be collected from the development area prior to any clearing and/or from as close as possible to the site and from the same general habitat (same soil type etc).
- A requirement for any replanting to occur when plant growth conditions give the native plants the best possible opportunity to establish.
- Maintenance requirements for the planted species.

9 Works Schedule

Phase (5) includes the requirement for a pre-clearing tree inspection but it only indicates that all hollow-bearing trees are to be inspected as per Section 7.2.1 (page 53). It is not clear why only hollow bearing trees are to be inspected for fauna when Condition 20(ii) does not specify this.

Table 3 indicates 106 trees are approved for removal and Section 7.2.1 includes a mitigation measure that “Prior to works commencing a pre-clearance survey must be conducted by a qualified Ecologist to determine the presence of any nests, dreys or fauna using hollows” (page 28).

The Fauna handling procedure (page 30) indicates for pre-felling and for all fauna that trees are to be examined for hollows, loose bark, dreys and nests. Nests, dreys, loose bark could be found in any of the 106 trees to be removed and not just trees with hollows. The Fauna handling procedure states “loose bark should be checked for reptiles and microchiropteran bats (using crow bars and gloves)”.

EES recommends:

- the Works Schedule is amended to state that all trees approved for removal are to be inspected pre-clearing for native fauna, nests, dreys, loose bark and hollows
- the VMP is amended to ensure consistency throughout the document that all trees to be removed are inspected.

Timing of Operation/Maintenance table

The table under Year 1 etc includes 1, 2, 3, 4 but it is not clear if 1,2,3,4 refers to the number of site visits (page 56). This needs to be clarified.

EES recommends:

- Details are included on the project timelines for the vegetation clearing and vegetation reinstatement (including approximate length of time to undertake the clearing/vegetation reinstatement; the month of the year when the clearing/revegetation are proposed to commence and be completed etc).
- The project timeline should allow time to collect native seed from the site / local area and then grow a range of plant species (as this may be 12 to 24 months or more).

End of Submission



Our ref: DOC20/848751

Senders ref: MP08-0255 MOD 2

Mr Alex Fraser
Fraser Ecological

Dear Mr Fraser

Subject: EES comments on Post Approval draft revised Vegetation Management Plan for Elf Mushroom Farm – 521 The Northern Road Londonderry - MP08-0255 MOD 2

Thank you for your email of 30 September 2020, requesting advice on the post approval draft revised Vegetation Management Plan (VMP) for MP08-0255 MOD 2.

The Environment, Energy and Science group (EES) has reviewed the draft revised VMP and provides its recommendations and comments in Attachment A.

EES does not need to review the draft VMP again provided that the comments /issues raised in its current submission can be addressed and/or incorporated into the VMP before it is finalised. Please note, to assist EES review any further revisions of the VMP it is requested a track change version is provided.

If you have any queries regarding this matter, please do not hesitate to contact Janne Grose, Senior Conservation Planning Officer on 02 8837 6017 or at janne.grose@environment.nsw.gov.au

Yours sincerely

A handwritten signature in black ink that reads 'S. Harrison'.

11/11/20

Susan Harrison

**Senior Team Leader Planning
Greater Sydney Branch
Environment, Energy and Science**

CC Emma Butcher, Planning and Assessment Group

Subject: EES comments on Post Approval draft revised Vegetation Management Plan for Elf Mushroom Farm – 521 The Northern Road Londonderry - MP08-0255 MOD 2

The Environment, Energy and Science Group (EES) has reviewed the revised Vegetation Management Plan (VMP) - 24 September 2020 for the Elf Mushroom Farm site, 521 The Northern Road, Londonderry.

EES previously provided a submission (dated 8 September 2020) on the draft VMP. The issues previously raised by EES in its response have largely been addressed and incorporated into the revised VMP. EES provides the following comments on the revised VMP:

7.2.1 Pre-clearing protocols

Mitigation Measures

EES suggested additional mitigation measures are included in Section 7.2.1 and supports the inclusion of these measures in the revised VMP. In relation to the inclusion of the following recommended mitigation measure:

- Any juvenile native plants that are removed from the development area should be transplanted within the Conservation Area or used in the site landscaped areas where plants from these plant community type (PCT) would naturally occur to conserve the local genetic diversity. The translocated plants should be maintained until established (i.e. weeding and watering).

EES notes there are two dot points included for this measure in the revised VMP. It is recommended the second dot point (which appears to be a typing error) is removed as it splits the mitigation measure into two (see page 31).

EES recommends the VMP also includes following additional mitigation measure:

- If the pre-clearance survey identifies native fauna using the existing hollows, compensatory tree hollows may need to be provided in the Conservation Area prior to removing the tree hollows unless the removed hollows can be relocated and installed in the Conservation Area on the same day they are removed and prior to the release of the hollow dependent native fauna.

An amendment needs to be made to the procedure listed in Section 7.2.1 which refers to notifying “the Office of Environment and Heritage (OEH); Department of Primary Industries (DPI) and/or Department of the Environment” if any unexpected threatened species are encountered (page 32). Please note, OEH was abolished on 1 July 2019 and its responsibilities and functions were transferred to the Environment, Energy and Science Group (EES) in the Department of Planning, Industry and Environment (DPIE). The reference to OEH should be replaced by the Environment, Energy and Science Group (EES) in the Department of Planning, Industry and Environment.

Table 3 - Tree Numbering Schedule

EES recommended Table 3 specifically identifies the hollow bearing trees and it includes a comment that for each hollow-bearing tree approved for removal that these are to be re-located into the Conservation Area. EES supports the amendment to Table 3 but notes it lists Tree 607 as a hollow bearing tree (see page 37) but Table 2 does not list Tree 607 as a hollow bearing tree (page 23). It is suggested the tables are amended so they are consistent with each other.

Figure 9 Mapped Trees

EES recommend the tree numbers/trees which have been identified with tree hollows (trees 604-609 and 632) are shown on Figure 9 in a different font colour to the other trees so that the hollow bearing trees are obvious and a key is included with this figure which identifies this.

7.2.2 During Clearing

Section 7.2.2 includes a mitigation measure that “Felled trees are to be placed within the Conservation Area where practical, particularly those with hollows” (page 43). Table 3, however indicates all hollow bearing trees approved for removal (trees 604-609) are to be relocated into the Conservation Area. It is recommended this mitigation measure in Section 7.2.2 is amended to be consistent with Table 3.

As noted above, the relocation of native fauna which use the tree hollows approved for removal may need compensatory tree hollows provided in the Conservation Area prior to any removal of the existing hollows and the release of the native fauna unless the existing tree hollows that are removed are installed (i) in the Conservation Area on the same day that they are removed and (ii) prior to any release of native fauna dependent on the tree hollows. EES recommends the following amendment is made to the Mitigation Measure:

- Any hollow sections of wood which have already been removed should be salvaged and either placed in the remaining areas of bushland or used to make natural nest boxes which can be installed within the site **prior to the release of native fauna that are found using the tree hollows. If the removed hollows can't be installed on the same day that they are removed, compensatory tree hollows must be provided in the Conservation Area prior to removal of the existing hollows and release of any captured hollow dependent fauna.**

7.5 Dam Dewatering Protocols

EES supports the inclusion of section 7.5 for dam dewatering protocols in the VMP and recommends the Construction Environmental Management Plan (CEMP) includes the measures outlined in section 7.5.

7.6 Consultation with NPWS and other relevant public authorities, local community restoration/rehabilitation groups, Landcare groups

EES supports the inclusion of section 7.6 in the VMP and in the Works Schedule in Section 9 and recommends the CEMP also includes details relating to consultation with community groups and the CEMP/VMP documents the community responses to this consultation.

9 Works Schedule

EES supports the amendments to the Works Schedule including to phase (5) Pre-clearing tree inspection; (6) Consult with NPWS and other regarding leftover felled trees; (7) Relocate felled trees as habitat into Conservation Area; and (8) Dam Dewatering.

Timing of Operation/Maintenance table

The table under Year 1, Year 2 etc includes 1, 2, 3, 4 but it is not clear what 1,2,3,4 means. This needs to be clarified (page 64).

The table indicates the bush regenerator and project ecologist is to be engaged at (3) in 2020 but the fencing installation for threatened plants is to commence prior to the engagement of the project contractor between (1)-(4). The responsibility column indicates the landscaper or construction contractor under the direction of Project ecologist will be responsible for undertaking the fencing installation. It is important the Project ecologist is present on site for the fencing installation of threatened plants.

Clarification is required as to whether the “Baseline survey” referred to in the table is meant to be the pre-clearance survey that is to be undertaken prior to the commencement of works, including the removal of any trees associated with the approved development and conducted by a qualified Ecologist to determine the presence of any nests, dreys or fauna using hollows. If so, the baseline survey appears to overlap with the vegetation clearing and it should be undertaken prior to the commencement of works, including the removal of any trees. The VMP should clarify this.

The table indicates 'vegetation clearing' will be the responsibility of the Civil works contractor under the direction of Project Ecologist. It is important the Project ecologist is always present on site during the vegetation clearing.

The table indicates the 'relocation of felled timber to Conservation Area' will be the responsibility of the Civil works contractor under the direction of Project Ecologist. It is important the Project ecologist is always present on site during the relocation of felled timber to Conservation Area. If compensatory hollows are not installed in the Conservation Area prior to vegetation clearing, it is important the tree hollows are relocated on the same day as they are removed to ensure hollow dependent fauna are not impacted. The table indicates the relocation of felled timber will also occur in Year (1) at (3) following vegetation clearing but the tree hollows should be relocated and installed the same day they are removed.

End of Submission

APPENDIX C: Recovery Plan for *Persoonia mollis* ssp. *nutans*





Our ref: DOC20/708632

Senders ref: MP08-0255 MOD 2

Mr Alex Fraser
Fraser Ecological

Dear Mr Fraser

Subject: EES comments on Post Approval draft Vegetation Management Plan for Elf Mushroom Farm – 521 The Northern Road Londonderry - MP08-0255 MOD 2

Thank you for your email of 20 August 2020, requesting advice on the post approval draft Vegetation Management Plan (VMP) for MP08-0255 MOD 2.

The Environment, Energy and Science group (EES) has reviewed the draft VMP and provides its recommendations and comments in Attachment A.

If you have any queries regarding this matter, please do not hesitate to contact Janne Grose, Senior Conservation Planning Officer on 02 8837 6017 or at janne.grose@environment.nsw.gov.au

Yours sincerely

A handwritten signature in black ink that reads 'S. Harrison'.

08/09/20

Susan Harrison

**Senior Team Leader Planning
Greater Sydney Branch
Environment, Energy and Science**

CC Emma Butcher, Planning and Assessment Group

Subject: EES comments on Post Approval draft Vegetation Management Plan for Elf Mushroom Farm – 521 The Northern Road Londonderry - MP08-0255 MOD 2

The Environment, Energy and Science Group (EES) has reviewed the following documents:

- Vegetation Management Plan – 521 The Northern Road Londonderry – 17 August 2020 (VMP)
- Project Approval – MP08-0255 – Elf Substrate Plant and Elf Mushroom Farm Project - 11 January 2012
- Modification of Project Approval MP08-0255 MOD 2 – modification to the Mushroom Farm site – 4 November 2019

and provides the following comments.

It is noted, Condition 20(i) of the Modification of Project Approval MP08-0255 MOD 2 requires that the VMP must be prepared in consultation with EES.

4.2 Fauna Habitat Features

Section 4.2 refers to three dams occurring on site which provide habitat for common waterbirds (page 17) and Figure 8 indicates the dams will be impacted by the approved building. It is not clear if other native fauna potentially use the dams (such as frogs and tortoises) and if an inspection of the dams is proposed to be undertaken prior to the commencement of the works/dewatering and removal of the dams and whether it is intended for a licensed wildlife carer and/or ecologist to be present during dewatering of the dams to relocate tortoises etc to appropriate nearby habitat. Condition 20ii in the Modification of Project Approval for Fauna Inspection requires that:

Prior to the commencement of works, including the removal of any trees associated with the approved development, an inspection for resident threatened fauna (including an inspection of hollows) must be undertaken by a wildlife handler/expert and any fauna found relocated.

While this condition requires an inspection is undertaken for “resident threatened fauna”, EES recommends the inspection applies to all “protected animals” under the *Biodiversity Conservation Act 2016* (BC Act) and not just threatened fauna. Protected animals are defined in Schedule 5 of the BC Act to include any of the following that are native to Australia or that periodically or occasionally migrate to Australia (including their eggs and young) -

- amphibians - frogs or other members of the class amphibia
- birds - birds of any species
- mammals - mammals of any species (including aquatic or amphibious mammals but not including dingoes)
- reptiles - snakes, lizards, crocodiles, tortoises, turtles or other members of the class reptilia.

As the focus of the VMP is the Conservation Area on the western portion of the site, the issue relating to the dewatering of the dams and the relocation of native fauna may need to be addressed in the Construction Environmental Management Plan rather than the VMP.

7.2.1 Pre-clearing protocols

Fauna Inspection

Section 7.2.1 of the VMP refers to Condition 20(ii) for Fauna Inspection and includes as a Mitigation Measure that “prior to works commencing a pre-clearance survey must be conducted by a qualified Ecologist to determine the presence of any nests, dreys or fauna using hollows. A report offindings for any required supervision of clearing works to be submitted to council”.

As noted above, Condition 20(ii) requires an inspection be undertaken for “resident threatened fauna” but EES recommends the inspection applies to all “protected animals” under the BC Act and that any protected animals found are also relocated to appropriate nearby habitat. It is recommended the VMP clarifies this that any inspection and relocation of native fauna applies to all “protected animals” and it is not only limited to threatened fauna.

Translocation of trees removed

Condition 20(i)(f) in the Modification of Project Approval requires that all trees approved for removal with a Diameter at Breast Height (DBH) of 30cm or greater, once felled are to be sawn into 2-6m lengths and relocated into the Conservation Area.

The VMP indicates Condition 20(i)(f) conflicts with bushfire protection requirements that permits a maximum of 29 tonnes per ha of fuel load (achieved under the natural process of decay) as it would add more biomass by relocating all sawn trees (greater than 30cm in diameter) and would increase the bushfire BAL and bushfire risk (section 1.1). It also indicates the relocating of these felled trees is not practical due to the large number of trees approved for removal as relocation would damage the native vegetation to be conserved (section 7.2.1). The VMP indicates it has suggested in Section 7.4 and Section 9 that all hollow-bearing trees approved for removal are to be sawn into 3m lengths and re-located into the Conservation Area under the supervision of the Project Ecologist (section 1.1). This reference to Section 7.4 appears to be a typing error and needs to be amended as Section 7.4 relates to weed control. It is noted however that Section 7.2.2 (During Clearing) includes a mitigation measure that “felled trees are to be placed within the Conservation Area where practical, particularly those with hollows”.

The VMP needs to state the total number of trees (with DBH of 30cm or greater) that have been approved to be removed and how many of these trees can be sawn into 2-6m lengths and appropriately relocated into the Conservation Area without increasing the bushfire BAL and bushfire risk and or damaging the native vegetation to be conserved.

As it appears that Condition 20(i)(f) can only partly be achieved on site, it is suggested for the remaining native trees approved for removal (with a DBH of 30cm or greater) which can't be reused on site that prior to their removal the Proponent consults with NPWS and other relevant public authorities, local community restoration/rehabilitation groups, Landcare groups etc to determine if there is an interest for the reuse of suitable timber and root balls in habitat enhancement and rehabilitation work. This detail including consultation with the community groups and their responses should be documented in the VMP and CEMP. It is recommended the VMP includes this as an additional mitigation measure.

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Section 7.2.1 lists mitigation measures that must also be implemented prior to the clearing of the remaining area of vegetation to be removed and one of these measures is:

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EES suggests the following additional measures are included:

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It is recommended Table 3 also specifically identifies which are the hollow bearing trees and it includes a comment that for each hollow-bearing tree approved for removal that these are to be re-located into the Conservation Area.

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Where removed trees can’t be relocated into Conservation Area and if there no interest by NPWS or others to reuse the timber offsite it is suggested mulch from the removed native trees is used in the site landscaping areas to restrict weed growth and retain soil moisture and this is included as a mitigation measure.

7.2.4 Post Construction

The VMP notes maintenance will be undertaken by a fully qualified bush regeneration crew for a minimum of five (5) years post completion of primary restoration works. Details need to be included in Section 7.2.4 on:

- the proposed frequency / number of proposed maintenance visits to the site per year over the 5-year period, especially during warmer months when weed growth is more prolific
- what the maintenance will entail (e.g. watering, weed removal; replacement of any plant losses).

Section 7.5 refers to “planting of tube stock from local provenance”. If tubestock is proposed to be planted, details are required on the frequency of maintenance watering

It is noted the Works Schedule in Section 9 indicates weed maintenance is to occur on a quarterly basis but the table which outlines the Timing of Operation/Maintenance only appears to show that four maintenance visits are proposed in Year 1 and then after this only two maintenance visits are proposed for each following (i.e. for Years 2-5). The VMP needs to clarify the frequency/ number of maintenance visits (see page 56).

The areas in the Conservation Areas that have been cleared of weeds should be regenerated. Where required, these areas should be revegetated with native trees, shrubs and groundcover species of local provenance from the relevant native plant community that occurs in the Conservation Area.

7.5 Reference Points for VMP Monitoring

The VMP notes monitoring should occur throughout the entire contract period. It is suggested details are included on the frequency of monitoring visits to the site. It indicates the monitoring program will continue for a period of two years, however as maintenance is to be undertaken for a minimum of 5 years EES recommends that the monitoring/progress reports continue for 5 years as well.

Section 7.5 notes that if planting is required then this too will be supervised by the contract bush regenerator or ecologist and it refers to “planting of tube stock from local provenance”. The VMP should include:

- procedures to demonstrate how plants and seed of local provenance are to be obtained and used
- details on native plant species proposed to be planted; the planting densities - demonstrate the planting densities and plant species are representative of the vegetation communities in its natural state/unmodified condition in this locality.

It is suggested mitigation measures are included in the VMP in relation to the planting of local native provenance species including:

- Any plants used in revegetating the Conservation Area must all be sourced from local provenance. Local provenance plants are grown from seed collected from plants growing at the site, near to and in similar environmental conditions as the planting site, which gives new plants the best chance of survival.
- Seed/propagation material must be collected from the development area prior to any clearing and/or from as close as possible to the site and from the same general habitat (same soil type etc).
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9 Works Schedule

Phase (5) includes the requirement for a pre-clearing tree inspection but it only indicates that all hollow-bearing trees are to be inspected as per Section 7.2.1 (page 53). It is not clear why only hollow bearing trees are to be inspected for fauna when Condition 20(ii) does not specify this.

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The Fauna handling procedure (page 30) indicates for pre-felling and for all fauna that trees are to be examined for hollows, loose bark, dreys and nests. Nests, dreys, loose bark could be found in any of the 106 trees to be removed and not just trees with hollows. The Fauna handling procedure states “loose bark should be checked for reptiles and microchiropteran bats (using crow bars and gloves)”.

EES recommends:

- the Works Schedule is amended to state that all trees approved for removal are to be inspected pre-clearing for native fauna, nests, dreys, loose bark and hollows
- the VMP is amended to ensure consistency throughout the document that all trees to be removed are inspected.

Timing of Operation/Maintenance table

The table under Year 1 etc includes 1, 2, 3, 4 but it is not clear if 1,2,3,4 refers to the number of site visits (page 56). This needs to be clarified.

EES recommends:

- Details are included on the project timelines for the vegetation clearing and vegetation reinstatement (including approximate length of time to undertake the clearing/vegetation reinstatement; the month of the year when the clearing/revegetation are proposed to commence and be completed etc).
- The project timeline should allow time to collect native seed from the site / local area and then grow a range of plant species (as this may be 12 to 24 months or more).

End of Submission



Our ref: DOC20/848751

Senders ref: MP08-0255 MOD 2

Mr Alex Fraser
Fraser Ecological

Dear Mr Fraser

Subject: EES comments on Post Approval draft revised Vegetation Management Plan for Elf Mushroom Farm – 521 The Northern Road Londonderry - MP08-0255 MOD 2

Thank you for your email of 30 September 2020, requesting advice on the post approval draft revised Vegetation Management Plan (VMP) for MP08-0255 MOD 2.

The Environment, Energy and Science group (EES) has reviewed the draft revised VMP and provides its recommendations and comments in Attachment A.

EES does not need to review the draft VMP again provided that the comments /issues raised in its current submission can be addressed and/or incorporated into the VMP before it is finalised. Please note, to assist EES review any further revisions of the VMP it is requested a track change version is provided.

If you have any queries regarding this matter, please do not hesitate to contact Janne Grose, Senior Conservation Planning Officer on 02 8837 6017 or at janne.grose@environment.nsw.gov.au

Yours sincerely

A handwritten signature in black ink that reads 'S. Harrison'.

11/11/20

Susan Harrison

**Senior Team Leader Planning
Greater Sydney Branch
Environment, Energy and Science**

CC Emma Butcher, Planning and Assessment Group

Subject: EES comments on Post Approval draft revised Vegetation Management Plan for Elf Mushroom Farm – 521 The Northern Road Londonderry - MP08-0255 MOD 2

The Environment, Energy and Science Group (EES) has reviewed the revised Vegetation Management Plan (VMP) - 24 September 2020 for the Elf Mushroom Farm site, 521 The Northern Road, Londonderry.

EES previously provided a submission (dated 8 September 2020) on the draft VMP. The issues previously raised by EES in its response have largely been addressed and incorporated into the revised VMP. EES provides the following comments on the revised VMP:

7.2.1 Pre-clearing protocols

Mitigation Measures

EES suggested additional mitigation measures are included in Section 7.2.1 and supports the inclusion of these measures in the revised VMP. In relation to the inclusion of the following recommended mitigation measure:

- Any juvenile native plants that are removed from the development area should be transplanted within the Conservation Area or used in the site landscaped areas where plants from these plant community type (PCT) would naturally occur to conserve the local genetic diversity. The translocated plants should be maintained until established (i.e. weeding and watering).

EES notes there are two dot points included for this measure in the revised VMP. It is recommended the second dot point (which appears to be a typing error) is removed as it splits the mitigation measure into two (see page 31).

EES recommends the VMP also includes following additional mitigation measure:

- If the pre-clearance survey identifies native fauna using the existing hollows, compensatory tree hollows may need to be provided in the Conservation Area prior to removing the tree hollows unless the removed hollows can be relocated and installed in the Conservation Area on the same day they are removed and prior to the release of the hollow dependent native fauna.

An amendment needs to be made to the procedure listed in Section 7.2.1 which refers to notifying “the Office of Environment and Heritage (OEH); Department of Primary Industries (DPI) and/or Department of the Environment” if any unexpected threatened species are encountered (page 32). Please note, OEH was abolished on 1 July 2019 and its responsibilities and functions were transferred to the Environment, Energy and Science Group (EES) in the Department of Planning, Industry and Environment (DPIE). The reference to OEH should be replaced by the Environment, Energy and Science Group (EES) in the Department of Planning, Industry and Environment.

Table 3 - Tree Numbering Schedule

EES recommended Table 3 specifically identifies the hollow bearing trees and it includes a comment that for each hollow-bearing tree approved for removal that these are to be re-located into the Conservation Area. EES supports the amendment to Table 3 but notes it lists Tree 607 as a hollow bearing tree (see page 37) but Table 2 does not list Tree 607 as a hollow bearing tree (page 23). It is suggested the tables are amended so they are consistent with each other.

Figure 9 Mapped Trees

EES recommend the tree numbers/trees which have been identified with tree hollows (trees 604-609 and 632) are shown on Figure 9 in a different font colour to the other trees so that the hollow bearing trees are obvious and a key is included with this figure which identifies this.

7.2.2 During Clearing

Section 7.2.2 includes a mitigation measure that “Felled trees are to be placed within the Conservation Area where practical, particularly those with hollows” (page 43). Table 3, however indicates all hollow bearing trees approved for removal (trees 604-609) are to be relocated into the Conservation Area. It is recommended this mitigation measure in Section 7.2.2 is amended to be consistent with Table 3.

As noted above, the relocation of native fauna which use the tree hollows approved for removal may need compensatory tree hollows provided in the Conservation Area prior to any removal of the existing hollows and the release of the native fauna unless the existing tree hollows that are removed are installed (i) in the Conservation Area on the same day that they are removed and (ii) prior to any release of native fauna dependent on the tree hollows. EES recommends the following amendment is made to the Mitigation Measure:

- Any hollow sections of wood which have already been removed should be salvaged and either placed in the remaining areas of bushland or used to make natural nest boxes which can be installed within the site **prior to the release of native fauna that are found using the tree hollows. If the removed hollows can't be installed on the same day that they are removed, compensatory tree hollows must be provided in the Conservation Area prior to removal of the existing hollows and release of any captured hollow dependent fauna.**

7.5 Dam Dewatering Protocols

EES supports the inclusion of section 7.5 for dam dewatering protocols in the VMP and recommends the Construction Environmental Management Plan (CEMP) includes the measures outlined in section 7.5.

7.6 Consultation with NPWS and other relevant public authorities, local community restoration/rehabilitation groups, Landcare groups

EES supports the inclusion of section 7.6 in the VMP and in the Works Schedule in Section 9 and recommends the CEMP also includes details relating to consultation with community groups and the CEMP/VMP documents the community responses to this consultation.

9 Works Schedule

EES supports the amendments to the Works Schedule including to phase (5) Pre-clearing tree inspection; (6) Consult with NPWS and other regarding leftover felled trees; (7) Relocate felled trees as habitat into Conservation Area; and (8) Dam Dewatering.

Timing of Operation/Maintenance table

The table under Year 1, Year 2 etc includes 1, 2, 3, 4 but it is not clear what 1,2,3,4 means. This needs to be clarified (page 64).

The table indicates the bush regenerator and project ecologist is to be engaged at (3) in 2020 but the fencing installation for threatened plants is to commence prior to the engagement of the project contractor between (1)-(4). The responsibility column indicates the landscaper or construction contractor under the direction of Project ecologist will be responsible for undertaking the fencing installation. It is important the Project ecologist is present on site for the fencing installation of threatened plants.

Clarification is required as to whether the “Baseline survey” referred to in the table is meant to be the pre-clearance survey that is to be undertaken prior to the commencement of works, including the removal of any trees associated with the approved development and conducted by a qualified Ecologist to determine the presence of any nests, dreys or fauna using hollows. If so, the baseline survey appears to overlap with the vegetation clearing and it should be undertaken prior to the commencement of works, including the removal of any trees. The VMP should clarify this.

The table indicates 'vegetation clearing' will be the responsibility of the Civil works contractor under the direction of Project Ecologist. It is important the Project ecologist is always present on site during the vegetation clearing.

The table indicates the 'relocation of felled timber to Conservation Area' will be the responsibility of the Civil works contractor under the direction of Project Ecologist. It is important the Project ecologist is always present on site during the relocation of felled timber to Conservation Area. If compensatory hollows are not installed in the Conservation Area prior to vegetation clearing, it is important the tree hollows are relocated on the same day as they are removed to ensure hollow dependent fauna are not impacted. The table indicates the relocation of felled timber will also occur in Year (1) at (3) following vegetation clearing but the tree hollows should be relocated and installed the same day they are removed.

End of Submission

APPENDIX C: Recovery Plan for *Persoonia mollis* ssp. *nutans*



Persoonia nutans R.Br. (Nodding Geebung)
Recovery Plan



January 2006



Australian Government

Department of
Environment and
Conservation (NSW)

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Requests for information or comments regarding the recovery program for *Persoonia nutans* should be directed to:

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Cover photograph: *Persoonia nutans* flowers

Photographer: M Cufer

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DEC 2006/182

Persoonia nutans Recovery Plan

Executive summary

This document constitutes the National and NSW State Recovery Plan for the shrub *Persoonia nutans* (Proteaceae), and as such considers the conservation requirements of the species across its known range. It identifies the future actions to be taken to ensure the short and long-term viability of *P. nutans* in nature and the parties who will carry out these actions.

Persoonia nutans is listed as endangered in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and as endangered in the Schedules of the NSW *Threatened Species Conservation Act 1995*. The species is a NSW endemic restricted to the Cumberland Plain, western Sydney, between Richmond in the north and Macquarie Fields in the south. The species has a disjunct distribution, with the majority of individuals (99%) restricted to a small area in the north of the species range, with isolated small populations occurring in the south.

The species is an obligate seeder and therefore in the event of a fire all existing *P. nutans* plants are killed and regeneration is dependent upon recruitment from a soil stored seed bank. *Persoonia nutans* populations are likely to be dynamic throughout the landscape, particularly in the north of the species range, and fluctuations in space and time of above ground individuals will be a natural occurrence. Given these fluctuations in time and space, the number of individuals and populations is difficult to estimate. Current information suggests there are 27 populations of *P. nutans* supporting greater than 5500 individuals in total. Only seven of these populations occur within conservation reserves, with the majority of populations occurring on private property and unoccupied crown land.

The main threats to the survival of *P. nutans* are habitat loss and fragmentation (due to clearing for mining, and rural/residential development) and inappropriate fire regimes, particularly frequent fire. The species is also threatened by habitat degradation due to disturbance associated with unrestricted access to *P. nutans* habitat. The overall objective of this recovery plan is to ensure the continued and long-term survival of *P. nutans* in the wild by promoting the *in situ* conservation of the species across its natural range. Specific recovery objectives include:

- minimise the loss and fragmentation of *P. nutans* habitat;
- identify and minimise the operation of threats at sites where *P. nutans* occurs;
- implement a survey and monitoring program that will provide information on the extent and viability of *P. nutans*;
- provide public authorities with information that assists in conserving the species;
- raise awareness of the species and involve the community in the recovery program; and
- promote research questions that will assist future management decisions.

It is intended that the recovery plan will be implemented over a five year period. The total cost to implement the plan is \$40,600 over five years, although this does not include site management costs as these costs are yet to be determined.



Lisa Corbyn
Director General
Department of Environment and Conservation



Bob Debus MP
Minister for the Environment

Acknowledgments

This recovery plan is based on a previous Conservation Research Statement and Recovery Plan for *Persoonia nutans* (NSW National Parks and Wildlife Service 1996). The original plan was prepared by Geoff Robertson, Maria Matthes and Martin Smith.

The Department of Environment and Conservation (DEC) wishes to acknowledge the following for their contributions to the development of this recovery plan:

- For providing information during preparation of this revised Recovery Plan; Diana Picone (Bankstown City Council); Peter Cuneo and Tracey Armstrong (Botanic Gardens and Domain Trust); Danny Wotherspoon (Blue Mountain Wilderness Services Pty Ltd); Emma Stevenson and Ken Donaldson (Campbelltown City Council); Jonathan Sanders and Sue Wesson (Department of Environment and Conservation), Lee De Gail (Department of Lands), Stephen Barry (Department of Mineral Resources); Teresa James (Environmental Consultant); Rebecca Ward (Liverpool City Council); Rhiannan Pace (Penrith City Council); Laurie Caffarella (Regional Illegal Dumping (RID) Squad); and Paul Rymer (University of Wollongong).
- For their contributions to the development of the original plan: Tony Auld, Steve Cox, Sharon Nash, Terry Agar, Peter Weston, Doug Benson, Teresa James, Tracey Armstrong, Siegy Krauss, and Margaret Johnston.
- The Australian Government Department of the Environment and Water Resources (previously Environment and Heritage) Natural Heritage Trust Program for the provision of funding to prepare this recovery plan and also the previous Conservation Research Statement and Recovery Plan.

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1 Introduction

Persoonia nutans (Proteaceae) is an erect to spreading shrub with yellow flowers and reddish stems and branches. The species is a NSW endemic, restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. The main threats to the survival of *P. nutans* are habitat loss and fragmentation (due to clearing for mining, and rural/residential development) and inappropriate fire regimes, particularly frequent fire. The species is also threatened by habitat degradation due to disturbance associated with unrestricted access to *P. nutans* habitat.

This document constitutes the formal NSW and National Recovery Plan for *P. nutans* and as such considers the requirements of the species across its known range. The recovery plan outlines the current status of the species, identifies threats to persistence, details past and current management initiatives, details the recovery program for the species over the next five years, and identifies the parties responsible for implementing recovery actions.

2 Legislative context

2.1 Conservation status

Persoonia nutans is listed as endangered under the *Threatened Species Conservation Act 1995* (TSC Act 1995). The species is also listed as endangered under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999). In addition, approximately half of the known *P. nutans* populations occur within habitat listed as endangered ecological communities in Schedule 1, Part 3 of the TSC Act 1995 (Section 5.2).

A review of the current conservation status of *P. nutans* found that the species is appropriately listed as endangered (Appendix 1). *Persoonia nutans* meets the requirements for endangered given that it possesses a restricted extent of occurrence; that the majority (>90%) of known individuals are restricted to only two populations; and that continuing declines are expected.

The consequences of listing a species under the TSC Act 1995 are outlined throughout the remainder of Section 2. Briefly, among the consequences of listing are the following:

- a recovery plan must be prepared for the species;
- consideration must be given to the species when assessing the impacts of developments and activities, with the aim of minimising adverse impacts; and

- other actions which are likely to result in the harming or picking of that species or damage its habitat must be licensed.

2.2 Recovery plan preparation

The TSC Act 1995 provides a legislative framework to protect and encourage the recovery of threatened species, endangered populations and endangered ecological communities in NSW. Under this legislation the Director General of the Department of Environment and Conservation (DEC) has a responsibility to prepare recovery plans for all species, populations and ecological communities listed as endangered or vulnerable on the TSC Act 1995 schedules. Similarly, the EPBC Act 1999 requires that the Commonwealth Minister for the Environment ensures that there is approved conservation advice in place for each nationally-listed species and community. The Commonwealth Minister may also require the preparation of a recovery plan for nationally listed species and communities or adopt plans prepared by others including those developed by State agencies. Both Acts include specific requirements for the matters to be addressed by recovery plans and the administrative process for preparing recovery plans.

This recovery plan has been prepared to satisfy the requirements of both the TSC Act 1995 and the EPBC Act 1999 and therefore will be the only recovery plan for the species. It is the intention of the Director General of the DEC to forward this recovery plan to the Commonwealth Minister for the Environment for adoption.

2.3 Recovery plan implementation

The TSC Act 1995 requires that a public authority must take any appropriate measures available to implement actions included in a recovery plan for which they have agreed to be responsible. Public authorities and councils identified as responsible for the implementation of recovery plan actions are required by the TSC Act 1995 to report on measures taken to implement those actions. In addition, the Act specifies that public authorities must not make decisions that are inconsistent with the provisions of the plan.

The public authorities responsible for actions in this plan are: the Department of Environment and Conservation (DEC), Department of Planning (DoP), Department of Lands (DOL), Department of Corrective Services, and the councils of Campbelltown, Liverpool, Bankstown, Blacktown, Hawkesbury, and Penrith. Consequently, the actions outlined for each of these public authorities must be implemented as described in the plan and public authorities that manage land that supports *P. nutans* must manage the site in accordance with this

plan. Relevant land management issues include fire management and habitat management.

The *EPBC Act 1999* specifies that a Commonwealth agency must not take any action that contravenes a recovery plan and states that the Commonwealth must implement a recovery plan on those areas that apply to Commonwealth lands. A population of *Persoonia nutans* has been recorded on Commonwealth land at Holsworthy Military Area, Holsworthy.

2.4 Relationship to other legislation

Persoonia nutans is known to occur on both private and public lands within the council areas of Campbelltown, Liverpool, Bankstown, Blacktown, Hawkesbury, and Penrith. The lands on which *P. nutans* occurs include those that are owned or managed by: Campbelltown City Council, Department of Corrective Services, Department of Environment and Conservation, Commonwealth Department of Defence, Department of Lands, and private landowners.

Relevant NSW and Commonwealth legislation includes:

- *Threatened Species Conservation Act 1995*;
- *Threatened Species Conservation Amendment Act 2002*;
- *National Parks and Wildlife Act 1974*;
- *Environmental Planning and Assessment Act 1979*;
- *Local Government Act 1993*;
- *Rural Fires Act 1997*;
- *Native Vegetation Conservation Act 1997*;
- *Native Vegetation Act 2003*;
- *Protection of the Environment (Operations) Act 1998*
- *Noxious Weeds Act 1993*
- *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*;
- *Crown Lands Act, 1989*; and
- *Aboriginal Land Rights Act 1983*

2.5 Environmental assessment

2.5.1 State environmental assessment

The New South Wales *Environmental Planning and Assessment Act 1979* (*EP&A Act 1979*) requires that consent and determining authorities, and the Director General of the DEC as a concurrence authority, consider relevant recovery plans when exercising a decision-making function under Parts 4 and 5 of the Act. Decision-makers must consider known and potential habitat, biological and ecological factors and the regional significance of individual populations.

The following public authorities have a decision making function in relation to *P. nutans* and must

consider the conservation strategy outlined in this plan and attached EIA guidelines (Appendix 3) when considering any activity which may affect *P. nutans*:

- The Department of Planning (DoP) as a consent authority, and in the making of Environmental Planning Instruments under the *EP&A Act 1979*;
- The Department of Environment and Conservation (DEC) as a land manager, licensing authority and in a concurrence role under the *EP&A Act 1979*;
- Campbelltown, Liverpool, Bankstown, Blacktown, Hawkesbury, and Penrith councils as land managers and/or consent and determining authorities, and in the making of Environmental Planning Instruments under the *EP&A Act 1979*; and
- The Rural Fire Service (RFS) when issuing Bush Fire Hazard Reduction Certificates.

The Minister for Planning is the consent authority for State significant development under Part 3A of the *EP&A Act 1979*. In this capacity he takes advice from the Department of Planning, who in turn seek advice from the Department of Environment and Conservation (NSW).

Additional public authorities may have responsibilities if the species is located in other areas in the future.

Any activity not requiring development consent under the *EP&A Act 1979*, and which is likely to affect *P. nutans*, requires a Section 91 licence under the provisions of the *TSC Act 1995* or a Section 132C licence under the *NP&W Act 1974*. The type of licence required will depend upon the activity proposed. If the activity is for scientific, conservation or educational purposes, a Section 132C licence is required. For example, any rehabilitation works, including weed control, in the habitat of *P. nutans* will require a Section 132C licence if no other approvals are required under the *EP&A Act 1979*.

2.5.2 Commonwealth environmental assessment

The *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act 1999*) regulates actions that may result in a significant impact on nationally listed threatened species and ecological communities. It is an offence to undertake any such actions in areas under State or Territory jurisdiction, as well as on Commonwealth-owned areas, without obtaining prior approval from the Commonwealth Minister for the Environment. As *P. nutans* is listed under the *EPBC Act 1999*, any person proposing to undertake actions likely to have a significant impact on this species should

refer the action to the Commonwealth Minister for the Environment for consideration (in addition to the state consent or determining authority). That Minister will then decide whether the action requires *EPBC Act 1999* approval.

Administrative guidelines, to assist proponents in determining whether their action is likely to have a significant impact, are available from the Australian Government Department of the Environment and Water Resources (DEW; previously Environment and Heritage).

In cases where the action does not require *EPBC Act 1999* approval, but will result in the death or injury to *P. nutans* in a Commonwealth area, a permit will be required from the Commonwealth Minister for the Environment, under the *EPBC Act 1999*.

The Commonwealth Minister for the Environment can also delegate the role of assessment and approval to other Commonwealth Ministers under a Ministerial Declaration and to the States and Territories under bilateral agreements. The development of a bilateral agreement between NSW and the Commonwealth is not complete at the date of this publication, but when in place will avoid the need for duplication of environmental assessment.

Further information concerning the operation of the *EPBC Act 1999* environmental assessment requirements can be obtained from DEW.

2.6 Key threatening processes

The *EPBC Act 1999* and the *TSC Act 1995* provide for the identification and listing of key threatening processes (KTP). A KTP is a process that threatens, or has the capability to threaten, the survival or evolutionary development of species, populations or endangered ecological communities.

2.6.1 New South Wales

Five key threatening processes listed under the *TSC Act 1995* (as of April 2004) are likely to, or potentially, threaten *P. nutans*. ‘*Clearing of native vegetation*’, has reduced the habitat of *P. nutans* (Sections 4.2 and 8.2.1). ‘*High frequency fire resulting in the disruption of life cycle process in plants and animals and loss of vegetation structure and composition*’, is highly likely to threaten the persistence of *P. nutans* populations (Sections 6 & 8.2.2). ‘*Competition from feral honeybees *Apis mellifera* L.*’ may also threaten *P. nutans* given that feral honeybees may reduce seed set in species of *Persoonia* due to inefficient transfer of pollen (Bernhardt and Weston 1996). ‘*Infection of native plants by *Phytophthora cinnamomi**’ and ‘*Anthropogenic climate change*’ may also affect *P.*

nutans. ‘*Competition and grazing by the feral European rabbit*’ and ‘*Invasion of native plant communities by exotic perennial grasses*’ are KTPs known to affect *P. nutans* at Simmos Beach Reserve.

In addition to these listed KTPs, a range of other processes are generally recognised as threatening the survival of *P. nutans* (Section 8.2).

2.6.2 Commonwealth

Three KTPs currently listed under the *EPBC Act 1999* (as of April 2004) are likely to, or potentially, threaten *P. nutans*. These KTPs are similar to *TSC Act 1995* listed KTPs and include; dieback caused by the root-rot fungus (*Phytophthora cinnamomi*), land clearance, and loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.

2.7 Critical habitat

The *TSC Act 1995* makes provision for the identification and declaration of critical habitat for species, populations and ecological communities listed as endangered. Once declared, it becomes an offence to damage critical habitat (unless the action is specifically exempted by the *TSC Act 1995*) and a species impact statement is mandatory for all developments and activities proposed within critical habitat, unless the impact is deemed trivial or negligible by the Director General of the DEC.

To date, critical habitat has not been declared for *P. nutans* under the *TSC Act 1995*. However, this recovery plan identifies the habitat features and locations (Sections 4, 5 and Appendix 2) that would contain habitat that is critical to the survival of the species, as required by the *EPBC Act 1999*. It is not currently considered a high priority to nominate critical habitat for *P. nutans*, as no demonstrable conservation outcome would accompany its identification and declaration. Action 1.3 of this Recovery Plan provides a mechanism for reconsidering the need for critical habitat nomination during the final year of implementation of the Plan.

3 Taxonomy & description

The genus *Persoonia* belongs to the family Proteaceae. The genus is endemic to Australia, contains c. 100 species and is represented in all states of Australia, with 49 species recorded from NSW (Weston 2002). Eight *Persoonia* taxa are listed as threatened nationally under the *EPBC Act 1999* and nine are listed as threatened in the schedules of the NSW *TSC Act 1995*.

The following description of *Persoonia nutans* R. Br. (syn: *P. nutans* R. Br. Subsp. A in Jacobs and Prickard 1981) is from Weston (2002): Erect to spreading shrub, young branchlets sparsely to

moderately hairy. Leaves linear, 1-3 cm long, 1-1.8 mm wide, usually flat, with recurved margins, sparsely hairy when immature, and glabrescent when mature, smooth. Inflorescences usually growing on into a leafy shoot; flowers mostly subtended by leaves; pedicels 7-12 mm long, recurved, glabrous. Tepals 8.5-11 mm long, caudate, glabrous. Ovary glabrous.

Persoonia nutans sometimes grows with *P. laurina* and *P. hirsuta* but no hybrids are known (Weston and Johnson 1991).

4 Distribution, abundance & land tenure

4.1 Current distribution

Persoonia nutans is a NSW endemic, restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south (Figure 1). The species has a disjunct distribution, with the majority of populations (& 99% of individuals) occurring in the north of the species range in the Agnes Banks, Londonderry, Castlereagh, Berkshire Park and Windsor Downs areas. This disjunct distribution is presumably influenced by soil type given that the species is confined to aeolian and alluvial sediments (Section 5.1). In the north, these deposits are extensive, whereas in the south these deposits are limited and the species is less abundant.

The species' core distribution occurs within the Penrith, and to a lesser extent, Hawkesbury, Local Government Areas (LGA), with isolated and relatively small populations also occurring in the Liverpool, Campbelltown, Bankstown and Blacktown LGAs.

There is likely to be numerous additional sites supporting *P. nutans* that have not yet been recorded given:

- (i) the availability of potential habitat (Figures 2 and 3). In particular, near Holsworthy in the south, and in the Shanes Park area in the north, where outcrops of suitable soil supporting suitable vegetation exist;
- (ii) that there has been very little targeted survey for the species; and that
- (iii) the species may not be detected during targeted survey at a particular site even if it is present (in the soil-stored seed bank) given that *P. nutans* is an obligate seeder (Section 6) and the number of above ground individuals will fluctuate in space and time.

The species current known distribution equates to a linear range of approximately 45km across the species entire range and only 14km excluding the

southern relatively small and disjunct populations (these southern populations account for <1% of total individuals). The species possesses an *extent of occurrence*¹ of approximately 38km². Given that very little is known of the area of known populations, the species' *area of occupancy*² (AOO) is unknown. The estimated area of potential habitat (i.e. suitable vegetation community and suitable soil type) is currently 5300 ha in the north of the species range and 573 ha in the south of the species range (Figures 2 and 3). These values considerably overestimate the AOO of *P. nutans* given that the species will not occupy all these areas at a particular point in time and some of this potential habitat may not be suitable habitat (e.g. may be subject to high fire frequency).

Population specific locational information is provided in Appendix 2 and additional information on population size is provided in Section 4.3. References to site numbers throughout this plan correspond to Appendix 2. Given concerns that the publication of exact location details for populations of *P. nutans* may compromise conservation, a complete Appendix 2 will not to be released to the public (detailed location descriptions and grid refs are excluded). Public authorities, land managers, or others with genuine reasons for requiring the data, may request the entire Appendix 2 by contacting the Threatened Species Unit (contact details provided on inside front cover).

4.2 Historical distribution

Persoonia nutans was probably never widespread across the Cumberland Plain as it is confined to aeolian and alluvial sediments. In the north, where the species appears to be locally abundant, these deposits are extensive, whereas in the south, where the species occurs only as relatively small and isolated populations, these deposits are limited (Figure 1). It is therefore likely that the species' extent of occurrence was historically similar to its current extent, although there may have been some losses to the north-east (south of Windsor) and north-west (north of Agnes Banks Nature Reserve) due to residential development and mining respectively.

Within the species current known range there would have been losses as considerable habitat has been cleared for mining, agriculture and rural-residential development (Section 8.2.1). For example, Agnes Banks Woodland and Castlereagh Scribbly Gum Woodland, the vegetation

¹ *Extent of occurrence* is the 'area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of a taxon...' (as defined by IUCN (2000)). 'This measure may exclude discontinuities or disjunctions within the overall distributions of a taxa' and in the case of *P. nutans* the central unoccupied area of the species distribution has been excluded.

² *Area of occupancy* is defined as the area within its 'extent of occurrence' which is actually occupied by a taxon (IUCN 2000).

communities that support the majority of *P. nutans* (Section 5.2), have been reduced to only 15.9% and 52.7% respectively of their pre-European settlement extent (NSW NPWS 2002a). In particular, the mining of large areas that previously supported Agnes Banks Woodland would have resulted in the loss of considerable numbers of *P. nutans*. For example, an unknown number of *P. nutans* plants were destroyed when site P10c was sand mined in the 1990s. The top-soil was removed prior to mining, stockpiled and returned to the site after completion of the mining. Subsequently, 1000's (potentially as great as 12,000) *P. nutans* seedlings germinated from the returned top-soil (D. Wotherspoon pers. com. 2004). However, the majority of these individuals will be lost to an approved residential subdivision in the near future.

The local extinction of at least one population has been recorded: L4, which was lost to industrial development (Appendix 2). There are also a number of other sites that are potentially extinct, including L2 which may have been lost to road widening; Pd2 which may have been lost to clearing for residential development; and P10c, if not cleared already, as discussed above, will soon be cleared for residential development.

4.3 Population structure & size

In the north of the species range, *Persoonia nutans* does not typically appear in discrete populations, but rather, occurs as scattered individuals throughout suitable habitat. Survey within the north of the species range is likely to reveal additional occurrences. It is therefore difficult to place precise limits on the boundaries of known populations. However, based on available information, there are 27 known extant populations³ of *P. nutans* (Appendix 2).

Current known estimates of population size were obtained largely from survey work undertaken in 1996 (NSW NPWS 1996). Given that *P. nutans* is a fire sensitive obligate seeder (Section 6), the species will exhibit considerable fluctuations in the number of mature individuals over time, depending upon time since fire. Consequently, estimates of above ground abundance should be viewed with caution and may be a poor indicator of the potential abundance of *P. nutans* at a site.

Available information suggests that the total number of mature *P. nutans* individuals across all 25 known populations is greater than 5500.

Population size varies from only a few individuals to thousands of plants, although the majority of populations support a low number of plants (Table 1). 84% of all populations support less than 50 individuals, with only two populations (P8, P10) supporting >500 plants. The majority of individuals occur in the north of the species range, with less than 1% of individuals occurring within the southern part of the species range.

Table 1: Size class distribution for the 27 known extant populations of *Persoonia nutans*

Size class [#]	Number of populations*	% of total no. of popns
≤ 10	17	63
11 ≤ 50	6	22
51 ≤ 200	1	4
201 ≤ 500	1	4
≥ 501	2	7

[#] number of mature individuals

*using lowest (pessimistic) estimate of population size

4.4 Land tenure & zoning

4.4.1 Land tenure

Over half the known populations of *P. nutans* (18/27) occur on freehold land (Table 2). However, given that the majority of populations on freehold land are relatively small and/or haven't been subject to targeted survey, freehold populations support only 2% of known individuals. The majority of known individuals occur within conservation reserves (70%) (nature reserves & regional parklands managed by the DEC) and crown land (28%). The remaining 1% of individuals occur on a range of tenures as outlined in Table 2.

The conservation reserves that support *P. nutans* occur within the north of the species range and include Agnes Banks Nature Reserve (NR), Windsor Downs NR, Castlereagh NR and the proposed Regional Parklands within the ADI site (Figure 1). The Crown Lands that support *P. nutans* are collectively known as the Castlereagh-Londonderry Crown Lands. Much of these crown lands are currently subject to an aboriginal lands claim under the NSW *Aboriginal Land Rights Act 1983*.

4.4.2 Zoning

The zoning of areas supporting *P. nutans* is described in Table 3. The majority of populations occur in areas with a rural zoning (13/25), however given that these populations are typically small and/or haven't been subject to targeted survey, these populations account for only 29% of known individuals. The majority of individuals (70% and 5/27 populations) occur within Nature Reserves managed by the DEC. The remaining zonings account for <1% of known individuals.

³ Populations are recognised in this recovery plan as 'geographically or otherwise distinct groups between which there is little demographic or genetic exchange (typically one successful migrant individual)' (IUCN 2000). Given the absence of information on gene flow in *P. nutans*, populations have been delineated using the 'rule of thumb' provided by Keith et al. (1997) of geographic discontinuity of more than 1 km. Groups of plants not separated by >1km are referred to as sites within this plan.

Additional site-specific detail on zoning and tenure is provided in Appendix 2.

4.4.3 Adequacy of representation in conservation reserves

Despite the majority of known individuals occurring within formal conservation reserves (nature reserves and regional parklands managed by the DEC) (see Section 4.4.1), *Persoonia nutans* is inadequately represented in conservation reserves, particularly within the south of the species range.

Only 17.8% of potential habitat (see Figures 2 & 3) and only seven of the 27 known populations (part or all of populations P1, P2, P3, P10, H2, BL1 and BL2), occur within conservation reserves. None of the southern populations occur within a formal conservation reserve, although, one of the southern populations (C1) is relatively protected within Simmos Beach Recreation Reserve (managed by Campbelltown City Council).

Table 2: Tenure and land managers for the 27 known extant populations of *Persoonia nutans*

Tenure*	Landmanager	Number of populations	Estimate of % of total number of individuals
Freehold [#]	Freehold	18	2
Conservation Reserve	Department of Environment and Conservation (NSW)	7	70
Crown	Department of Lands	5	28
Community land	Campbelltown City Council	1	<1
Commonwealth	Department of Defence	1	<1
Road verge	Unknown	2	<1

*where a population occupies two different tenures it has been recorded as two separate populations.

[#] Estimates for the number of individuals on freehold land do not include the 1000s of plants at P10c that will be, or have been already, cleared for residential development.

Table 3: Land-use zoning for the 27 known extant populations of *Persoonia nutans*

Zoning	Number of populations	Estimate of % of total number of individuals
Rural	13	29
Nature Reserve (DEC estate)	5	70
Special Uses (subject to rezoning proposal)	1	<1
Recreation/ Public open space	3	<1
Environmental protection-Rural and Residential	3	<1
Regional Parklands (DEC estate)	2	<1
Industrial	2	<1
Road reserve/utility	2	<1

*where a population occupies two different land-use zonings it has been recorded as two separate populations.

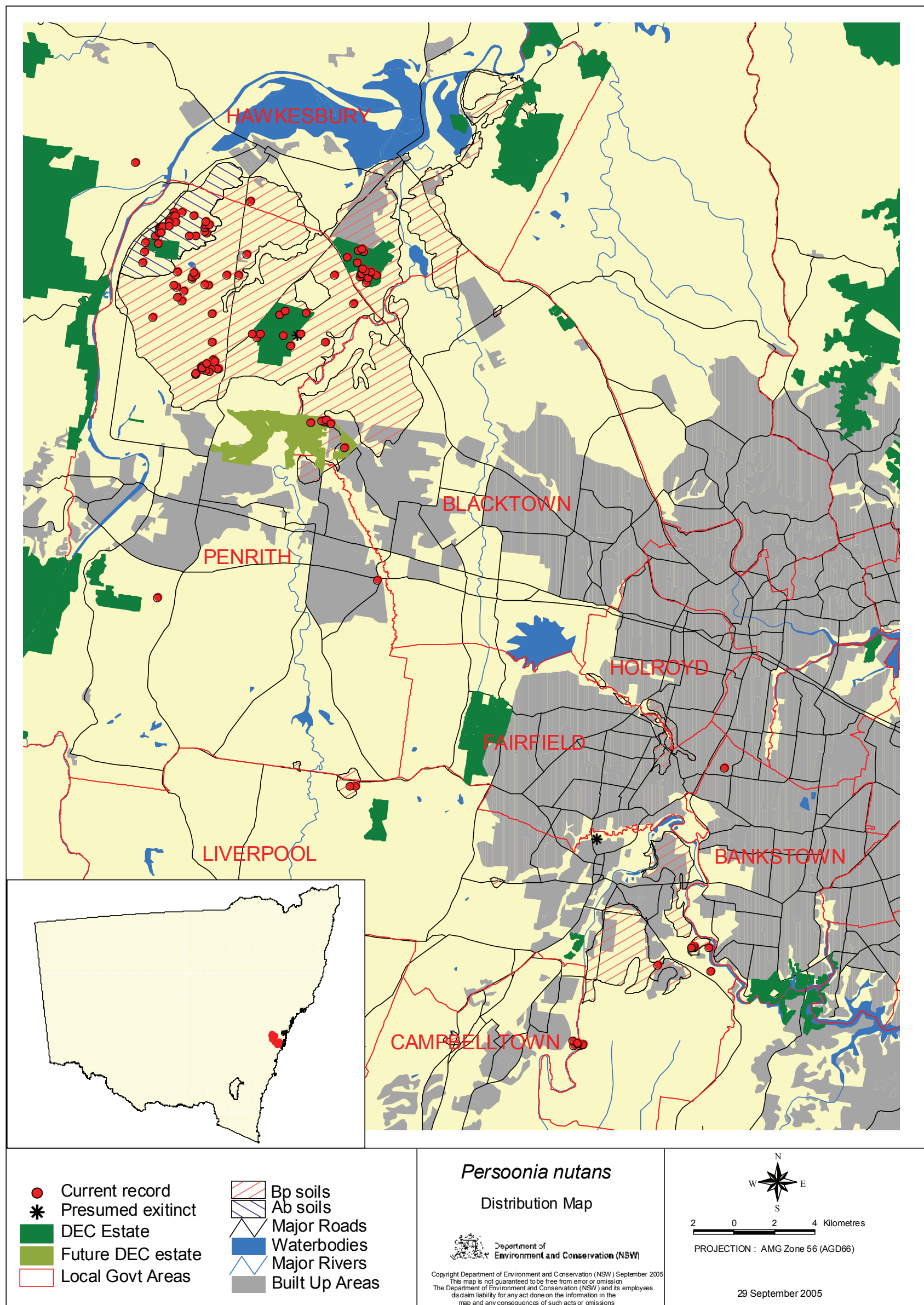


Figure 1. The known distribution of *Persoonia nutans* within western Sydney, NSW. The distribution of *P. nutans* is influenced by associated soil types, which include the Berkshire Park (Bp soil) and Agnes Banks (Ab soil) soil landscapes.

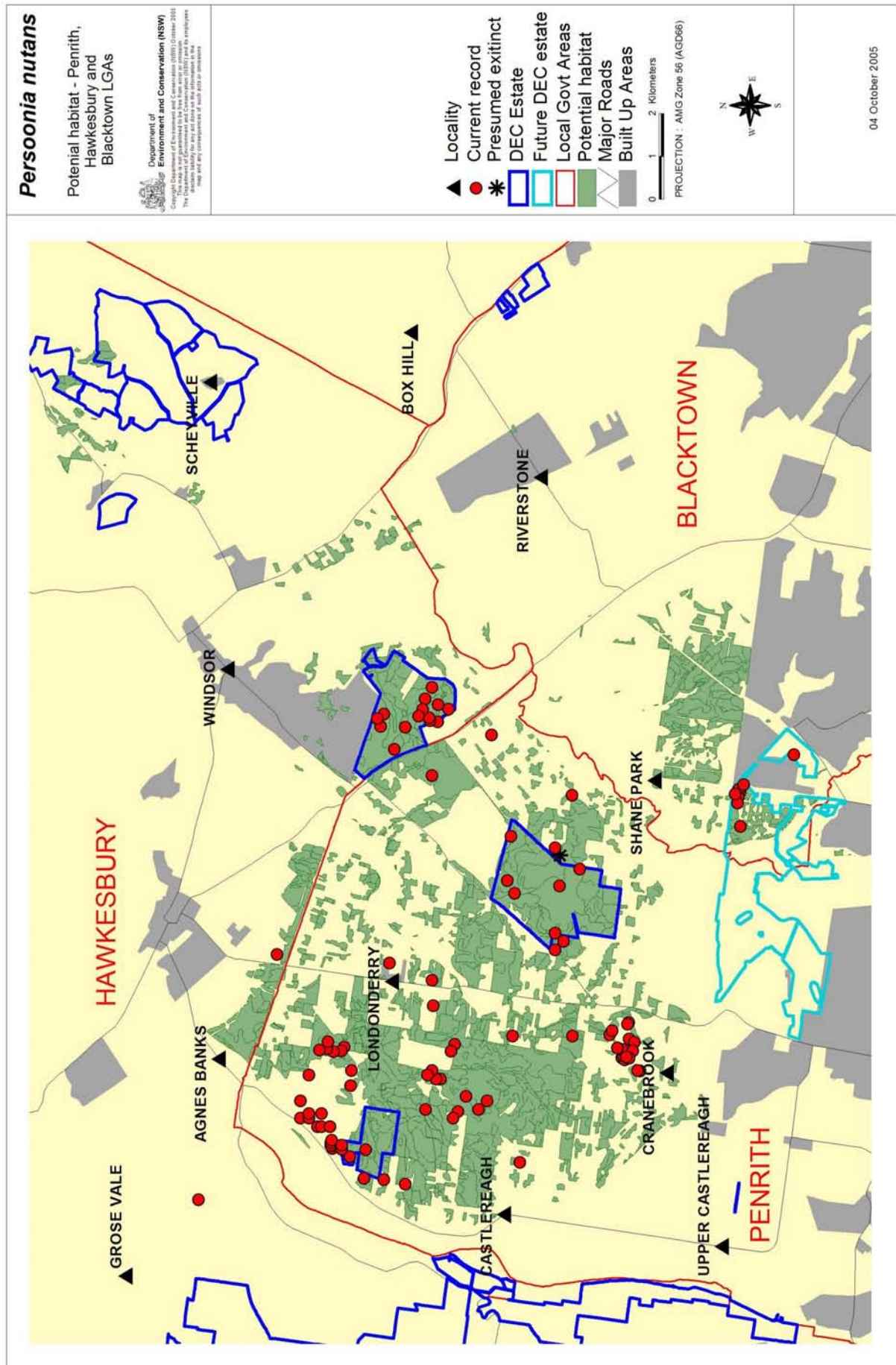


Figure 2. Potential habitat for *Persoonia nutans* within the north of the species distribution. The identified potential habitat represents those areas that possess suitable soil type (Agnes Banks or Berkshire Park soil formations) and also support suitable vegetation (see Table 4) as identified in NSW NPWS 2002a).

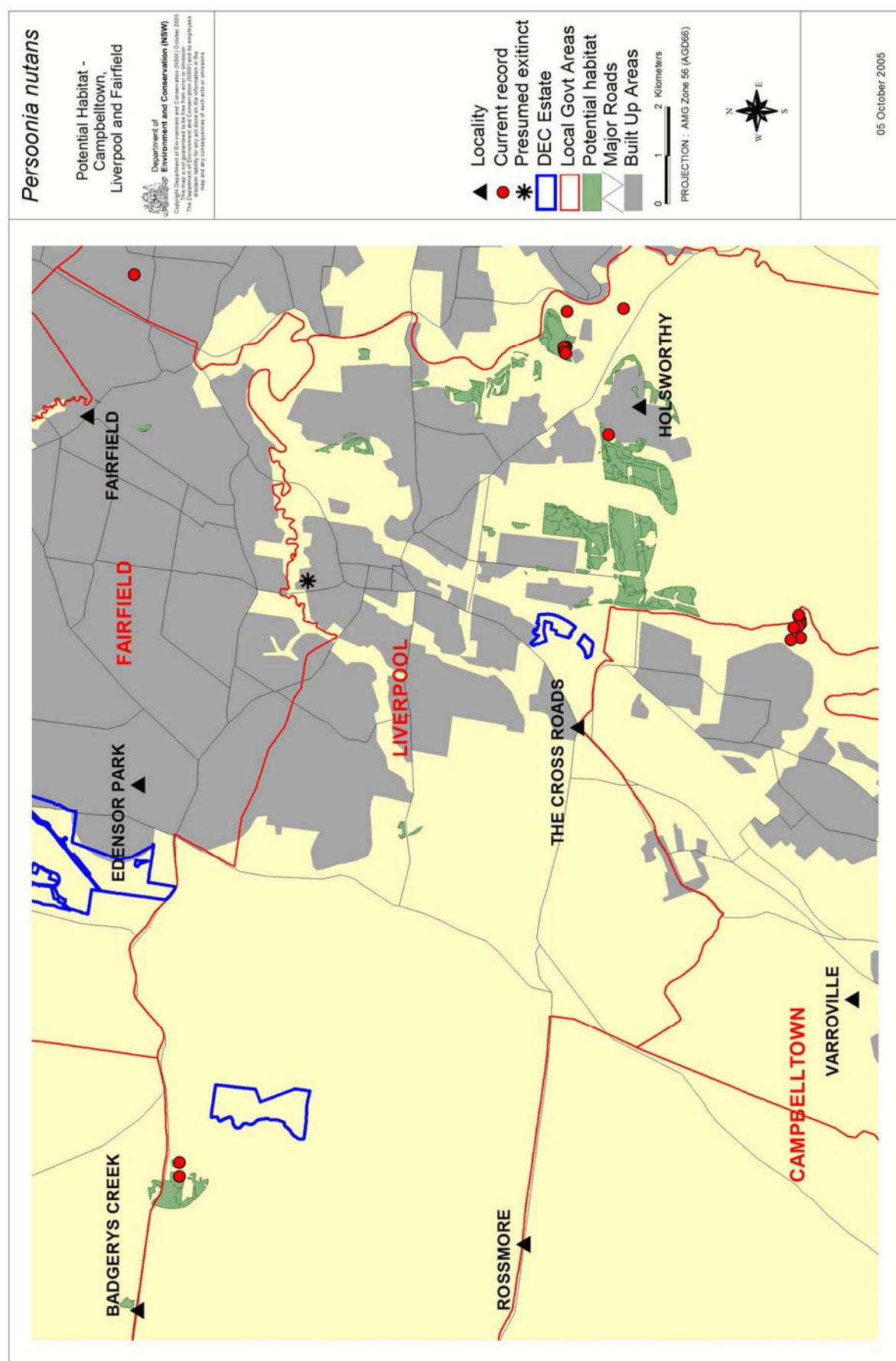


Figure 3. Potential habitat for *Persoonia nutans* within the south of the species distribution. The identified potential habitat represents those areas that possess suitable soil type (Agnes Banks or Berkshire Park soil formations) and also support suitable vegetation (see Table 4) as identified in NSW NPWS 2002a).

5 Habitat

5.1 Landform, geology & soils

Persoonia nutans is confined to aeolian and alluvial sediments and is found primarily on the Agnes Banks and Berkshire Park soil landscapes (see Figure 1) (Bannerman and Hazelton, 1990). The Agnes Banks soil landscape forms low parallel sand dunes deposited on a flat tertiary surface. The soil comprises quartz sands derived from sandstones of the upper Hawkesbury and Nepean catchment. The Berkshire Park formation is a Tertiary alluvial sediment derived from sandstone and clay, and consists of sandy loams, sandy clays, clay loams and heavy clays. The topography of these areas is gently undulating low rises.

P. nutans appears more common on the deeper sands of the Agnes Banks soil landscape than at the edge of the deposit. For the Berkshire Park formation, *P. nutans* occurs on low rises as opposed to swales or other low lying areas (NSW NPWS 1996).

5.2 Associated vegetation

Vegetation mapping of the Cumberland Plain (NSW NPWS 2002a) reveals that *Persoonia nutans* occurs within a range of vegetation communities (Table 4), with the majority of individuals (99%) occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland. A number of populations also occur within other Tertiary alluvium communities including Cooks River Castlereagh Ironbark Forest and Shale/Gravel Transition Forest. Two small populations have been recorded in Shale Sandstone Transition Forest. Some individuals recognised as occurring in Agnes Banks Woodland may in fact occur within Castlereagh Swamp Woodland. Further survey will be necessary to determine whether the species does or does not occur within this vegetation community.

As indicated in Table 4, the majority of these vegetation communities are listed as endangered ecological communities under the NSW *TSC Act 1995*, with one also listed under the Commonwealth *EPBC Act 1999*.

Detailed information on each of the associated vegetation communities can be found in NSW NPWS (2002a). In summary, **Agnes Banks Woodland** is a low woodland community dominated by scribbly gum (*Eucalyptus sclerophylla*) and *Angophora bakeri* with a diverse understorey of sclerophyllous shrub species (including *Banksia aemula*, *Banksia oblongifolia*, *Conospermum taxifolium* and *Dillwynia sericea*).

Castlereagh Scribbly Gum Woodland is dominated by *Eucalyptus parramattensis* subsp. *parramattensis*, *Agophora bakeri* and *E. sclerophylla*. A small tree stratum of *Melaleuca decora* is sometimes present. The community has a well developed shrub stratum consisting of sclerophyllous species such as *Banksia spinulosa* subsp. *spinulosa*, *M. nodosa*, *Hakea sericea* and *H. dactyloides*.

Cooks River/Castlereagh Ironbark Forest is a community that ranges from open forest to low woodland, with a canopy dominated by broad-leaved ironbark (*Eucalyptus fibrosa*) and paperbark (*Melaleuca decora*), with *E. longifolia* occurring at lower frequency. The typically dense shrubby understorey is dominated by *Melaleuca nodosa* and *Lissanthe strigosa*.

Shale Sandstone Transition Forest (High Sandstone Influence) is dominated by *Eucalyptus punctata* and *E. crebra*, with *E. fibrosa*, *Corymbia gummifera* and *Syncarpia glomulifera* occurring less frequently. A smaller tree stratum is usually present and is most often dominated by *Allocasuarina littoralis*, *Syncarpia glomulifera*, *Persoonia linearis* and *Acacia decurrens*.

Table 4: Associated vegetation community type for the 27 known extant populations of *Persoonia nutans* and whether the vegetation community is listed as an endangered ecological community (EEC) under the NSW *TSC Act 1995* and the Commonwealth *EPBC Act 1999*. The extent of loss of each community since European settlement is also provided.

Vegetation Community [#]	Number of populations*	% of total number of individuals	<i>TSC Act 1995</i>	<i>EPBC Act 1999</i>	Proportion of pre 1750 extent remaining [@]
Agnes Banks Woodland [^]	3	65	EEC	Not listed	15.9%
Castlereagh Scribbly Gum Woodland	16	34	Not listed	Not listed	52.7%
Cooks River Castlereagh Ironbark Forest	5	<1	EEC	Not listed	8.3%
Shale/Gravel Transition Forest	4	<1	EEC	Not listed	31.7%
Shale Sandstone Transition Forest	2	<1	EEC	EEC	22.6%
Castlereagh Swamp Woodland	?	?	EEC	Not listed	61.2 %

[#] as determined by NSW NPWS (2002a)

* where a population occupies two different vegetation communities it has been recorded as two separate populations.

[@] as determined by NSW NPWS (2002a)

[^] some of these individuals may actually occur within Castlereagh Swamp Woodland.

6 Biology & ecology

The biology and ecology of *P. nutans* are not well understood. Current knowledge is based largely on general observations made during survey work.

6.1 Life-history

Persoonia nutans is an obligate seed regenerator (NSW NPWS 2002b; Benson and McDougall 2000). In the event of a fire all existing plants of *P. nutans* are killed and regeneration is dependent upon recruitment from a soil stored seed bank. Consequently, *P. nutans* populations are likely to be dynamic throughout the landscape, particularly in the north of the species range, and fluctuations in space and time of above ground individuals will be a natural occurrence.

6.2 Pollination & seed production

Peak flowering is from December to January (Benson and McDougall 2000) with sporadic flowering all year round (Bernhardt & Weston, 1996).

Bees and wasps appear to be the major foragers on the flowers of *Persoonia* in eastern Australia (Bernhardt & Weston, 1996). Bernhardt & Weston (1996) collected long-tongue bees of the *Chalicodma* and *Leioproctus* genera foraging on *P. nutans* flowers.

Plants appear to set abundant fruit. Fruit has been observed on plants as small as 30 cm (up to 60 fruit) and plants c. 1m high can support in excess of 300 fruit (NSW NPWS 1996). Large plants (>1m high) found in the Agnes Banks area were observed to produce thousands of fruit (NSW NPWS 1996). The fruit is fleshy, with one or two seeds enclosed in a hard woody stone, shed at maturity (from December to October) (Benson and McDougall 2000).

6.3 Seed dispersal & seed bank dynamics

Seed is likely to be dispersed, after consumption of the fruit, by large birds such as Currawongs, and mammals such as rats, kangaroos and possums (Low 1991; Benson and McDougall 2000). P. Rymer (pers com. 2004) investigated seed dispersal in four *Persoonia* sp. and found Wallabies removed large numbers of *Persoonia* seeds and viable *Persoonia* seeds were found in numerous Wallaby scats. The eastern Grey Kangaroo, Common Wallaroo and Swamp Wallaby have all been recorded in the habitat of *P. nutans* in recent years (Atlas of NSW Wildlife) and potentially disperse *P. nutans* seed.

Historically, indigenous peoples may have also dispersed seed. *Persoonia* species were a popular

Aboriginal food source and large quantities of the fruit was eaten when in season (Low 1991; Wreck Bay Community and Renwick 2000; Mason 2001). ‘They swallowed the pulp and the stone, which they squeezed from the skin with their fingers’ (Low 1991). The aboriginal use of *Persoonia* sp. is discussed in more detail in Section 8.7.

Nothing is known of the longevity of the soil-stored seed bank of *P. nutans*. It appears germination is promoted, not only by fire, but also by physical disturbance (NSW NPWS 1996; D. Wotherspoon pers. com.). It is not known whether the seed bank is completely exhausted by a single fire. The extent to which germination occurs in the absence of disturbance is unknown, although observations during the 1996 survey (NSW NPWS 1996) indicate such germination is likely to be rare.

6.4 Disturbance ecology

The frequency of disturbance, particularly fire, is of vital importance for the management and conservation of *P. nutans*. It is highly likely that too frequent disturbance, and also potentially a long-term absence of disturbance, may be detrimental to the persistence of *P. nutans*.

For species killed by fire the presence of a seed bank is essential for persistence after a fire event unless propagules of the species are widely dispersed (Auld et al. 2000; Keith 1996). If fires occur at an interval too small to allow re-establishment of a soil stored seed bank following a previous fire then local extinction will occur. The critical fire frequencies for survival of *P. nutans* have not yet been determined, although NSW NPWS (2002b) suggest > 7 year intervals and the *Draft Threatened species Hazard Reduction List* for the *Bush Fire Environmental Assessment Code* states that fire should not occur more than once every ten years in the habitat of *P. nutans*. Fires do occur within the habitat at *P. nutans* at greater than 7 year frequencies and local extinctions due to frequent fire are very likely to occur (see Section 8.2.2).

A long-term absence of fire may also be detrimental to *P. nutans* population persistence given that recruitment is likely to be largely dependent upon disturbance. However, it appears that most of the largest populations in the north of the species range burn relatively frequently. It is likely therefore that frequent rather than infrequent fire poses the greatest threat to the persistence of *P. nutans* (Section 8.2.2).

7 Previous recovery actions

7.1 Preparation & implementation of a draft recovery plan

A Conservation Research Statement and Species Recovery Plan for *P. nutans* was prepared by the NSW National Parks and Wildlife Service in 1996 (NSW NPWS 1996). The 1996 plan was prepared in order to satisfy the requirements for a recovery plan under the Commonwealth *Endangered Species Protection Act 1992*. The implementation of this previous plan was not funded.

7.2 Profile & environmental impact assessment guidelines

A species profile and environmental impact assessment guidelines were prepared for *P. nutans* in 2001 and revised in 2003, 2004 and 2005 (Appendix 3). The aim of these documents is to assist the assessment of potential impacts on the species during the preparation and review of assessments under Parts 4 and 5 of the *EP&A Act 1979* and Part 6 of the *TSC Act 1995*.

7.3 Surveys

The majority of then known populations were surveyed in 1996 during preparation of the 1996 recovery plan (NSW NPWS 1996). Subsequent opportunistic surveys by consultants have located previously unrecorded *P. nutans* populations and these are now incorporated into the NSW Wildlife Atlas.

No further formal surveys of the populations have been undertaken since the production of NSW NPWS (1996), although as preparation for this current recovery plan, a brief survey of some sites was conducted. Surveying of known sites and potential habitat is proposed as part of the implementation of this plan.

7.4 *Ex situ* propagation

The Mt Annan Botanic Garden houses *P. nutans* material collected from sites in Villawood (site BA1) and Londonderry. Propagation of this material has been successful using cuttings (NSW NPWS 1996). There are approximately three surviving individuals in the living collection at Mt Annan and the Seed Bank houses 96 seeds collected from a single plant at Villawood (T. Armstrong pers. com. 2004). This species is not a priority for *ex situ* conservation and the surviving plants are used only for display purposes (P. Cuneo pers. com. 2003).

7.5 Preparation of management plans

Campbelltown Council has prepared a management plan for Simmos Beach Reserve, including actions to manage *P. nutans*.

8 Management issues

8.1 Introduction

The management and conservation of *P. nutans* requires the development of a recovery program which considers: (i) the factors that threaten the survival of the species; (ii) limits to current knowledge; (iii) the social, political and organisational parameters that may affect the success or otherwise of the program; and (iv) the economic factors which may influence the plan's implementation. As such, this section discusses these management issues.

8.2 Threatening processes

The main threats to the survival of *P. nutans* are habitat loss and fragmentation (due to clearing for mining, and rural/residential development) and inappropriate fire regimes, particularly frequent fire. The species is also threatened by habitat degradation due to disturbance associated with unrestricted access to *P. nutans* habitat.

8.2.1 Habitat loss and fragmentation

The key threatening process '*Clearing of native vegetation*' is one of the major threats to the survival of *P. nutans*. Clearing of the habitat of *P. nutans* has occurred over many years and continues to occur for mining and rural, residential and industrial development (Section 4.2). For example, Agnes Banks Woodland, the vegetation community that supports the majority of *P. nutans* individuals (see Section 5.2) has been reduced to only 15.9% of its pre-European settlement extent (NSW NPWS 2002a). This loss is due primarily to sand and gravel extraction, which has occurred throughout much of the Agnes Banks sand deposits. Around 90% of the aeolian dunes at Agnes Banks have been extracted since the 1960s (NSW NPWS 1999). As summarised in Table 4, all other vegetation communities that support *P. nutans* have suffered considerable losses since European settlement.

This loss of habitat from clearing impacts *P. nutans* directly through the loss of individuals and also indirectly through fragmentation of existing populations. Habitat fragmentation can potentially reduce the long-term viability of remnant populations of *P. nutans* because the species is dependent upon recolonisation via seed dispersal (see section 6.3) in the event of local extinction due to frequent fire. Habitat fragmentation will reduce the chances of, or even prevent, recolonisation following local extinction. In order to ensure the long-term viability of *P. nutans*, it is important that any further loss of the species' habitat does not increase fragmentation of existing habitat and in particular does not further decrease connectivity between the four conservation reserves (and any

future conservation reserves) within the north of the species range.

Given that only seven of the 25 known populations and 17.8% of potential habitat occurs within conservation reserves (Section 4.4.3) and that many populations occur on small rural lots, habitat loss is likely to continue for *P. nutans*. Particularly concerning is the potential loss of currently unknown populations. As outlined in Section 6, *P. nutans* populations are likely to be dynamic throughout the landscape, particularly in the north of the species range, and fluctuations in space and time of above ground individuals will be a natural occurrence. Therefore if pre-development surveys occur at a recently burnt, or long unburnt site, then *P. nutans* may be present only in a soil stored seed bank and may go undetected. In addition, given that the species appears to often occur as scattered individuals at low densities (NSW NPWS 1996), the species may be missed unless the subject of sufficient targeted survey.

8.2.2 Inappropriate fire regimes

As outlined in Section 6, *P. nutans* is threatened by frequent and also potentially infrequent fire. Due to its urban setting, arson is a major problem in the bushland remnants of western Sydney, increasing the frequency of fire. In addition, many of the smaller remnants have been excluded from fire for long periods.

Some of the largest populations of *P. nutans*, occupying Castlereagh NR (P1), Agnes Banks NR (P10), Windsor Downs NR (H2), and the Castlereagh-Londonderry Crown Lands (P8), are subject to frequent fires (DEC 2004). NSW NPWS (1999) suggests that in recent times the above Nature Reserves have been subject to high intensity fires every five to seven years. For example, the entire known *P. nutans* population within Windsor Downs NR (H2) burnt in the 1997/98 fire season. The majority of the known population then burnt again during the 2002/03 fire season (a fire-free interval of only five years) (DEC 2004). In addition, smaller fires occur at more frequent intervals resulting in a fire regime of approximately 3-5 years across the reserve (NSW NPWS 1999). The frequent fire within Windsor Downs NR has altered the vegetation community composition and lead to the localised dominance of pyrogenic species such as Blady Grass (NSW NPWS 1999). A brief survey in 2004 of some of the Windsor Downs NR *P. nutans* sites revealed no *P. nutans* and it is possible this population is now locally extinct due to frequent fire. Castlereagh NR has suffered similarly high frequency fire in recent years (Jonathan Sanders pers. com. 2004).

The critical fire frequencies for survival have not yet been determined, although NSW NPWS

(2002b) suggest > 7 year intervals for *P. nutans* and the *Threatened species Hazard Reduction List* for the *Bush Fire Environmental Assessment Code* states that fire should not occur more than once every ten years in the habitat of *P. nutans*. Consequently, fire frequencies of less than 10 years should be avoided within the habitat of *P. nutans*.

Persoonia nutans is listed on the *Threatened Species Hazard Reduction List* (TSHRL) and consequently, if a particular site is identified as supporting *P. nutans* in the TSHRL, or a certifying authority determines the species is likely to be present at a site, then the management actions identified within the schedule of that list must be incorporated as a condition of the bush fire hazard reduction certificate. Management actions identified in the TSHRL include: no fire more than once every ten years; and no slashing, trittering or tree removal. For these procedures to protect *P. nutans* from frequent fire it is vital that the NSW Wildlife Atlas (source of TSHRL records) contains records for all 'known' *P. nutans* sites.

The Plan of Management (POM) for Castlereagh, Agnes Banks and Windsor Downs NR's (NSW NPWS 1999) recognises the threat frequent fire imposes upon the vegetation communities within these reserves and acknowledges that fire needs to be carefully managed to maintain biodiversity. The POM specifies a range of policies and actions for preventing, managing and suppressing fire within the reserves. In addition, a Fire Management Plan is being prepared for the reserves and will address the threat frequent fire poses to the vegetation of these reserves (J. Sanders pers comm. 2004).

For the nature reserve populations, the fire management measures outline within the POM (NSW NPWS 1999) and the future Fire Management Plan are likely to meet the general fire management needs of *P. nutans*. However, the need for additional fire prevention and suppression measures needs to be evaluated, particularly within Windsor Downs NR and Castlereagh NR.

A better understanding of the lower and upper thresholds (of inter-fire intervals) for *P. nutans* would provide greater insight into the degree an inappropriate fire frequency threatens the species and would provide more detailed recommendations for appropriate fire management.

Given the difficulty of controlling frequent fire and that local extinctions are likely to occur due to frequent fire, it is important that habitat fragmentation is minimised, thereby increasing chances of re-colonisation following local extinction (Section 8.2.1).

8.2.3 *Habitat degradation and rubbish dumping related to unrestricted access*

The majority of populations outside of the nature reserves (the nature reserves are now fenced to exclude vehicular access), particularly the unoccupied crown lands (Castlereagh-Londonderry Crown Lands), are subject to high levels of disturbance associated with unrestricted access. Disturbances include damage by inappropriate vehicular access and rubbish dumping.

Persoonia nutans habitat is commonly dissected by an extensive network of tracks. The flat terrain, open woodland and often sparse understorey make it easy for drivers to leave the existing tracks to avoid obstacles. Several *P. nutans* populations have been damaged by vehicles (NSW NPWS 1996). The extensive track network has opened up sites to rubbish dumping. Large quantities of rubbish (household, garden, building and industrial) are often dumped and can smother the populations of *P. nutans*. Stolen cars are also regularly dumped within *P. nutans* habitat. This may have an immediate impact on individuals, but more seriously the vehicle is often burnt, providing the additional threat of frequent fire (see Section 8.2.2).

The Regional Illegal Dumping (RID) Squad (see www.resource.nsw.gov.au/RID/rid.htm), which was established in 1999 to combat illegal dumping in Western Sydney, is also contributing towards the minimisation of rubbish dumping within the Castlereagh-Londonderry Crown Lands. However, the problem of illegal rubbish dumping within these lands is still huge and is unlikely to be controlled while vehicles have access to the lands (Laurie Caffarella pers. com. 2004).

Additional targeted protection methods such as fencing, the erection of bollards or placement of rocks to prevent vehicular access may be required around the most significant populations. Signage of a general nature, regarding the damage vehicles may cause to threatened plant species, could also be placed in areas where illegal access frequently occurs. Education to encourage an appreciation of the local natural environment within the local community is needed, however this is unlikely to have much effect in the short term.

Typically, a major consequence of habitat degradation and fragmentation is weed invasion. Survey of *P. nutans* sites in 1996 revealed that weed invasion did not then pose a major threat to any populations (NSW NPWS 1996). The Castlereagh Scribbly Gum Woodlands and Agnes Banks Woodlands (the predominant habitat for *P. nutans*; Section 5.2) grow on acidic, nutrient poor soil which is not highly susceptible to extensive weed invasion (Benson 1992). However, NSW

NPWS (1996) did note a number of weed species in close proximity to *P. nutans* individuals including; Prickly Pear (*Opuntia* sp.), African Lovegrass (*Eragrostis curvula*) and Whisky grass (*Andropogon virginicus*). Dumping of garden waste also has the capacity to introduce additional weeds. It is important that the current threat posed by weed invasion for *P. nutans* is evaluated.

8.3 Limits to current knowledge

Our ability to manage a threatened species is dependent on our knowledge of the ecological requirements of that species and the circumstances that threaten population persistence. In order to effectively manage and conserve *P. nutans*, greater understanding is required of: the impact of fire frequency on population persistence; the current status, distribution and abundance of the species; and on the impact of habitat fragmentation on the long-term viability of populations (Table 5).

8.4 Translocation/ex situ conservation

8.4.1 Translocation

Translocation is the deliberate transfer of plants or regenerative plant material, from an *ex situ* collection or natural population, to a location in the wild, including existing or new sites or those where the taxon is now locally extinct (Vallee et al. 2004). Translocation is often raised as a possible method of conserving threatened flora. However, given the high cost and risk associated with the technique, translocation should only be considered as a last resort when all other management options are deemed inappropriate or have failed. As stated by Vallee et al. (2004), 'where possible, resources will be more effective when directed towards conserving existing populations *in situ* through habitat protection and/or habitat rehabilitation measures and through the control of threatening processes'.

Translocation is not currently considered necessary for the survival of *P. nutans* as the *in situ* conservation measures proposed in this recovery plan are expected to meet the conservation needs of the species. Further, primarily due to the uncertainty of success and the risks associated with translocation, the technique should not be considered by consent/determining authorities to be an appropriate means of ameliorating the impact of a proposal on the species (Vallee et al. 2004). In addition, the use of translocation as a compensatory measure should not be considered when determining the potential impact of a development (i.e. translocation does not decrease the significance of an impact) (Vallee et al. 2004).

8.4.2 Ex situ collection

As outlined in Section 7.4, limited *P. nutans ex situ* material (seed and plants) is housed at Mount

Annan Botanic Garden. There are no plans to expand the *ex situ* collection as *ex situ* conservation is not currently considered necessary for *P. nutans*.

8.5 Ability to recover

‘Recovery’ in the context of this plan, is to ensure the continued and long-term survival of *P. nutans* in the wild. The likelihood of recovery of the species in this context is high provided the recovery actions outlined in this recovery plan are implemented, monitored and amended as required.

8.6 Social and economic consequences

8.6.1 Social consequences

Negative social impacts are not envisaged as the implementation of this recovery plan is not expected to affect responsible public land usage to any great extent, and modification of private land management patterns will occur at the land

managers discretion. Liaison with the local community, affected landholders and government agencies will address and minimise any unforeseen negative social impacts arising from the conservation of *P. nutans*.

It is expected that the implementation of this recovery plan will have positive social impacts. The main social benefit of conserving the habitat in which *P. nutans* survives is in meeting the desire of many in the community that further loss of remnant urban bushland and threatened species should be prevented. The involvement of the local communities in the implementation of recovery actions (including site monitoring, surveys and site protection measures) will provide benefits to the environment and/or enhance the general well being of the community and individuals involved.

Table 5. Limits to current knowledge for *Persoonia nutans*. The justification for the research and the methodology that may be used to address each question is broadly identified, as are the potential benefits of the increased knowledge.

Knowledge gap	Justification	Potential methodologies	Benefits of increased knowledge
1. Impact of fire frequency on population persistence. What are the lower and upper thresholds of inter-fire intervals for <i>P. nutans</i> ?	<i>P. nutans</i> is threatened by frequent (and also potentially infrequent) fire (Sections 6.4 & 8.2.2). Many of the previously recorded sites, including some within NRs, may now be locally extinct due to frequent fire (see Section 8.2.2).	Long-term monitoring of selected <i>P. nutans</i> sites and collection of fire frequency, intensity and season data for monitored sites. Monitoring should include: timing of seedling recruitment following fire, age at which plants become reproductively mature, level of seed production in relation to plant age, and adult survival. Collation of available fire frequency data for <i>P. nutans</i> habitat and exploration in relation to current and past known occurrences of <i>P. nutans</i> .	Provide land managers with more detailed recommendations for appropriate fire management. Provide greater insight into the degree frequent fire threatens the species and hence assist in identifying how much effort should be placed on fire suppression activities in <i>P. nutans</i> habitat.
2. Current status, distribution and abundance of the species.	There are likely to be numerous additional sites supporting <i>P. nutans</i> that have not yet been recorded (Section 4.1). Many of the previously recorded sites, including some within NRs, may now be locally extinct due to frequent fire (see Section 8.2.2).	Targeted survey of known sites to assess current status and abundance. Targeted survey of selected areas of potential habitat where the species hasn't been recorded previously.	Greater understanding of the current status of the species. Consent and determining authorities would have greater information to enable them to effectively determine the impact of a proposed development on the species.
3. Impact of habitat fragmentation on the long-term viability of populations	<i>P. nutans</i> has suffered, and is likely to continue to suffer, high rates of habitat loss and fragmentation (Section 8.2.1). Greater understanding of gene flow (particularly the likely seed dispersal distances) will provide insight into the extent habitat fragmentation threatens population persistence.	Genetic study to investigate the level of gene-flow within and among populations to gain insight into effective population size and the potential impact of habitat fragmentation on gene flow.	Provide information that can guide the selection of corridors to retain connectivity between core <i>P. nutans</i> populations. Consent and determining authorities would have greater information to enable them to effectively determine the impact of a proposed development on the species.

8.6.2 Economic consequences

The economic consequences of this recovery plan are those costs that are associated with its implementation. These include on-ground habitat management, conducting survey and monitoring, community education and participation, and on-going recovery program coordination. These costs can be off-set and minimised by:

- implementing a long-term strategic framework for managing the species and its habitat;
- seeking funds from external sources;
- maintaining accurate information on the distribution and status of sites; and
- adopting a cooperative approach to management, involving the relevant land managers and the community.

The improved environmental impact assessment that will result from mechanisms established in this recovery plan will assist consent and determining authorities to meet their statutory responsibilities. The production of this recovery plan will decrease the costs associated with collating available information on *P. nutans* when undertaking impact assessment.

8.7 Special knowledge/roles/interests of indigenous people

The *TSC Act 1995* requires that in the preparation of a recovery plan, that consideration must be given to any special knowledge or interests that indigenous people may have in the species and in the measures to be contained in the plan. In addition, the *EPBC Act 1999* requires that in the preparation of a recovery plan, that regard must be had to the role and interests of Aboriginal people in the conservation of Australia's biodiversity.

Although no information on the use of *P. nutans* specifically has been obtained, *Persoonia* species were a popular Aboriginal food source and large quantities of the fruit was eaten when in season (Low 1991; Wreck Bay Community and Renwick 2000; Mason 2001). As outlined in Section 6.3, it is possible that historically, Aboriginal consumption of the raw fruit may have contributed to seed dispersal. In addition to consuming the raw fruit, aboriginals also roasted and cracked the seed and ate the nut inside (Mason 2001). *Persoonia* species were also used as seasonal plant indicators, with the fruiting season indicating that small marsupials such as possum, bandicoot and wallaby could be caught feeding in the area (Mason 2001).

There are a number of Aboriginal community groups in the area affected by this recovery plan, including the Deerubbin, Gandangarra, and Thararwal Local Aboriginal Land Councils (LALC); the Darug Custodial Aboriginal Corporation; and the Darug Tribal Aboriginal

Corporation. The majority of *P. nutans* populations occur in the Deerubbin LALC area and this LALC owns land that supports at least one known population of *P. nutans*. In addition, a Land Claim has been lodged for Crown lands that support *P. nutans*.

These Aboriginal community groups were provided with an opportunity to comment on this plan prior to its public exhibition. In addition, implementation of recovery actions under the plan will include consideration of the roles and interests of indigenous communities in the region.

8.8 Biodiversity benefits

The conservation of *P. nutans* will benefit the endangered ecological communities (EECs) that provide habitat for *P. nutans*. As outlined in Section 5.2, these EECs include Agnes Banks Woodland, Cooks River Castlereagh Ironbark Forest and to a lesser extent Shale/Gravel Transition Forest and Shale Sandstone Transition Forest. The conservation of *P. nutans* will also benefit other threatened flora species that share the same habitat as *P. nutans*, including *Dillwynia tenuifolia*, *Pultenaea parviflora*, *Acacia bynoeana*, *Micromyrtus minutiflora*, *Allocasuarina glaricola* and *Grevillea juniperina* subsp. *juniperina*.

The raised awareness of *P. nutans* created during the implementation of this recovery plan will raise the profile of all threatened species in the community. This in turn will lead to greater opportunities for the conservation of threatened species and increased protection of biodiversity.

8.9 International obligations

In making a Commonwealth recovery plan, regard must be had to meeting Australia's obligations under relevant international agreements, which include;

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).
- Convention on Biological Diversity, ratified by Australia in 1993
- The Global Strategy for Plant Conservation.

Persoonia nutans is not identified in the CITES Schedules and the actions proposed within this plan are consistent with Australia's obligations under these international agreements.

9 Proposed recovery objectives, actions & performance criteria

Overall recovery objective

The overall objective of this recovery plan is to ensure the continued and long-term survival of *P. nutans* in the wild by promoting the *in situ* conservation of the species across its natural range.

This plan consists of six specific recovery objectives that will each contribute to the overall objectives:

- minimise the loss and fragmentation of *P. nutans* habitat using land-use planning mechanisms.
- identify and minimise the operation of threats at sites where *P. nutans* occurs;
- implement a survey and monitoring program that will provide information on the extent and viability of *P. nutans*;
- provide public authorities with information that assists in conserving the species;
- raise awareness of the species and involve the community in the recovery program; and
- promote research questions that will assist future management decisions

Specific recovery actions and performance criteria follow.

Specific Objective 1: To minimise the loss and fragmentation of *P. nutans* habitat using land-use planning mechanisms.

Only 17.8% of potential *P. nutans* habitat occurs within conservation reserves (Section 4.4.3) and habitat loss and fragmentation is likely to continue (Section 8.2.1). This objective aims to minimise the loss and fragmentation of *P. nutans* habitat through the following mechanisms:

- Environmental Planning Instruments under Part 3 of the *EP&A Act 1979*;
- Environmental impact assessment under parts 4 and 5 of the *EP&A Act 1979*; and
- Consideration of a critical habitat declaration under the *TSC Act 1995*.

Action 1.1: *Councils and the Department of Planning will ensure that all relevant Environmental Planning Instruments (prepared under Pt 3 of the EP&A Act) are prepared, or reviewed, with reference to this recovery plan and any future advice from the Department of Environment and Conservation regarding the species.*

Action 1.2: *All relevant consent and determining authorities (under Pt 4 & 5 of the EP&A Act)*

will assess developments and activities with reference to this recovery plan, environmental impact assessment guidelines (Appendix 3) and any future advice from the Department of Environment and Conservation regarding the species.

For the purposes of Action 1.2, consent and determining authorities include:

- Department of Environment and Conservation;
- Department of Planning; and
- the councils of Campbelltown, Liverpool, Bankstown, Blacktown, Hawkesbury, and Penrith.

Performance Criterion for actions 1.1 and 1.2: *The level of protection afforded *P. nutans* populations and habitat is increased through conservation planning and land-use decisions.*

Action 1.3: *The Department of Environment and Conservation will reconsider the need for a recommendation of critical habitat by the final year of implementation of this plan.*

Performance Criterion 1.3: *Need for recommendation of critical habitat re-evaluated in year five.*

Specific Objective 2: To identify & minimise the threats operating at sites where the species occurs

Threats operating at *P. nutans* sites (in addition to land clearing) include: inappropriate fire regimes (particularly frequent fire) (section 8.2.2) and habitat degradation and rubbish dumping related to unrestricted access (Section 8.2.3). Actions under this objective aim to minimise these threats through the provision of information regarding the management of *P. nutans* to selected land managers and public authorities; the incorporation of appropriate threat abatement measures into relevant management plans; and the implementation of appropriate *in situ* threat abatement measures.

Management of threats to *P. nutans* on Department of Environment and Conservation estate:

Action 2.1: *The Department of Environment and Conservation (DEC) will prepare site management statements for populations located on DEC estate.*

The DEC will survey known sites located on DEC estate. The DEC will then prepare site management statements (following the proforma in Appendix 4) that detail any specific threat abatement measures

required and a timetable to implement these measures.

Performance Criterion 2.1: *Site management statements for relevant populations prepared within three years.*

Action 2.2: *The Department of Environment and Conservation will implement any necessary threat abatement measures in accordance with the site management statements prepared under Action 2.1.*

Performance Criterion 2.2: *In situ threat abatement measures implemented for P. nutans on DEC estate as required.*

Action 2.3: *The Department of Environment and Conservation to ensure any Plan of Management or Fire Management Plan for DEC estate supporting P. nutans provides for the species' conservation.*

Performance Criterion 2.3: *Plans of Management for DEC estate supporting P. nutans provides for the conservation of P. nutans.*

Management of threats to *P. nutans* on community land managed by local government:

Action 2.4: *Councils will incorporate site specific threat abatement measures for P. nutans into Plans of Management for community land.*

Currently, Campbelltown City Council is the only council known to manage community land that supports *P. nutans* (Simmos Beach Recreation Reserve- site C1a). Campbelltown City Council, and any other councils subsequently found to manage community land that supports *P. nutans*, will incorporate site specific *in situ* protection measures for the species into Plans of Management for community land where the species occurs.

Site specific information to be incorporated into these plans includes:

- an estimate of the number of *P. nutans* individuals and location details (specific location details not to be included in the public document);
- an assessment of existing and potential threats to *P. nutans* at the site;
- details of threat abatement measures to be implemented to address these threats; and
- details of a monitoring program that (i) assess the effectiveness of threat abatement measures and (ii) provides information on the viability of *P. nutans* within the reserve.

Where a Plan of Management has already been prepared that does not address the matters listed above, an addendum to the plan will be prepared to address these matters.

Performance Criterion 2.4: *In situ protection measures for the species incorporated into Plans of Management for council managed community land within three years.*

Action 2.5: *Councils will implement threat abatement measures in accordance with the site specific recommendations incorporated into the Plan of Management prepared under Action 2.4.*

Performance Criterion 2.5: *Threat abatement measures for relevant sites implemented in accordance with Plan of Management by year five.*

Management of threats to *P. nutans* on lands managed by other public authorities:

Action 2.6: *Other public authorities that manage land that supports P. nutans will prepare a site management statement(s) (following the proforma in Appendix 4), in consultation with the Department of Environment and Conservation, for P. nutans habitat under their management.*

For the purposes of this action 'other public authorities' include:

- Department of Lands
- Department of Corrective Services.

Performance Criterion 2.6: *Site management statements for relevant populations prepared within three years.*

Action 2.7: *Other public authorities (as identified in action 2.6) will implement any necessary and feasible threat abatement measures within the habitat of P. nutans to mitigate against habitat degradation related to unrestricted access, and frequent fire, in accordance with the site management statements prepared under Action 2.6.*

Performance Criterion 2.7: *Threat abatement measures implemented in accordance with the site management statements by year 4 of the plan.*

Action 2.8: *The Department of Environment and Conservation will liaise with the Commonwealth Defence Department to facilitate the implementation of threat abatement measures at sites within Holsworthy Military Area.*

Performance Criterion 2.8: Threat abatement measures implemented at all sites within Holsworthy Military Area within five years.

Management of threats to *P. nutans* on private property

Action 2.9: The Department of Environment and Conservation will encourage and assist private landholders in the preparation of site management statements (following the proforma in Appendix 4) for sites located on freehold land.

Performance Criterion 2.9: Site management statements prepared for at least 5 sites on freehold land within three years, subject to landholder approval.

Action 2.10: The Department of Environment and Conservation will encourage landholders in the implementation of threat abatement measures on freehold land in accordance with the site management statements prepared under Action 2.8.

Performance Criterion 2.10: Threat abatement measures for relevant sites implemented in accordance with site management statements within five years, subject to landholder approval.

Strategic management of frequent fire:

Action 2.11: The Department of Environment and Conservation will liaise with the Rural Fire Service and relevant Bush Fire Management Committees to ensure that the fire requirements of *P. nutans* are taken into consideration when relevant Bush Fire Risk Management Plans are drafted and reviewed.

Performance Criterion 2.11: Relevant Bush Fire Risk Management Plans take into account the fire requirements of *P. nutans*.

Action 2.12: Department of Environment and Conservation) and the NSW Rural Fire Service will review the mitigative conditions for *P. nutans* on the Threatened Species Hazard Reduction List of the Bush Fire Environmental Assessment Code.

DEC will review the available biological and ecological information to reassess the immediate and cumulative impact of bush fire hazard reduction works on *P. nutans* and the adequacy of the mitigative conditions required to be applied under the Bush Fire Environmental Assessment Code.

Performance Criterion 2.12: The mitigative conditions for *P. nutans* on the Threatened Species Hazard Reduction List (TSHRL) reviewed by year 5 of this plan.

Specific Objective 3: Develop & implement a survey & monitoring program that will provide information on the extent and viability of *P. nutans*.

Action 3.1: The Department of Environment and Conservation will design and facilitate a long-term monitoring program that will enable long-term monitoring of the viability of selected populations and in particular will provide insight into the lower and upper thresholds of inter-fire intervals for *P. nutans*.

Performance Criterion 3.1: A long-term monitoring program to be designed by year two and implemented by year three.

Action 3.2: The Department of Environment and Conservation to facilitate surveys of potential habitat on public lands and to promote community involvement in the surveys.

Performance Criterion 3.2: At least one survey to be conducted annually for *P. nutans* and resultant data submitted to the NSW Wildlife Atlas.

Specific Objective 4: To provide public authorities with information that assists in conserving the species

The prompt and effective distribution of information on *P. nutans* is an important component of ensuring that the conservation requirements of the species are appropriately considered in decisions regarding land-use planning, development control and hazard reduction activities. Actions under this objective use the following mechanisms to aid the dissemination of information about the species:

- verification and prompt distribution of accurate location records to relevant parties; and
- revision and distribution of a species profile and environmental impact assessment guidelines for *P. nutans*.

Action 4.1: The Department of Environment and Conservation will coordinate the prompt distribution of site records through the Atlas of NSW Wildlife.

Performance Criteria for action 4.1: Location records available on the Atlas of NSW Wildlife within four months of verification.

Action 4.2: The Department of Environment and Conservation will update the profile and environmental impact assessment guidelines for the species to incorporate information acquired during the implementation of this recovery plan.

Performance Criterion 4.2: Profile and environmental impact assessment guidelines for the species updated as required.

Action 4.3: Councils and the Department of Planning (DoP) will inform the Department of Environment and Conservation (DEC) of decisions (made under the EP&A Act 1979) that may affect *P. nutans*.

Councils and DoP will inform the DEC if planning or development decisions are made that may affect *P. nutans* or its habitat. This includes information on decisions that protect habitat, as well as those that lead to a reduction in habitat and/or individuals. This information will assist the DEC in the coordination of the species' recovery program.

The Rural Fire Service will implement this action, with respect to bush fire hazard reduction, by ensuring that there is adequate access for the Department of Environment and Conservation to temporal and spatial data from the Bushfire Risk Information Management System (BRIMS).

Performance Criterion 4.3: Department of Environment and Conservation informed of land-use and planning decisions that affect *P. nutans* or its habitat.

Specific Objective 5: To raise awareness of the species and involve the community in the recovery program

In order to enhance the social benefits of the recovery program for *P. nutans* and assist in its implementation, actions under this objective aim to raise awareness of the recovery plan and involve the community in its implementation.

Action 5.1: The Department of Environment and Conservation will distribute information on the progress of the recovery program to raise awareness of the recovery program and encourage community involvement in its implementation.

The DEC will prepare an annual newsletter on threatened species recovery planning in western Sydney and will include information on the progress of the *P. nutans* recovery program. The newsletter will be distributed to public authorities, community groups, interested individuals and selected affected landholders.

Performance Criterion 5.1: Newsletter produced and distributed annually.

Action 5.2: The Department of Environment and Conservation will raise awareness of, and encourage community involvement in, the recovery program.

The DEC will raise awareness of the recovery program amongst community groups and interested individuals, and will encourage involvement in the implementation of recovery actions including survey and monitoring (Specific Objective 1).

Performance Criterion 5.2: The local community is involved in at least two days of recovery plan implementation each year.

Specific Objective 6: To promote research projects that will assist future management decisions

As outlined in Section 8.3 and Table 5, there are a number of potential research questions that could assist in the management of *P. nutans*. However, given the absence of funds to conduct this research, this plan advocates the promotion of potential research questions rather than funding the actual research.

Action 6.1: The Department of Environment and Conservation to promote potential research projects as identified in this recovery plan

The Department of Environment and Conservation will encourage tertiary and research institutions to conduct research into the species consistent with the priorities outlined in Section 8.3.

Performance Criterion 6.1: All major tertiary and research institutions within the Sydney/Illawarra regions contacted regarding potential research areas by year 3.

10 Implementation

The total cost to implement this plan is estimated to be at least \$40,600 over five years. This amount does not include site specific threat abatement costs (which are yet to be determined) or the costs associated with the preparation and incorporation of site specific threat abatement measures into plans of management for community land. This amount also does not include the cost of conducting any research on *P. nutans*.

A total of \$21,350 will be provided as in-kind contributions with an additional \$19,250 required to implement currently unfunded actions. Additional funds for unsecured actions and site specific threat abatement works will be sought from various sources including the Natural Heritage Trust, Environmental Trust, industry sponsors, Threatened Species Network, and Department of

Environment and Conservation annual provisions for implementation of threatened species programs.

Table 6 details the costs and identifies the parties responsible for the implementation of specific recovery actions.

11 Preparation details

This recovery plan was prepared by Tricia Hogbin, Meredith Henderson, and Ray Giddins of the Department of Environment and Conservation (DEC) Threatened Species Unit, Central Directorate. This plan is a revision of a conservation research statement and recovery plan prepared for the Australian Nature Conservation Agency (ANCA - now Australian Government Department of the Environment and Water Resources) and DEC (then NSW NPWS) in 1996 (NSW National Parks and Wildlife Service 1996). The conservation research statement and recovery plan was authored by Geoff Robertson, Maria Matthes and Sharon Nash.

12 Review date

This recovery plan is to be formally reviewed and updated by the Department of Environment and Conservation five years from the date of its publication.

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14 Acronyms used in this document

DEC – Department of Environment and Conservation

DEW – Australian Government Department of the Environment and Water Resources

DoP – Department of Planning

DOL – Department of Lands

EP&A Act 1979 – NSW Environmental Planning and Assessment Act 1979

EPBC Act 1999 – Commonwealth Environment Protection and Biodiversity Conservation Act 1999

LALC - Local Aboriginal Land Council

LGA – Local Government Area

NPW Act – *NSW National Parks and Wildlife Act 1974*

NPWS – NSW National Parks and Wildlife Service

NR – Nature Reserve

POM – Plan of Management

RFS – NSW Rural Fire Service

TSC Act 1995 – NSW Threatened Species Conservation Act 1995

TSHRL- Threatened Species Hazard Reduction List

Recovery Plan for *Persoonia nutans*

Table 6: Estimated costs, funding source and responsible parties for implementing the actions identified in the *Persoonia nutans* Recovery Plan.

Action No.	Description	Responsible party ¹	Priority ²	Fund source ³	Estimated cost/yr ⁴					Total Cost
					Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	
					2004/05	2005/06	2006/07	2007/08	2009/10	
1.1	Preparation and review of EPIs	DoP, and Local Government	1	-	#	#	#	#	#	-
1.2	Environmental impact assessment	DEC, DoP, and Local Government	1	-	#	#	#	#	#	-
1.3	Consider critical habitat	DEC	3	In kind	-	-	-	-	\$700	\$700
2.1	Preparation of site management statements for DEC estate	DEC	1	In kind	\$1750	\$1750	\$1750	-	-	\$5200
2.2	Implement threat abatement for DEC estate	DEC	1	In kind	*	*	*	*	*	-
2.3	Plans of management for DEC estate	DEC	1	In kind	#	#	#	#	#	-
2.4	Plans of Management for community land	Campbelltown City Council	1	In kind	*	*	*	-	-	-
2.5	Threat abatement on community land	Campbelltown City Council	1	Unsecured	*	*	*	*	*	-
2.6	Preparation of site management statements for other public lands	DEC, DOL, Corrective	1	In kind	\$1750	\$1750	\$1750	-	-	\$5200
2.7	Threat abatement on other public lands	DOL, Corrective	1	Unsecured	*	*	*	*	*	-
2.8	Liase with Department of Defence	DEC	1	In kind	√	√	√	√	√	-
2.9	Preparation of site management statements for freehold sites	DEC	2	Unsecured	\$700	\$700	\$700	\$700	\$700	\$3500
2.10	Encourage threat abatement for freehold sites	DEC	2	Unsecured	\$700	\$700	\$700	\$700	\$700	\$3500
2.11	Liase re Bush Fire Risk Management Plans	DEC	1	In kind	\$350	\$350	\$350	\$350	\$350	\$1750
2.12	Review TSHRL	DEC & RFS	1	In kind	-	-	-	-	\$700	\$700
3.1	Design and implement long-term monitoring	DEC	1	Unsecured	\$1750	\$1750	\$1750	\$1750	\$1750	\$8750
3.2	Facilitate surveys of potential habitat	DEC	2	Unsecured	\$700	\$700	\$700	\$700	\$700	\$3500
4.1	Review and update Wildlife Atlas records	DEC	1	In kind	\$1050	\$350	\$350	\$350	\$350	\$2450
4.2	Update species profile and EIA guidelines	DEC	1	In kind	-	-	\$700	-	-	\$700
4.3	DEC informed of planning and land-use decisions	DoP, Local Government	1	In kind	*	*	*	*	*	-
5.1	Prepare and distribute annual newsletter	DEC	2	In kind	\$350	\$350	\$350	\$350	\$350	\$1750
5.2	Encourage community involvement in recovery program	DEC	1	-	#	#	#	#	#	-
6.1	Promote Research Projects	DEC	1	In kind	\$700	\$700	\$700	\$700	\$700	\$3500
	Annual and total cost			Unsecured	\$3850	\$3850	\$3850	\$3850	\$3850	\$19250
				In kind	\$5950	\$5250	\$5950	\$1750	\$2450	\$21350
				TOTAL	\$9800	\$9200	\$9800	\$5600	\$6300	\$40,600

¹ **DEC** : Department of Environment and Conservation; **DoP**: Department of Planning; **Local Government** refers to the Campbelltown City Council, Liverpool City Council, Bankstown City Council, Blacktown City Council, Hawkesbury City Council, and Penrith City Council; **DOL**: Department of Lands; **Corrective**: Department of Corrective Services and **RFS**: Rural Fire Service.

² **Priority ratings are:** **1** - Action critical to meeting plan objectives, **2** - Action contributing to meeting plan objectives, **3** – Desirable but not essential action.

³ **In kind** funds represent the salary component of permanent staff and recurrent resources. Salary for in-kind contributions is calculated at \$350 per day, which includes officer salary and on-costs, provision of office space, vehicles, administration support and staff management. **Unsecured** funds will be sought from sources including DEC annual provisions for the implementation of threatened species programs, the Natural Heritage Trust, Environmental Trust, industry sponsors, the NSW State Biodiversity Program, Threatened Species Network, Threatened Species Appeal and DEC annual provisions for implementation of threatened species programs.

⁴ **#** - No direct cost (either cost of action is negligible or action is a statutory responsibility of the responsible party), **√** - No additional costs (included in the cost of other actions), ***** - Amount to be determined by the responsible party

15 Appendices

Appendix 1: Review of the conservation status of *Persoonia nutans*

Appendix 2: *Persoonia nutans* general location details and population specific information

Appendix 3: Revised species profile and environmental impact assessment guidelines

Appendix 4: Site Management Statement Proforma

Appendix 5: Advice on draft recovery plan received from the Scientific Committee.

Appendix 1: Review of the conservation status of *Persoonia nutans*

A review of the conservation status of *Persoonia nutans* found that the species is appropriately listed as **Endangered**. Assessment of the current conservation status of *P. nutans* was conducted using two internationally accepted risk assessment schemes; the IUCN Red List Criteria Version 3.1 (2000) (IUCN 2000) and the Endangered Flora Network (EFN) modified IUCN criteria (Keith et al. 1997; Keith 1998; Keith et al. 2000) (Table 1).

Table A1. Summary of the EFN Modified IUCN Red List Criteria and IUCN Version 3.1 assessment for *Persoonia nutans* as assessed 24/02/04. P = pessimistic assessment, B = Best estimate, and O = Optimistic assessment.

	Overall			Rule A			Rule B			Rule C			Rule D			Rule E			Rule F		
Assessment scheme	P	B	O	P	B	O	P	B	O	P	B	O	P	B	O	P	B	O	P	B	O
EFN Modified IUCN Red List Criteria (1998)	EN	EN	EN	DD	DD	DD	EN	EN	EN	VU	VU	VU	LR	LR	LR	DD	DD	DD	VU	VU	VU
IUCN Red List Criteria 3.1 (2000)	CR	EN	EN	DD	DD	DD	CR	EN	EN	VU	VU	VU	LR	LR	LR	DD	DD	DD	na	na	na

From the current information available, the conservation status for *P. nutans* was assessed as **Endangered** through rule B using the 1998 EFN modified IUCN Assessment Scheme and Critically Endangered through rule B using the 2000 (v 3.1) IUCN Red List Criteria. The contrast between the two schemes is due to modifications made to the EFN modified IUCN criteria to make them more applicable to sessile plants (in contrast to mobile animals). The main factors that influences the species' current status as endangered are its restricted extent of occurrence; that the majority (90%) of individuals are restricted to only two populations; and that continuing declines are expected.

Summary of the pessimistic assessment using EFN Modified IUCN Red List Criteria (1998)

- A. Data Deficient.** There is no data on the time frame over which population declines have occurred.
- B. Endangered.** Extent of occurrence estimated to be c. 50km² (<500 km²), and the following conditions exist:
1. At least 90% of mature individuals are known to exist at no more than 5 locations.
 2. Continuing declines are predicted in extent of occurrence, area of occupancy, area and extent of habitat, number of subpopulations and the number of mature individuals.
 3. Extreme fluctuations are expected in the number of mature individuals given that the species is a fire sensitive obligate seeder.
- C. Vulnerable.** Total population may be as low as c. 5400 mature individuals (<10000) and the following conditions exist:
1. At least 90% of mature individuals are known to exist at no more than 5 locations.
 2. Continuing declines are predicted in extent of occurrence, area of occupancy, area and extent of habitat, number of subpopulations and the number of mature individuals.
 3. Extreme fluctuations are expected in the number of mature individuals given that the species is a fire sensitive obligate seeder.
- D. Low risk.** There are greater than 1000 individuals. Area of occupancy or number of subpopulations are not considered to be acutely restricted.
- E. Data deficient.** No information on the quantitative analysis of extinction probability.
- F. Vulnerable.** 90% of all individuals contained within only 2 subpopulations, only one of which is free of Class I threats.

References:

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Appendix 2: *Persoonia nutans* general location details and population specific information

Popn code	Site code	LGA	General Location	E	N	No. mature individs	Current status*	Vegetation Community	Tenure (Land manager)	Zoning
BA1	BA1a	Bankstown	Birmingham Avenue, Villawood			<10 (1996)	Extant	CSGW	Freehold	Industrial
BA2		Bankstown	Bankstown Biodiversity Strategy also lists a potential site near east Hills Park.			???	Unknown	???	???	???
BL1	Bl1a	Blacktown	Eastern Section of Australian Defence Industries (ADI) Site			<10 (1997)	Extant	CRCIF & SGTF		
BL2	BLb	Blacktown	Eastern Section of Australian Defence Industries (ADI) Site			<10 (1993)	Extant	CRCIF	Currently Freehold (To be included within DEC Managed Conservation Reserve in future)	Regional Park under SREP30
BL3 & 4		Blacktown	UBBS also lists popns for Shanes park and E of Bells creek			???	Unkown	???	???	???
C1	C1a	Campbelltown	Simmo's Beach Recreation Reserve, Maquarie Fields			11<50 (2004)	Extant	SSTF	Community Land (Campbelltown City Council – partially owned DoP)	6b Regional Open Space
L1	L1a	Liverpool	North Holsworthy			? (1998)	Extant	SGTF	Holsworthy Military Area (Commonwealth Defence Department)	7b Environmental Protection - 'Bushland'.
L2	L2a	Liverpool	Pleasure Point, on track parallel and N of Heathcote Rd			0.00	Potentially extinct	CSGW	Unknown	5c- Special uses - Arterial Rd.
L3	L3a	Liverpool	Western side of Georges River at Voyager Point, North of footbridge.			<10 (2001)	Extant	CSGW	Freehold	7b - Environmental Protection - 'Bushland'.
	L3b	Liverpool	North of East Hills military barracks at Voyager Point.			<10 (2004)	Extant	CSGW	Freehold.	Deferred Matter' or may now be zoned as 7b - Environmental Protection - 'Bushland'.
L4	L4a	Liverpool	Orange Grove Rd, industrial area, Hargrave Park.			0.00	Extinct (Industrial development)			
L5	L5a	Liverpool	Christadelphian Heritage School, Cnr Cross St & Devonshire Road, Kemps Ck.			11<50 (1997)	Extant	CSGW	Freehold	1(b) rural - small holdings
" "	L5c	Liverpool	Land to the west of Kemps Ck Primary School.			<10 (2003)	Extant	CSGW	Freehold	7(b) Environmental Protection - 'Bushland'.
P1	P1a	Penrith	Castlereagh Nature Reserve			11<50 (1996)	Extant	CSGW	Nature Reserve (DEC)	Nature Reserve
" "	P1b	" "	" "			<10 (1996)	Extant	CSGW	" "	" "
" "	P1c	" "	" "			200<500 (1996)		CSGW	" "	" "
P2	P2a	Penrith	Castlereagh Nature Reserve			<10 (1996)	Extant	CRCIF	Nature Reserve (DEC)	Nature Reserve
" "	P2b	" "	Castlereagh Nature Reserve			<10 (1996)	Extant	CRCIF	" "	" "
" "	P2d	" "	Cnr Spence and Llandilo Rds, Llandilo			0 (2004)	Potentially extinct (Residential development)	CSGW	Freehold	1(A) (Rural A Zone-Gen) (LEP 201)
" "	P2e	" "	Eastern side Llandilo Road.			<10 (1990)	Extant	CSGW	Freehold??	??

Recovery Plan for *Persoonia nutans*

Popn code	Site code	LGA	General Location	E	N	No. mature individs	Current status*	Vegetation Community	Tenure (Land manager)	Zoning
P18	P18a	Penrith	Corner Spence and Government Roads, Berkshire Park			<10 (1995)	Extant	CRCIF	Crown Land (Department of Lands)	1(A) (Rural A Zone-Gen) (LEP 201)
P3	P3a	Penrith	Berkshire Park in bushland contiguous with Castlereagh Nature Reserve			< 10 (?)	Extant	CSGW	Crown Land (Department of Lands)	TPLN Zone FA open Space (Existing) (PPS)
" "	P3b	" "	" "			< 10 (1995)	Extant	CSGW	" "	" "
" "	P3c	" "	Castlereagh Nature Reserve			<10 (1996)	Extant	CSGW	Nature Reserve (DEC)	Nature Reserve
P4	P4a	Penrith	Trail S of Smeaton Rd, Rickaby's Ck - east of Londonderry Road, Londonderry			<10 (1996)	Extant	CSGW	Deerubbin Local Aboriginal Land Council	1(A) (Rural A Zone-Gen) (LEP 201)
P5	P5a	Penrith	Londonderry			<10 (2002)	Extant	CSGW	Freehold	1(A) (Rural A Zone-Gen) (LEP 201)
P8	P8a	Penrith	Castlereagh - Londonderry Crown Lands			<10 (1996)	Extant	CSGW	Crown Land (Department of Lands)	1(A) (Rural A Zone-Gen) (LEP 201)
" "	P8b	Penrith	" "			11<50 (1996)	Extant	CSGW	" "	" "
" "	P8c	Penrith	" "			>500 (1996)	Extant	CSGW	" "	" "
" "	P8d	Penrith	" "			<10 (1996)	Extant	CSGW	" "	" "
" "	P8e	Penrith	" "			<10 (1996)	Extant	CSGW	" "	" "
" "	P8f	Penrith	" "			<10 (1996)	Extant	CSGW	" "	" "
" "	P8g	Penrith	" "			51<200 (1996)	Extant	CSGW	" "	" "
" "	P8h	Penrith	" "			>500 (1996)	Extant	CSGW	" "	" "
" "	P8i	Penrith	" "			<10 (1996)	Extant	CSGW	" "	" "
" "	P8j	Penrith	" "			<10 (1996)	Extant	CSGW	LALC (but council says crown??)	Zone (8) National Park & Nature Reserve) (LEP 201)
" "	P8k	Penrith	" "			< 10 (1996)	Extant	CSGW	Crown Land (Department of Lands)	1(A) (Rural A Zone-Gen) (LEP 201)
" "	P8l	Penrith	Private Property north of Devlin Road, Londonderry			11<50 (2000)	Extant	CSGW	Freehold	1(A) (Rural A Zone-Gen) (LEP 201)
" "	P8m	Penrith	Spencer road, Londonderry.			<10 (??)	Extant	CSGW	Freehold	??
P9	P9a	Penrith	Agnes Banks on Portion 157 near Richards Rd. nr track			11<50 (1985)	Unknown- may be the same as P9b	ABW	Crown Land (Department of Lands)	1(A) (Rural A Zone-Gen) & 5(C) (A RDS/A RD W) (LEP 201)
" "	P9b	Penrith	Agnes Banks, Richards road. In remnant north of speedway and opposite lot 14.			<10(2004)	Extant	ABW	Freehold??	1(B) (Rural B Zone Smlhldings)(LEP 201)???
P10	P10a	Penrith	Agnes Banks Nature Reserve (& new addition to the north)			>500 (1996)	Extant	ABW (& potentially also Castlereagh Swamp Woodland)	Nature Reserve (DEC)	Nature Reserve
	P10a						Extant			
	P10a						Extant			
	P10b	Penrith	Private property & road verge across the road from the Agnes Banks NR fire trail entry off Richards Road.			<10 (2004)	Extant	ABW	Freehold	??

Recovery Plan for *Persoonia nutans*

Popn code	Site code	LGA	General Location	E	N	No. mature individs	Current status*	Vegetation Community	Tenure (Land manager)	Zoning
	P10c	Penrith	Prev CSR lands north of Agnes Banks NR and additions			Prior to development 7000-12000 (but probably mostly seedlings)	Potentially extinct, or soon to be extinct (residential development)	ABW	Freehold	??
P11	P11a	Penrith	Between First and Second Roads, Berkshire Park			25 (2000)	Extant	SGTF	Freehold	1(B) (Rural A Zone-Gen)(LEP 201)
P13	a	Penrith	Bushland between John Morony Centre and Llandilo Rd			<10 (1996)	Extant	CSGW	Freehold (Department of Corrective Services)	Open space (existing) PPS
P15	P15a	Penrith	Castlereagh - Londonderry Crown Lands			<10 (1996)	Extant	ABW	Crown Land (Department of Lands)	1(A) (Rural A Zone-Gen) (LEP 201)
" "	P15b	" "	" "			<10 (1996)	Extant	ABW	Crown Land (Department of Lands)	1(A) (Rural A Zone-Gen) (LEP 201)
" "	P15c	" "	" "			11<50 (1996)	Extant	ABW	Crown Land (Department of Lands)	1(A) (Rural A Zone-Gen) (LEP 201)
" "	P15d	" "	" "			11<50 (1996)	Extant	ABW	Crown Land (leased to a mining company?)	???
P17	P17a	Penrith	Sheridan Road, Castlereagh			<10 (2004)	Extant	CSGW	Freehold	1(B) (Rural B Zone Smlhldings)(LEP 201)
P19	P19a	Penrith	O'Brien Rd, Londonderry			0.00	Extant	CSGW	Freehold	Residential?
P20	P20a	Penrith	101 Londonderry road, Londonderry			<10 (???)	Extant	CSGW	Freehold	??
P21	P21a	Penrith	Former Air Services Australia property, Cranebrook			31	Extant	CSGW, CRCIF	Freehold	Special Uses?
P22	P22a	Penrith	Sth of M4, W of Erskine Park Rd, St Clair			1	Extant	SGTF	Unknown	Unknown
H1	H1a	Hawkesbury	The Driftway, Western Sydney University			??	Extant	CSGW	Freehold (western Sydney university)	??
H2	H2a	Hawkesbury	Windsor Downs Nature Reserve			11<50 (1996)	Extant	CSGW	Nature Reserve (DEC)	Nature Reserve
" "	H2b	" "	" "			<10 (1986)	" "	CSGW	" "	" "
" "	H2c	" "	" "			<10 (1996)	" "	CSGW	" "	" "
" "	H2d	" "	" "			<10 (1986)	" "	CSGW	" "	" "
" "	H2e	" "	" "			<10 (1996)	" "	CSGW	" "	" "
" "	H2f	" "	" "			<10 (1996)	" "	CSGW	" "	" "
" "	H2g	" "	" "			11<50 (1996)	" "	CSGW	" "	" "
" "	H2h	" "	" "			<10 (1996)	" "	CSGW	" "	" "
" "	H2i	" "	" "			11<50 (1996)	" "	CSGW	" "	" "
" "	H2j	" "	" "			<10 (1996)	" "	CSGW	" "	" "
" "	H2k	" "	" "			<10 (1996)	" "	CSGW	" "	" "
" "	H2l	" "	" "			<10 (1996)	" "	CSGW	" "	" "
" "	H2m	" "	" "			<10 (1996)	" "	CSGW	" "	" "
" "	H2n	" "	" "			<10 (1996)	" "	CSGW	" "	" "
H3	H3a	Hawkesbury	London place Grose Wold			<10 (2002)	Extant	SSTF	Freehold	??

*Each site has been identifies as extant unless specific information has been provided to indicate otherwise. Hence it is possible that some of the populations listed as extant may now in fact be locally extinct.

Appendix 3: Revised species profile and environmental impact assessment guidelines



Persoonia nutans R.Br.

Common Name: Nodding Geebung

Conservation Status

Persoonia nutans is listed as an endangered species on Schedule 1 of the NSW Threatened Species Conservation Act 1995 and as an endangered species under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.



Description

Persoonia nutans R. Br. (Proteaceae) (syn: *P. nutans* R. Br. subsp. A in Jacobs and Prickard 1981) is an erect to spreading shrub to 2.5m high. Flowers are yellow pendent shaped and drooping. Leaves are linear, 1-3 cm long, 1-1.8 mm wide, usually flat, with recurved margins, sparsely hairy when immature, and glabrescent when mature, smooth. Inflorescences usually growing on into a leafy shoot; flowers mostly subtended by leaves; pedicels 7-12 mm long, recurved, glabrous. Tepals 8.5-11 mm long, caudate, glabrous. Ovary glabrous (Weston 2002, Fairley & Moore 1989).

Distribution

Persoonia nutans is a NSW endemic, restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south (Figure 1). The species has a disjunct distribution, with the majority of populations (& 99% of known individuals) occurring in the north of the species range in the Agnes Banks, Londonderry, Castlereagh, Berkshire Park and Windsor Downs areas. This disjunct distribution is presumably influenced by soil type given that the

species is confined to aeolian and alluvial sediments (DEC 2005). In the north, these deposits are extensive, whereas in the south these deposits are limited and the species is less abundant.

The species core distribution occurs within the Penrith, and to a lesser extent, Hawkesbury, Local Government Areas (LGA), with isolated and relatively small populations also occurring in the Liverpool, Campbelltown, Bankstown and Blacktown LGAs.

Based on available information, there are 27 known extant populations of *P. nutans*. Survey, particularly within the north of the species range, is likely to reveal additional occurrences (DEC 2005).

Recorded occurrences in conservation reserves

Persoonia nutans occurs in Windsor Downs Nature Reserve (NR), Agnes Banks NR and Castlereagh Nature NR. The species also occurs within the proposed Regional Parklands within the ADI site, St Marys.

Habitat

Persoonia nutans is confined to aeolian and alluvial sediments and is found primarily on the Agnes Banks and Berkshire Park soil landscapes (see Figure 1) (Bannerman and Hazelton, 1990).

Vegetation mapping of the Cumberland Plain (NSW NPWS 2002) reveals that *P. nutans* occurs within five different vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland (DEC 2005). The species also occurs within Cooks River Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Shale Sandstone Transition Forest. All these communities, except Castlereagh Scribbly Gum Woodland are

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listed as endangered ecological communities under the NSW *TSC Act 1995*. Additional details on these vegetation communities can be found in DEC (2005) and NSW NPWS (2002).

Ecology

The biology and ecology of *P. nutans* are not well understood. Current knowledge is based largely on general observations made during survey work.

Persoonia nutans is an obligate seed regenerator (Benson and McDougall 2000). In the event of a fire all existing plants of *P. nutans* are killed and regeneration is dependent upon recruitment from a soil stored seed bank. Consequently, *P. nutans* populations are likely to be dynamic throughout the landscape, particularly in the north of the species range, and fluctuations in space and time of above ground individuals will be a natural occurrence (DEC 2005).

Peak flowering is from December to January (Benson and McDougall 2000) with sporadic flowering all year round (Bernhardt & Weston, 1996). Bees and wasps appear to be the major foragers on the flowers of *Persoonia* in eastern Australia (Bernhardt & Weston, 1996).

Plants appear to set abundant fruit (NSW NPWS 1996). Seed is likely to be dispersed, after consumption of the fruit, by large birds such as Currawongs and large mammals such as kangaroos and possums (Benson and McDougall 2000).

Seed germination is promoted, not only by fire, but also by physical disturbance (NSW NPWS 1996). The frequency of disturbance, particularly fire, is of vital importance for the management and conservation of *P. nutans* and it is likely

that frequent fire threatens the persistence of *P. nutans*. If fires occur at an interval too small to allow re-establishment of a soil stored seed bank following a previous fire then local extinction will occur. The critical fire frequencies for survival have not yet been determined, although NSW NPWS (2002b) suggest > 7 year intervals for *P. nutans* and the *Draft Threatened species Hazard Reduction List* for the *Bush Fire Environmental Assessment Code* states that fire should not occur more than once every ten years.

Threats

The main threats to the survival of *P. nutans* are habitat loss and fragmentation (due to clearing for mining, and rural/residential development) and inappropriate fire regimes, particularly frequent fire (DEC 2005). The species is also threatened by habitat degradation due to disturbance associated with unrestricted access to *P. nutans* habitat.

Management

The recovery plan for *P. nutans* (DEC 2005) identifies a range of actions required to effectively conserve the species. Management should be aimed at minimising habitat loss and fragmentation; reducing fire frequency in areas prone to frequent fire; and controlling habitat degradation related to unrestricted access to many sites. Other management initiatives should include: survey and monitoring; community education and awareness; and also conducting research that will assist future management decisions.

Recovery Plans

A recovery plan has been prepared for *Persoonia nutans* (DEC 2005).

For Further Information contact

Threatened Species Unit, Metropolitan Branch, NSW DEC, PO Box 1967, Hurstville NSW 2220. Phone 02 9585 6678. www.environment.nsw.gov.au

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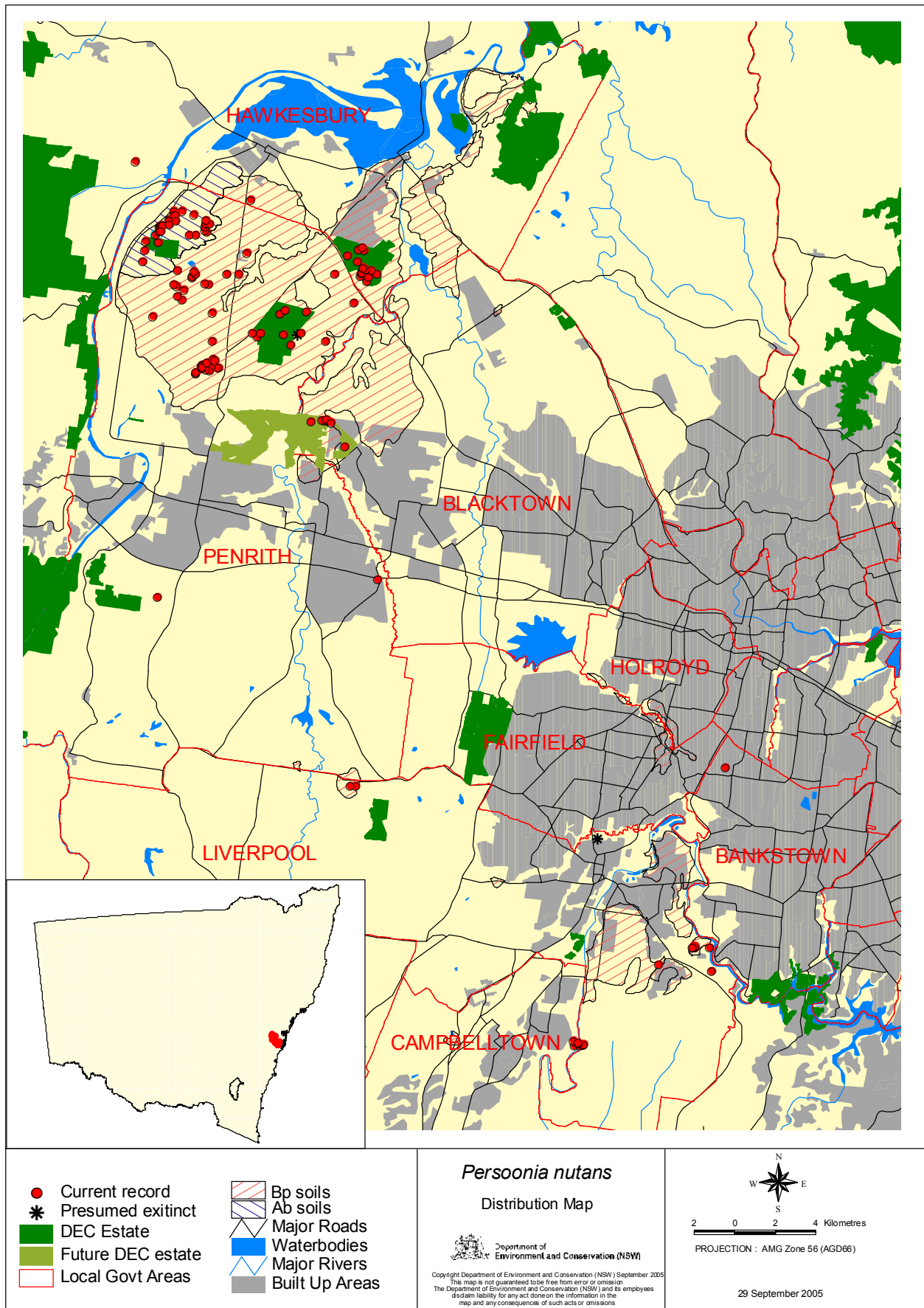


Figure 1. The known distribution of *Persoonia nutans* within western Sydney, NSW. The distribution of *P. nutans* is influenced by associated soil types, which include the Berkshire Park (Bp soil) and Agnes Banks (Ab soil) soil landscapes.

ENVIRONMENTAL IMPACT ASSESSMENT GUIDELINES

Persoonia nutans R. Br.

Nodding Geebung

The following information is provided to assist authors of Species Impact Statements, development and activity proponents, and determining and consent authorities, who are required to prepare or review assessments of likely impacts on threatened species pursuant to the provisions of the *Environmental Planning and Assessment Act 1979*. These guidelines should be read in conjunction with the NPWS *Information Circular No. 2: Threatened Species Assessment under the EP&A Act: The '8 Part Test' of Significance* (November 1996) and the accompanying 'Threatened Species Information' profile.

Survey

Persoonia nutans is most easily detected when in flower. Peak flowering is from December to January, with sporadic flowering all year round. Targeted survey should therefore be carried out over the summer months.

Persoonia nutans is an obligate seed regenerator and in the event of a fire all existing plants are killed and regeneration is dependent upon recruitment from a soil stored seed bank. Consequently, *P. nutans* populations are likely to be dynamic throughout the landscape, and fluctuations in space and time of above ground individuals will be a natural occurrence (DEC 2005). Therefore if survey occurs at a recently burnt (<3 years), or long unburnt site, then *P. nutans* may be present only in a soil stored seed bank or as young seedlings and may go undetected. In addition, given that the species appears to often occur as scattered individuals at low densities (NSW NPWS 1996), the species may be missed unless the subject of sufficient targeted survey.

Consequently, consent and determining authorities should assume, particularly in the north of the species range, that all

potential habitat for the species supports the species, irrespective of whether or not the species is detected during targeted survey. [Note: This recommendation (that all potential habitat should be assumed to support the species) does not automatically trigger significance (under the 8-part test) within potential habitat. Species presence is only one of a number of considerations when determining significance of impact.]

Reference should be made to DEC (2005) for additional detail on the potential habitat for *P. nutans*. Figures 1 and 2 identify potential habitat for *P. nutans* (based on soil and vegetation type) in the north and south of the species range respectively. Briefly, the species is confined to aeolian and alluvial sediments and is found primarily on the Agnes Banks and Berkshire Park soil landscapes. The species has been recorded from a range of vegetation communities including Agnes Banks Woodland, Castlereagh Scribbly Gum Woodland, and to a lesser extent Cooks River Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Shale Sandstone Transition Forest (DEC 2005).

Surveys should aim to determine presence of potential habitat, species presence, number of individuals, and area of suitable habitat.

Life cycle of the species

Proposals which are likely to impact on the life cycle of the species, such that a local population is put at risk of extinction would include proposals that:

- result in total destruction of habitat;
- result in a partial destruction or modification of habitat (including changes to hydrology and nutrification of the soil substrate) which may result in changes to vegetation community structure;
- result in increased fragmentation of *P. nutans* habitat;

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- result in a requirement for frequent (<10 year) hazard reduction activities (fire or slashing), preventing establishment of a soil stored seed bank;
- increase vehicular, bike, pedestrian, or other, access to habitat; or
- increase rubbish dumping and associated weed invasion or arson (for example, through adjacent residential development).

Threatening processes

Seven key threatening processes listed under the *TSC Act 1995* (as of December 2005) are likely to, or potentially, threaten *P. nutans*.

- ‘Clearing of native vegetation’, has reduced and fragmented the habitat of *P. nutans*.
- ‘High frequency fire resulting in the disruption of life cycle process in plants and animals and loss of vegetation structure and composition’, is highly likely to threaten the persistence of *P. nutans* populations.
- ‘Competition from feral honeybees *Apis mellifera* L.’ may also threaten *P. nutans* given that feral honeybees may reduce seed set in species of *Persoonia* due to inefficient transfer of pollen (Bernhardt and Weston 1996).
- ‘Invasion of native plant communities by exotic perennial grasses’, ‘Competition and grazing by the feral European Rabbit’, ‘Infection of native plants by *Phytophthora cinnamomi*’ and ‘Anthropogenic climate change’ may also affect *P. nutans*.

Additional details of the threats to *P. nutans* can be found in DEC 2005. In addition to the above listed KTPs, *P. nutans* is also threatened by habitat degradation due to disturbance associated with unrestricted access to *P. nutans* habitat.

Viable local population

Very little information is available as to the viability of known populations of *P. nutans*. In the absence of such

information, DEC considers that all populations should be considered viable.

It appears the species is capable of persisting at very small population sizes. Based on available information, 84% of all populations support less than 50 individuals, with only two populations supporting >500 plants (Table 1).

Table 1: Size class distribution for the 27 known extant populations of *Persoonia nutans*

Size class [#]	Number of populations*	% of total no. of popns
≤ 10	17	63
11 ≤ 50	6	22
51 ≤ 200	1	4
201 ≤ 500	1	4
≥ 501	2	7

[#]number of mature individuals

*using lowest (pessimistic) estimate of population size

A significant area of habitat

The estimated area of potential habitat for *P. nutans* (i.e. suitable vegetation community type and condition and suitable soil type) is currently 5300 ha in the north of the species range and 573 ha in the south of the species range (Figures 1 and 2). These values considerably overestimate the area occupied by *P. nutans* given that the species will not occupy all these areas at a particular point in time and some of this potential habitat may not be suitable habitat (e.g. may be subject to high fire frequency).

Given the relatively small and fragmented amount of habitat remaining in the south of the species distribution (Figure 2), any area of known habitat in the south should be considered as a significant area of habitat.

In the north of the species range, where *P. nutans* does not typically appear in discrete populations, but rather, occurs as scattered individuals throughout suitable habitat, it is more difficult to quantify what is a significant area of habitat.

Each case should be assessed individually, and the following factors will need to be considered when determining whether a site supports a significant area of *P. nutans* habitat:

- the area and condition of habitat on the site;
- the area, condition and security, of other, nearby, habitat;
- connectivity with other areas of habitat;
- the impact of the loss of that habitat on potential seed dispersal among *P. nutans* populations, in particular among the four conservation reserves (Agnes Banks Nature Reserve (NR), Castlereagh NR, Windsor Downs NR, and the Regional Parklands within the east of the ADI site, St Marys).

Isolation/fragmentation

Habitat fragmentation and isolation is a particularly strong threat to the persistence of *P. nutans*. Habitat fragmentation can potentially reduce the viability of remnant populations of *P. nutans* because the species is dependent upon recolonisation via seed dispersal in the event of local extinction due to frequent fire. Habitat fragmentation will reduce the chances of, or even prevent, recolonisation following local extinction.

As outlined in DEC (2005) such local extinctions are likely to occur, particularly within the north of the species range, given the high fire frequencies within the area. Indeed, given recent fire frequencies within Castlereagh Nature Reserve and Windsor Downs Nature Reserve, it is possible that *P. nutans* is now locally extinct within these reserves (DEC 2005).

In order to ensure the long-term viability of *P. nutans*, it is important that any further loss of the species' habitat does not increase fragmentation of existing habitat and in particular does not further decrease connectivity between the four conservation reserves (and any future conservation reserves) within the north of the species range.

Regional distribution of the habitat

Persoonia nutans occurs within the Sydney Basin Bioregion and is restricted to the Cumberland Plain in western Sydney, between Richmond in the north

and Macquarie Fields in the south. The species has a disjunct distribution, with the majority of populations (& 99% of known individuals) occurring in the north of the species range in the Agnes Banks, Londonderry, Castlereagh, Berkshire Park and Windsor Downs areas.

Limit of known distribution

The current known distribution of *P. nutans* extends from Richmond in the north to Macquarie Fields in the south. The eastern most population occurs at Villawood and the western most at Grose Wold and Agnes Banks.

Adequacy of representation in conservation reserves or other similar protected areas

Persoonia nutans is inadequately represented in conservation reserves, particularly within the south of the species range. Only 17.8% of potential habitat (see Figures 1 & 2) and only seven of the 25 known populations, occur within conservation reserves. The conservation reserves that support *P. nutans* occur within the north of the species range and include Agnes Banks Nature Reserve (NR), Windsor Downs NR, Castlereagh NR and the Regional Parklands within the ADI site (Figure 1). None of the southern populations occur within a formal conservation reserve, although, one of the southern populations (C1) is relatively protected within Simmos Beach Recreation Reserve (managed by Campbelltown City Council).

Critical habitat

Critical habitat has not been declared for *Persoonia nutans*.

For Further Information contact

Biodiversity Conservation Section, Metropolitan Branch, NSW DEC, PO Box 1967, Hurstville NSW 2220. Phone 02 9585 6678. www.environment.nsw.gov.au

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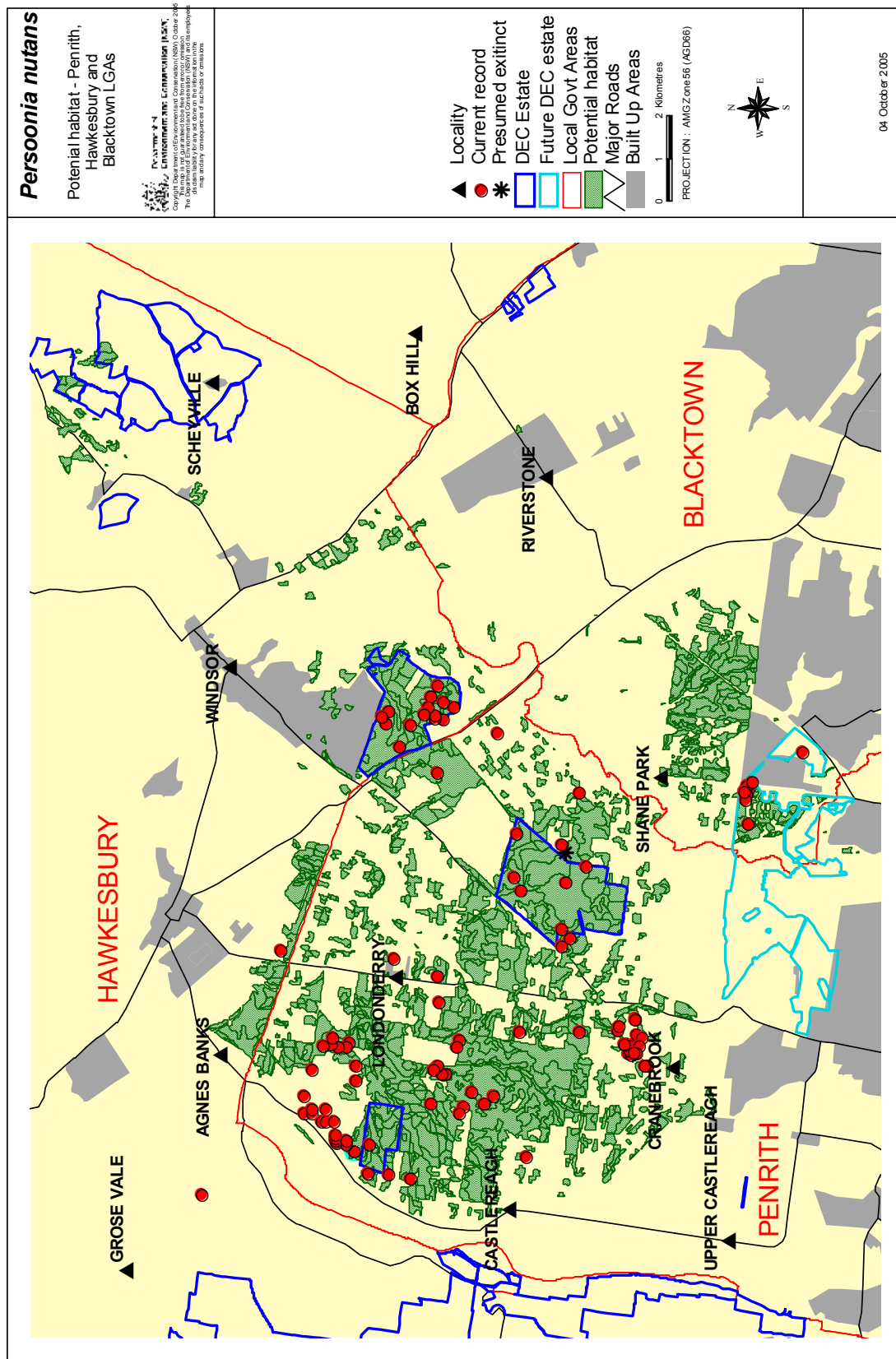


Figure 1. Potential habitat for *Persoonia nutans* within the north of the species distribution. The identified potential habitat represents those areas that possess suitable soil type (Agnes Banks or Berkshire Park soil formations) and also support suitable vegetation (see Table 4) as identified in NSW NPWS 2002a).

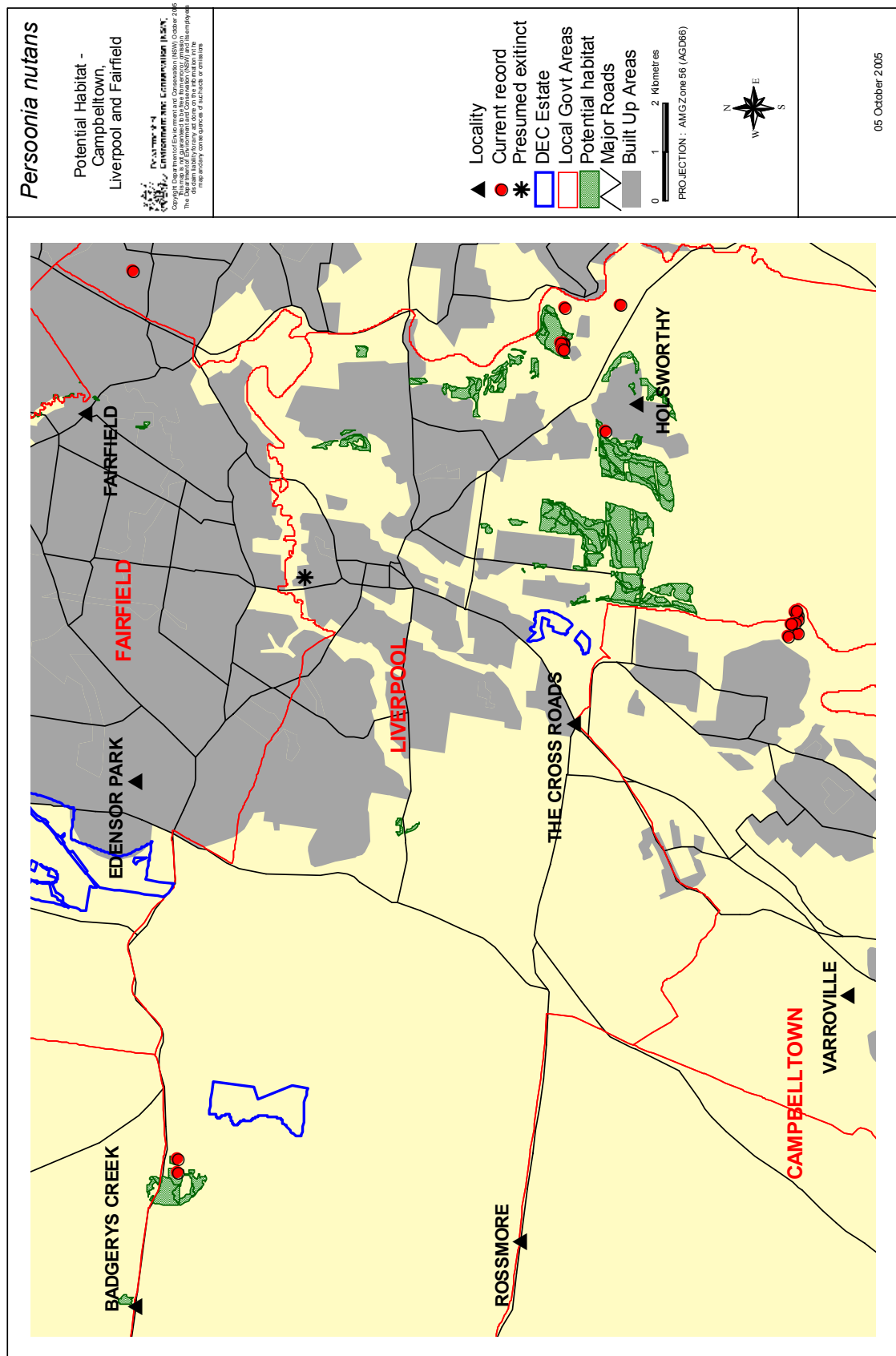


Figure 2. Potential habitat for *Persoonia nutans* within the south of the species distribution. The identified potential habitat represents those areas that possess suitable soil type (Agnes Banks or Berkshire Park soil formations) and also support suitable vegetation (see Table 4) as identified in NSW NPWS 2002).

Appendix 4: Site Management Statement Proforma**Site Management Statement**

Prepared by:

Date:

Site details:

Site Name:

Site Code:

Location:

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Easting: Northing: AMG Zone:

Landowner/Landmanager contact details

Name:

Phone number:

Postal address:

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Parcel details:

LGA:

Portion/Lot:

Street address:

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Zoning:

Tenure:

Current landuse:

Population details:

No. adults: Count: [] Estimate: []

Lowest estimate = Best estimate = Upper estimate =

No. seedlings: Count: [] Estimate: []

Lowest estimate = Best estimate = Upper estimate =

Area of Occupancy: Accurate: [] Estimate: []

Detailed site map attached: Yes/No

Reproduction: Buds: [] Flowers: [] Fruit: []

Habitat:

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Dominant Associated species:

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Threats:

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Predominant weed species and abundance:

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Previous management actions (describe apparent success):

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Threat abatement actions required:

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Recommended monitoring and evaluation program:

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Timetable for implementation of actions and monitoring:

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Appendix 5: Advice on draft recovery plan received from the Scientific Committee.

The NSW Scientific Committee made three comments on the draft recovery plan. They are listed below, together with a response from the DEC and a note on any changes made to the recovery plan in light of those comments.

1. “Tables 2, 3 and 4 all have the words “25 known extant populations” in the title, yet all have more than 25 populations listed – 32, 29 and 27+, respectively”

All three tables have a footnote indicating that, where a single populations occurs on more than one tenure, zoning or vegetation type, they are listed more than once in the table. Hence total numbers add up to more than the total number of populations.

2. “Section 7.4 – states that “This species is not a priority of ex-situ conservation.” It would be desirable to give some brief reasons why this is so.”

That section is stating that the species is not a priority for ex-situ conservation for the Mount Annan Botanic Garden, not that it is not an overall priority.

3. Given that 28% of the total number of individuals of this species occur on Dept. of Lands property, DOL should be listed as one of the consent and determining authorities under Action 1.2.

For Part 5 authorities (such as the the Dept of Lands) this action is restating an existing statutory requirement under s.112A of the Environmental Planning and Assessment Act. There is therefore no need to make this modification to the recovery plan.



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APPENDIX D: Phytophthora hygiene protocols

Task	Action
Timing	When possible/practical, the development should be completed in dry soil conditions and postponed following significant rainfall. Working in dry soil conditions will reduce the need for cleaning vehicles and equipment. If it is necessary to work in wet or damp areas then greater attention will need to be spent on vehicle and equipment cleaning.
Staff	Contractors and staff involved in the development are to be made aware that fungus has / has not been recorded on site, and provided with information regarding management protocols and its threat to native vegetation.
Drainage and Water	Alterations to drainage that may result in the spread of <i>Phytophthora</i> into new areas are to be avoided as highest priority. Water used during construction should be minimised. When water is necessary, it should be from a reticulated mains system, bore supply or sterilised source. Surface water collected from infected areas should not be used. Water draining from the site should not to enter bushland areas. The use of water for dust suppression should be kept to a minimum.
Landscaping and Bush Regeneration	Plants used in landscaping should be purchased from a nursery with accreditation from the Nursery Industry Association, or from a nursery with excellent hygiene conditions. Species selected for landscaping should preferably be resistant to <i>Phytophthora cinnamomi</i>. Any gravel/sand/topsoil to be bought onto site should be purchased from a Nursery Industry Association accredited supplier, or should be certified (through testing) to be free of <i>Phytophthora cinnamomi</i>. Any infected soil/sand/gravel/vegetation moved on the site, or removed from the site should be stored at in area that is also infected with <i>Phytophthora cinnamomi</i>, or a site where the pathogen will not have any impact. Storage of gravel/sand/topsoil on site should preferably be on a dry well drained surface. Construction materials such as pipes, rocks, timber, bricks etc, should be free of mud and soil when arriving at the site. Staff should not enter infected areas unless necessary, movement within these areas should be kept to a minimum.
Vehicles and Machinery	All machinery, vehicles and equipment should arrive at the site free of uncontained mud and soil, particularly on tyres, mudflaps and the underbody. Vehicles and machinery exiting the site to be free of all uncontained mud and soil, particularly on the tyres, mudflaps and the underbody. Minimise the amount of water used. Try to remove soil and mud when it is dry (a stiff brush or stick maybe useful). Cleaning will be easier and more effective if it is completed at a depot or a permanent/designated cleaning area (it is acceptable for vehicles and machinery to be taken to a cleaning facility on sealed roads). If cleaning is to occur in the field select a site with a hard, well-drained surface (eg. a road) that is well away from remnant vegetation. If possible, wash down in an area that is close to the area you have been operating in. Wash down on ramps if possible. Do not allow mud and wash-down effluent to drain into bushland. Do not drive through wash-down effluent.
Footwear and Tools	Try to remove as much mud and soil as possible when it is dry with a stiff brush or stick. Minimise the amount of water used to initially clean footwear and tools. Footwear and tools should be scrubbed with a sterile solution (see below). All mud and soil should be collected (including in liquid) and removed in a bag or bucket. This material is to be disposed of at a site that is already infected with Cinnamon Fungus, or a site that contains no bushland.
Sterilising	Equipment can be sterilised by soaking in a disinfectant such as bleach (containing sodium hypochlorite). The bleach should be diluted (1 part bleach to 10 parts water), soak the tools for a few minutes, and then rinse. Alternatively methylated spirits can also be used for sterilising small hand tools and footwear in the field. A spray bottle containing methylated spirits can be used to cover all surfaces, allowing time for it to soak into all soil material (a couple of minutes is sufficient). A sterile water solution suitable for spraying down vehicles and machinery can be made by mixing 6mL of sodium hypochlorite (eg. pool chlorine or bleach) to every 10L of water.