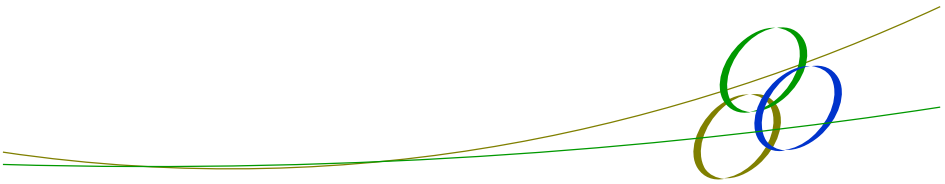
Appendix 7

Commonwealth and State Impact Assessments



A7.1 Commonwealth Assessment

Two Matters of National Environmental Significance were recorded on the site, being Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest and Grey-headed Flying Fox. Species such as Koala, Green and Golden Bell Frog and *Pimelea spicata* were not recorded despite detailed targeted searches in the correct seasons. No other species or communities listed under the EPBC Act were considered to warrant detailed impact assessments, other than the two recorded entities.

Impact assessments in accordance with the Significant Impact Guidelines 1.1 (2013) are therefore provided below for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest and Grey-headed Flying Fox.

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- ***reduce the extent of an ecological community***

SLR (2015) (Appendix 16) shows that the total area of this community on the site is 13.77ha. Of this, 13.14ha is in very low to low condition and 0.63ha is in moderate condition. The area of woodland (in various conditions) to be removed by the combined impact of the SSD and rezoning will be approximately 9.5ha.

- ***fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines***

The existing patch of this community on the GWS is highly degraded and already partially isolated and fragmented from larger tracts of vegetation within the locality. The removal of this patch of Shale Plains Woodland vegetation will increase fragmentation within the site itself and the areas to be retained will be smaller and more spread out than is currently the case.

- ***adversely affect habitat critical to the survival of an ecological community***

The majority of this community will be removed as a result of the GWS projects.

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

The majority of this community will be removed as a result of the GWS projects.

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

The majority of this community will be removed as a result of the GWS projects.

- ***cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:***
    - ***assisting invasive species, that are harmful to the listed ecological community, to become established, or***
    - ***causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or***

The majority of this community will be removed as a result of the GWS projects.

- ***interfere with the recovery of an ecological community.***

The majority of this community will be removed as a result of the GWS projects.

Conclusion

It is considered that, while the vegetation to be impacted is in relatively low condition, the impacts of the SSD and rezoning would result in a controlled action due to the removal of over 9ha of this community. A Referral to DoE is therefore recommended in relation to the impacts to the threatened community.

Grey-headed Flying Fox

Specifically in relation to this species, the DoE has prepared two guidelines, being:

- Draft EPBC Act Policy Statement: Camp management guidelines for the Grey-headed and Spectacled flying-fox (2014)
- EPBC Act Administrative Guidelines on Significance - Supplement for the Grey-headed Flying-fox (2003)

Both of those documents generally tend to focus on impacts to "camps", where this species congregate in known important areas. No permanent camp is known to occur on the site or considered likely. The nearest known camp is located approximately 3.5km to the south at Macquarie Fields and the Commonwealth DoE has identified that the Macquarie Fields camp is Nationally Important.

Single flying foxes were recorded foraging in the woodland near the dam in February 2015. Such records indicate that the remnant vegetation is likely to be used as part of the greater foraging range of this highly mobile species. This species has not been previously recorded during the numerous previous surveys.

The factors requiring consideration for this species under the EPBC Act are addressed hereunder.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- ***lead to a long-term decrease in the size of an important population of a species***

It is considered unlikely that the removal of the majority of the remnant woodland from the site would lead to a long-term decrease in an important population. Extensive foraging habitat for this species occurs throughout the nearby Holsworthy defence site and this is likely to be retained in perpetuity, along with habitats in National Parks such as Royal National Park.

- ***reduce the area of occupancy of an important population***

It is considered than an important population is not likely to be reduced as a result of the projects, due to the persistence of extensive foraging habitats in the locality.

- ***fragment an existing important population into two or more populations***

This species is highly mobile and it is not considered that the projects would fragment any important populations.

- ***adversely affect habitat critical to the survival of a species***

It is not considered that any habitat critical to the survival of the species occurs on the site.

- ***disrupt the breeding cycle of an important population***

Disruptions of breeding of an important local population is unlikely to occur.

- ***modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The impacts of the project are not likely to result in the decline of this species.

- ***result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat***

This is not considered to be a relevant consideration for this species.

- ***introduce disease that may cause the species to decline, or***

The projects are not likely to result in introduction of disease to this species.

- ***interfere substantially with the recovery of the species.***

The projects are not likely to interfere substantially with the recovery of this species.

Conclusion

It is considered unlikely that the projects would either impact on a known important camp or impact on an important population. An EPBC Referral is not considered to be necessary specifically for this species alone.

A7.2 State Assessment

Considerations of the effects of the proposed development under the guidelines of Section 5A of the *Environmental Planning and Assessment Act 1979 (EPA Act 1979)* for threatened species, populations and / or ecological communities considered to have a greater than moderate likelihood of occurrence (see Appendices 3-4 for likelihood of occurrence assessment) are given below. For the purposes of the Seven-Part Test, where appropriate, threatened species have been grouped into functional 'guilds' based on similar habitat or ecological requirements.

The following Seven-Part Tests have been completed (those recorded on-site are in bold text):

Threatened Ecological Communities

Cumberland Plain Woodland
River-Flat Eucalypt Forest on Coastal Floodplains

Fauna

Phascolarctos cinereus	Koala
Litoria aurea	Green and Golden Bell Frog
Meridolum corneovirens	Cumberland Plain Land Snail
Pteropus poliocephalus	**Grey-headed Flying-fox**

Hollow/shelter dependent microbats

Saccolaimus flaviventris	**Yellow-bellied Sheathtail-bat**
Mormopterus norfolkensis	**East-coast Freetail-bat**
Scoteanax rueppellii	Greater Broad-nosed Bat
Falsistrellus tasmaniensis	Eastern False Pipistrelle
Miniopterus australis	**Little Bentwing bat**
Miniopterus schreibersii oceanensis	**Eastern Bentwing bat**
Myotis macropus	Large-footed myotis

Flora

Pimelea spicata	Spiked Rice-flower

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

Not applicable.

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

No endangered populations were identified during site surveys, nor are they considered likely to occur within the subject site.

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

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

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

The Shale Plain Woodland (Critically Endangered Ecological Community) is present on site in the southern portion of the GWS site. This community has been surveyed and is the subject of a Cumberland Plain Woodland Assessment Report completed by SLR Consulting (Appendix 15). From this report a map was created (Figure 7 in Appendix 15) to delineate the vegetated portion of the site and determine its overall condition status.

Further refinement of this mapping, including additional field work was undertaken by SLR and is contained in Appendix 16. The additional field work included BioBanking plots and determination of the condition of the Cumberland Plain Woodland with reference to the BioBanking condition parameters. This additional work identified that the total area of this community on the site is 13.77ha. Of this, the area of woodland (in various conditions) to be removed by the combined impact of the SSD and rezoning will be approximately 9.5ha.

There are a number of factors to be considered when determining whether the proposed action is likely to have an adverse effect on the extent of this community such that its local occurrence is likely to be placed at risk of extinction. The factors to consider include the following:

Fragmentation of the site

The GWS site is bound by a number of barriers to fauna movement, including Cambridge Avenue to the south, the Main Southern passenger railway, and the Southern Sydney Freight Lines to the west, East Hills Railway Line, which traverses the site in an east-westerly direction dividing the site into north and south parcels of land, Georges River along the eastern side, the landfill, quarry, and recycling operational areas together with the internal roads within the GWS precinct. The site and surrounding lands to the north, east, west and south (within 10km and excluding the south east) are also subject to disturbance as they are urban areas with isolated parcels of vegetative areas in the broader landscape. The land to the south east within 10km is a vast vegetated area and part of the Holsworthy Military Area under ownership of the Commonwealth. These urban and physical barriers reduce the potential movement of small and larger terrestrial (flightless) mammals into and through the Shale Plain Woodland in the southern portion of the site. The more mobile mammal bird and bat species are more likely to have access to the site and may use the site on occasion as part of a larger home range. Larger terrestrial mammals that may occur in the locality are likely to be excluded from much of the study area due to the physical barriers surrounding and within the site, with a major concern being the potential movement of these larger mammals across these barriers potentially leading to fatalities or injuries from cars, trains etc.

Habitat connectivity within the study area appears the greatest within the riparian vegetation associated with Georges River on the eastern side of the site, which maintains connectivity with riparian vegetation to the north and south. This riparian corridor could facilitate the movement of less mobile species, including cover-dependent species, larger terrestrial mammals and arboreal mammals. It is the intention that in conjunction with the proposed development, this connecting strip of riparian vegetation may be rehabilitated including the removal of weeds and the establishment of nesting boxes for use by hollow dependent fauna.

South east of the investigation area to the east of the Georges River is the adjacent Holsworthy Military Area. This site support approximately 18,000 hectares of continuous native vegetation that is part of a larger major contiguous vegetated area of approximately 140,000ha that continues from the site south to between Bowral and Wollongong. The diversity of vegetation communities within the Military Area and beyond includes forests, woodlands, heath and swamp communities, which in turn provide important habitat to locally and regionally occurring, threatened flora and fauna species. Highly mobile fauna species such as birds and some mammals may predominantly reside within the Holsworthy Military Area and utilise the limited resources offered by the study area on a temporary or transient basis.

The overall condition of the woodland

The studies conducted by SLR have determined that there are varying degrees of disturbances to the understorey and groundcover through the CPW area, resulting in areas of 'Very Low', 'Low' and 'Moderate' condition vegetation being mapped on the site. BioBanking Assessment work in Appendix 16 identified that the total area of this community on the site is 13.77ha. Of this, the area of woodland (in various conditions) to be removed by the combined impact of the SSD and rezoning will be approximately 9.5ha. It has been stated by SLR Consulting in their 2013 report that the areas which constitute the CPW community can broadly be described as moderately to highly disturbed, and have been for a considerable period of time.

Previous clearing and continued/historical maintenance of the ground layer

The Glenfield Waste Site has been in single family ownership since the 1800's with the understorey and groundcover being continually maintained for a number of purposes over that period. From aerial photography (Appendix 17) (AHMS 2012) dating back to the 1930's it is clear that the GWS was used for orchards and general farming practices. In photographs dating from the 1950's through to the 1970's it is evident that the woodland portion of the site has had the understorey and groundcover managed. In anecdotal conversations with the landowners regarding the historical management much of the site, including the woodland portion, has been used for grazing of livestock, general agricultural purposes and more recently also managed by slashing. Since the 1980s, under relevant development consents, a large portion of the GWS site has been previously cleared of native vegetation for the purpose of operating as a quarry and waste facility. Vegetation on the GWS site is primarily restricted to the Georges River riparian land and approximately 12.6ha of woodland vegetation located on the southern parcel of land in the Campbelltown LGA. As a result of continual management over the last century the ground layer grass and forb species composition has degraded across much of the site.

Lack of evidence of key fauna species present within the CPW community

In 2006, Eco Logical prepared a preliminary ecological assessment of the GWS with a total of 23 fauna species (birds) recorded with no threatened species observed as part of the survey. Subsequent surveys of the site were conducted by EPS ecologists in 2012, 2013, 2014 and again in 2015. The only threatened species recorded were highly mobile bats that can utilise disturbed habitats. Other species of flora and fauna recorded were those adapted to disturbed habitats. No species requiring large and structurally intact forested habitats were recorded.

Occurrence of this community in the local area

In combination with the vegetation within the Holsworthy Military Area to the south east of the site there are also a number of corridors of vegetation to the south and south-east of the site mapped in OEH SixViewer as CPW community. The GWS may have small areas of mapped 'Low-moderate' condition CPW; however, in the broader landscape this area is generally highly degraded and is unlikely to be preferred habitat considering the corridors of suitable vegetation in the broader landscape.

The GWS contains a small portion of Shale Plain Woodland which has been documented throughout this report as being in fairly low condition and also partially isolated and fragmented from larger patches of this community type in the local area, however this patch of vegetation does form part of a larger contiguous area of the overall ecological community and there is the potential for the movement of flora and fauna species, and therefore the exchange of genetic material across the boundary of the study site.

In determining the risk of extinction to the local occurrence of this CEEC, the proposed action is not likely to have an adverse effect on the extent of this community such that its local occurrence is likely to be placed at risk of extinction in the short term due to the direct actions of clearing this vegetation.

However, it cannot be assumed that the proposed actions will not potentially contribute to the extinction of this community in the long term through any number of indirect actions (beyond the control of this development) in the years to come. The Cumberland Plain Woodland Recovery Plan has been developed as a strategy to effectively manage those areas of the woodland that are considered of greatest significance and relevance to the continued existence of this community within the locality and broader Sydney Basin Bioregion. The site does not form part of the Cumberland Plain Woodland Recovery Plan Priority Conservation Areas.

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

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

In relation to the ecological community present on site, being Shale Plains Woodland the area of woodland to be removed will be approximately 9.5ha (2.58 low condition and 6.91 moderate to good condition). The following table and three figures below provide quantitative information that shows how the Shale Plains Woodland relates to representative CPW community in the wider locality. Within a radius of 2km from the GWS site Shale Plains Woodland comprises 54.6ha with 9.5ha of this on the GWS and proposed for removal which equates to 17% of the total area of this community within 2km radius and 45.1ha remaining within this area (Figure 1).

Within a radius of 5km there is a total of 256.3ha of Shale Plains Woodland and removal of the required 9.5 ha for the proposed development equates to a total of 3.7% of the total area of this community with an area of 246.5ha then remaining within this broader locality (Figure 2). The figures have not been accurately calculated for the 10km radius as shown in Figure 3; however from calculated estimates it is determined that the total area of Shale Plains Woodland is approximately double the area of hectares as calculated for the 5km radius.

Table 1: Hectares and % Shale Plain Woodland in the GWS Locality

	2km		5km	
	Total area (ha)	**% GWS**	**Total area (ha)**	**% GWS**
Shale Plains Woodland	54.6		256.3	
Less GWS	9.5	17%	9.5	3.7%
Residual	**45.1 ha**		**246.8 ha**	

Further consultation is required with Local Government, DoPI and OEH to determine possible impacts and offsetting pathways in order to minimise the impact to this community.

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

The existing patch of vegetation on the GWS is highly degraded and already partially isolated and fragmented from larger tracts of vegetation within the locality. The removal of this patch of Shale Plains Woodland vegetation will increase fragmentation within the site itself and the areas to be retained will be smaller and more spread out than is currently the case.

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

This patch of vegetation is highly degraded and greatly modified with the understorey vegetation having been managed through agricultural practices such as grazing, and then more recently also by slashing and grazing for primarily bush fire protection. This patch of woodland vegetation is considered highly disturbed and partially fragmented. Generally it is considered that the woodland to be impacted on the site is not highly important to the long-term survival of this community in the locality.

Figure 1: Shale Plain Woodland within and surrounding the GWS at a 2km radius.

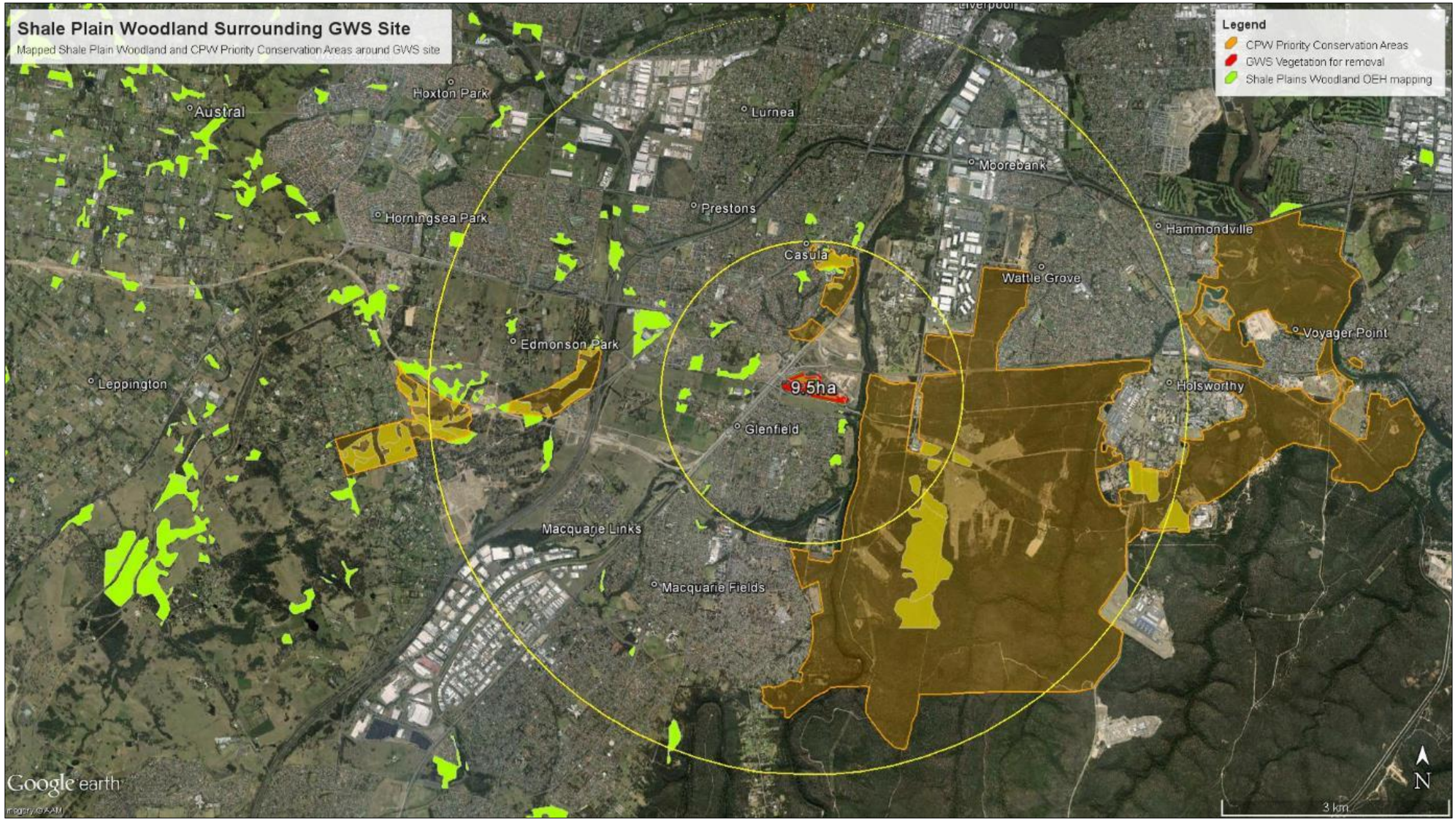


Figure 2: Shale Plain Woodland within and surrounding the GWS at a 5km radius.

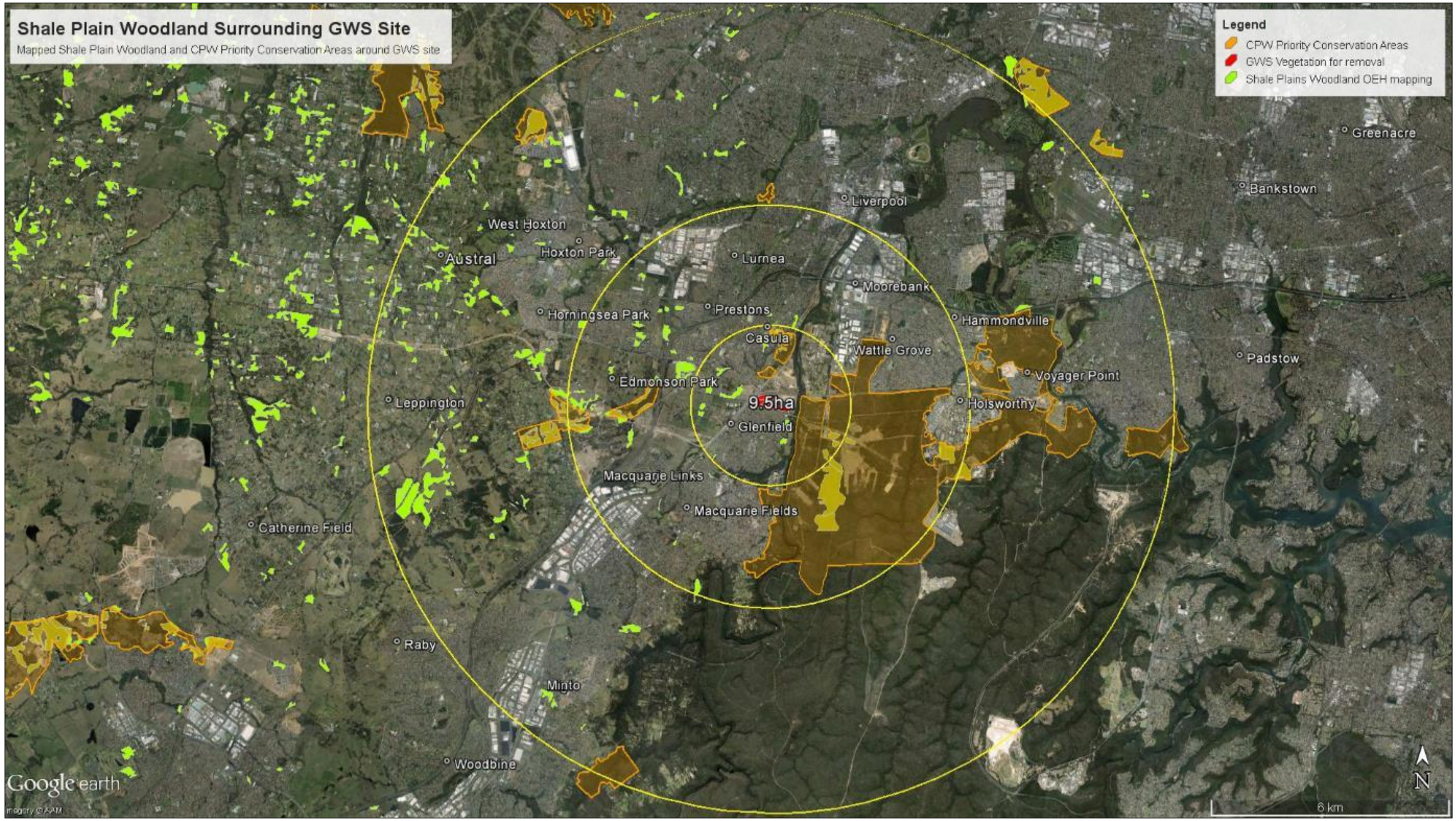


Figure 3: Shale Plain Woodland within and surrounding the GWS at a 10km radius.

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

The subject site is not located near any declared areas of critical habitat.

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

There is a recovery plan in place for the Cumberland Plain Woodland, of which Shale Plain Woodland forms part. It is noted that DECCW (2010) in the *Cumberland Plain Recovery Plan* excluded areas that were "*zoned for residential and industrial purposes*", as well as areas "*that have been identified for future urban growth*". This is largely because of the difficulties in rezoning these areas for conservation purposes - due to their "*higher land values and stronger development pressures*". This is of particular relevance for the GWS site.

The proposal will remove an area of Cumberland Plain Woodland and as such this contradicts recovery strategies for this CEEC. However, this site is highly degraded and partially fragmented.

The recovery plan for the Cumberland Plain Woodland will play a role in determining the offsetting options to mitigate potential impacts to this community and will be used in discussions with Local Government, DoPI and OEH.

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

The potential for key threatening processes (KTPs) to impact the CEEC considered likely to occur on site have been considered in Appendix 5 above. The proposal may increase the operation of the KTP "Clearing of vegetation", "Removal of dead wood and dead trees" and "Loss of Hollow-bearing Trees". The proposal involves the intention to clear native vegetation and as such this is considered a KTP, however, the proposed intension is to remove a generally small portion of already highly degraded, fragmented and isolated native vegetation and as such this is consider a minor contribution to this KTP.

Conclusion

It is considered that pursuant to the seven part test criteria that the removal of the 9.5ha of vegetation in the GWS is unlikely to result in a significant impact to:

- result in a likely adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

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

However, the proposed works have the potential to result in an indirect impact over the long term by contributing to the overall degradation of the wider CPW community. The level of indirect impact is difficult to quantify and the temporal scale for this impact is also unknown.

Therefore, it is recommended that some form of biodiversity offset be provided for the local area to ameliorate the indirect impact over the long term. It is recommended that a combination of locally orientated biodiversity measures be investigated.

River-Flat Eucalypt Forest on Coastal Floodplains

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

Not applicable.

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

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

The River-Flat Forest ecological community occurs alongside the Georges River. It is not proposed that this ecological community will be detrimentally affected by the proposal. In fact, it is proposed that this area of ecological community be protected in perpetuity as part of future biodiversity offset outcomes.

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

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

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

The River-Flat Forest ecological community occurs alongside the Georges River. It is not proposed that this ecological community will be detrimentally affected by the proposal. In fact, it is proposed that this area of ecological community be protected in perpetuity as part of future biodiversity offset outcomes. No significant fragmentation or isolation of this ecological community is considered likely to occur.

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

The subject site is not located near any declared areas of critical habitat.

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

Recovery strategies for threatened communities generally outlined by OEH will play a role in determining the offsetting options to mitigate potential impacts to this community and will be used in discussions with Local Government, DoPI and OEH.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. Future management of issues such as weeds as part of future offset outcomes are likely to reduce KTP's impacting this ecological community.

Koala

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

There are recognised Koala feed trees present on site including *Eucalyptus tereticornis*. However, there was no evidence of scats or scratchings on trees. The site is bound by a number of potential barriers to larger (flightless) mammal movement including Cambridge Avenue and Moorebank Avenue, the main south passenger and Southern Sydney Freight railway lines to the west, the East Hills railway line traversing the site and significant residential sprawl surrounding the GWS site. The site is also bounded by a combination of both chain mesh fencing and colourbond fencing that, in combination with the above roads, rail and residential areas, would severely limit Koala movement into the site. The site is also exposed, on a daily basis, to considerable anthropogenic disturbance from the operation of the waste facility including noise and dust from truck movement. The site is considered highly degraded and partially fragmented from larger tracts of vegetation that may be used by this species as part of a larger home range.

The proposed development will remove only a small portion of potential habitat available to the species and is not considered a suitable/safe site for the presence of Koalas. As such the proposal is not considered likely to have an adverse effect on the life cycle of *P. cinereus* such that a viable local population will be placed at risk of extinction.

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

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
>
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

Not applicable.

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

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

Approximately 9.5ha of potential habitat will be affected.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The removal of this small patch of Shale Plain Woodland vegetation will not further isolate or fragment any patch of vegetation for this species.

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

The habitat within the site represents potential foraging/nesting habitat for highly mobile and also less mobile common and threatened species as part of larger home ranges. The site is already highly degraded and partially fragmented. There are risks associated with larger mammal species accessing the site including impacts from cars using the busy Cambridge Avenue and trains using the railway lines running to the west and through the site. The site is also currently bounded on all sides by both chain/wire topped and colour bond fencing. The road and rail, and the addition of anthropogenic disturbance throughout the site are a limiting factor for safe habitat and possible breeding on site. It is not considered likely that the long term survival of this species will be put at risk with the removal of this vegetation.

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

The subject site is not located near any declared areas of critical habitat.

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

There is a Recovery Plan in place for the Koala. The proposal will remove a small area of native vegetation and as such this contradicts recovery. However, this site is highly degraded and fragmented and through numerous field surveys it has been concluded that presence of this species on the site is unlikely.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. The proposal may increase the operation of the KTP "Clearing of vegetation", relevant to this species.

Notwithstanding that the proposal is intended on clearing native vegetation and as such this is considered a KTP, however, the proposal involves the intention to clear native vegetation, and as such this is considered a KTP, the proposal is limited to the removal of a small portion of already highly degraded, fragmented and isolated native vegetation. As such this proposal is considered a very small contribution to this KTP.

Green and Golden Bell Frog

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

L. aurea may occur within the subject site on occasion as part of a larger home range. However the site is subject to considerable anthropogenic disturbance from the operation of the waste facility and considered highly degraded and partially fragmented from larger tracts of vegetation that may be used by this species as part of a larger home range. There is the potential for species movement on and off the site through possible vehicular transportation, however this is unlikely. In relation to other threatened species and movement on and off the site, this species is not limited by the barrier of the Georges River and as such movement of genetic material is possible. The area around the artificial dam, deemed potential suitable habitat is small in size and is unlikely to provide enough habitat for the presence/ or sustained reproduction of this species. This species was not identified during the targeted diurnal or nocturnal surveys, which were undertaken in accordance with survey guidelines and it is considered unlikely that it actually occurs on the site. The proposal is not considered likely to have an adverse effect on the life cycle of *L. aurea* such that a viable local population will be placed at risk of extinction.

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

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

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

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

The small dam will be affected by the GWS projects.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The removal of this small patch of Shale Plain Woodland vegetation and the adjoining dam will not further isolate or fragment any patch of vegetation.

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

The site is already highly degraded and partially fragmented, and the aquatic habitat is considered to be low quality for this species. Only 5% of the fringing vegetation is considered suitable for this species. It is not considered likely that the long term survival of this species will be put at risk with the removal of the habitat on the site.

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

The subject site is not located near any declared areas of critical habitat.

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

There is a draft Recovery Plan in place for the Green and Golden Bell Frog. The proposal will remove a small area of habitat and as such this contradicts recovery strategies for this threatened species. However, this site is highly degraded and fragmented and through numerous field surveys it has been concluded that presence of the species on the site is unlikely.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. In relation to this species no significant exacerbation of KTP's is considered likely.

Cumberland Plain Land Snail

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

M. corneovirens may occur within the subject site on occasion as part of a larger home range. However the site is subject to considerable anthropogenic disturbance and considered highly degraded and partially fragmented from larger tracts of vegetation that may be used by this species as part of a larger home range. There is the potential for species movement on and off the site through possible vehicular transportation, however this is highly unlikely. This species was not identified during the targeted diurnal or nocturnal surveys. No evidence of egg clutches or empty shells were observed in areas considered potential habitat including under logs, loose bark or old tyres and sheet iron. The proposal is not considered likely to have an adverse effect on the life cycle of *M. corneovirens* such that a viable local population will be placed at risk of extinction.

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

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
>
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

Not applicable.

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

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

Approximately 9.5ha of potential habitat will be affected.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The remaining patches will be further isolated and fragmened from other areas of Cumberland Plain Woodland, although the current patch is quite isolated already.

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

The site is already highly degraded and partially fragmented. Despite targeted searches, no evidence of the occurrence of this species was recorded and this is likely due to the historic understorey disturbance that has occurred on an ongoing basis. It is not considered likely that the long term survival of this species will be put at risk with the removal of this vegetation.

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

The subject site is not located near any declared areas of critical habitat.

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

The proposal will remove a small area of native vegetation and as such this contradicts recovery strategies for threatened species. However, this site is highly degraded and fragmented and through numerous field surveys it has been concluded that presence of this species on the site is unlikely.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. The proposal may increase the operation of the relevant KTP “Clearing of vegetation” and “Removal of dead wood and dead trees”.

Notwithstanding that the proposal is intended on clearing native vegetation and as such this is considered a KTP, however, the proposal involves the intention to clear native vegetation, and as such this is considered a KTP, the proposal is limited to the removal of a small portion of already highly degraded, fragmented and isolated native vegetation. As such this proposal is considered a small contribution to this KTP.

Grey-headed Flying Fox

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

Single Grey-headed Flying Foxes were recorded in the woodland adjoining the dam in February 2015 on two nights. The woodland habitat is expected to comprise a small proportion of available foraging habitat in the expansive foraging habitats in the locality and region. In addition, the River-Flat Forest will be retained, which provides foraging habitat for this species. It is considered unlikely that the projects would result in a viable local population being placed at risk of extinction.

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

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
>
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

Not applicable.

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

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

Approximately 9.5ha of potential habitat will be affected.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The removal of this patch will increase fragmentation within the site itself and the areas to be retained will be smaller and more spread out than is currently the case.

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

The habitat within the site represents potential foraging/nesting habitat for this highly mobile threatened species as part of larger home ranges. Expansive foraging habitat existing in the locality. The site is already highly degraded and partially fragmented. It is not considered likely that the long term survival of this species will be put at risk with the removal of this vegetation.

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

The subject site is not located near any declared areas of critical habitat.

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

The proposal will remove a small area of native vegetation and as such this contradicts recovery strategies for this species.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. The proposal may increase the operation of the relevant KTP “Clearing of vegetation” to a minor degree.

Hollow/shelter dependent microbats

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

Yellow-bellied Sheathtail-bat, East-coast Freetail-bat, Greater Broad-nosed Bat, Eastern False Pipistrelle, Little Bentwing bat, Eastern Bentwing bat and Large-footed myotis were considered likely to forage throughout the site on some occasion. Of these, Yellow-bellied Sheathtail-bat, East-coast Freetail-bat, Little Bentwing bat and Eastern Bentwing bat were recorded foraging within the site.

Hollow-bearing trees with small to medium sized hollows and cracks are present within the subject site. The hollows may be used at some point by these species (particularly The Yellow-bellied Sheathtail-bat and East-coast Freetail-bat) for shelter and breeding.

The clearing of the site is not considered likely to have an adverse effect on the life cycles of these hollow-dependent species such that a viable local population will be placed at risk of extinction. The nearby extensive areas of forest vegetation are likely to contain similar suitable roosting habitat. However it is recommended that an ecologist or Fauna Spotter-catcher be present to supervise vegetation removal within the subject site as a precautionary approach to reduce the risk of harm to fauna. This should include pre-clearance inspections of the tree hollows using a cherry picker. A 2:1 replacement ratio is also to be applied to install nest boxes suitable for these species.

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

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
>
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

Not applicable.

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

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

Approximately 9.5ha of known foraging habitat will be affected. This includes approximately 109 hollows that may be suitable for roosting by these species.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The removal of this patch of Shale Plains Woodland vegetation will increase fragmentation within the site itself and the areas to be retained will be smaller and more spread out than is currently the case.

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

The habitat within the site represents potential foraging/nesting habitat for highly mobile microbats as part of larger home ranges.

The site is already highly degraded and partially fragmented, however there is a high density of tree hollow suitable for these species to roost in. While roosting habitat is not likely to be a limiting factor in the locality, due to the extensive areas of forest habitat in the Holsworthy area, these hollows are still of value for these species locally. Hence nest boxes / replacement hollows at a ratio of 2:1 is proposed to ensure roosting habitat remains available in the immediate locality.

It is not considered likely that the long term survival of these species will be put at risk with the removal of this vegetation.

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

The subject site is not located near any declared areas of critical habitat.

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

The proposal will remove a small area of native vegetation and as such this contradicts recovery strategies for threatened species. However, this site is highly degraded and fragmented and through numerous field surveys it has been concluded that a significant impact upon these species is unlikely.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. The proposal may increase the operation of the KTP "Clearing of vegetation", "Removal of dead wood and dead trees" and "Loss of Hollow-bearing Trees".

Notwithstanding that the proposal is intended on clearing native vegetation and as such this is considered a KTP, however, the proposal involves the intention to clear native vegetation, and as such this is considered a KTP, the proposal is limited to the removal of a small portion of already highly degraded, fragmented and isolated native vegetation. As such this proposal is considered a small contribution to this KTP.

The woodland trees on the site have been surveyed on a number of occasions with a hollow bearing tree assessment having occurred in 2012 and further investigations and observations made in surveys in 2013 and 2014. From this it has been documented that the majority of hollow bearing trees (containing dead limbs) were not being used to a significant extent with only two hollows possibly providing nesting and habitat to Galahs and one hollow providing habitat to European bees. The impact of the proposed development and the removal of hollow bearing trees and dead limbs are considered to be a very small contribution to these two KTP's.

Pimelea spicata

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

The site is considered to sustain quite small areas of moderate and low quality Shale Plain Woodland which forms part of this flora species likely habitat. However the site is generally of a poor quality in terms of floristic composition.

This species was the subject of a specific targeted random meander search at a time of year in which this species was known to be flowering at reference sites in close proximity to the GWS site. This species was not identified during this targeted survey.

As the site is highly degraded and fragmented with a high level of anthropogenic disturbance it is considered unlikely that this species is present at this site. The clearing of the site is not considered likely to have an adverse effect on the life cycles of *P. spicata* such that a viable local population will be placed at risk of extinction.

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

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

Not applicable.

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

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

Approximately 9.5ha of low quality potential habitat will be affected.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The remaining patch of EEC will be further isolated and fragmented from other areas of Cumberland Plain Woodland, although the current patch is quite isolated already.

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

The site is already highly degraded and partially fragmented. The habitat is considered to be poor for this species due to the regular underscrubbing that is permitted to occur within the woodland.

It is not considered likely that the long term survival this threatened species will be put at risk with the removal of this vegetation.

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

The subject site is not located near any declared areas of critical habitat.

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

The proposal will remove a small area of native vegetation and as such this contradicts recovery strategies for this species. However, this site is highly degraded and fragmented and through numerous field surveys it has been concluded that presence of this species on the site is unlikely.

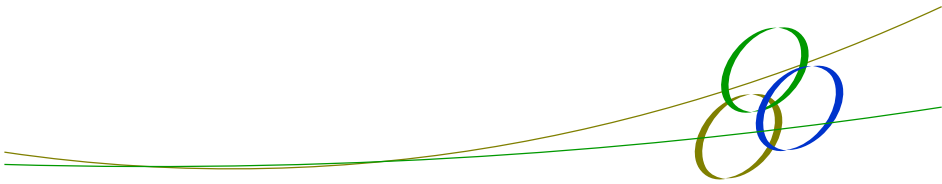
(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. The proposal may increase the operation of the relevant KTP "Clearing of vegetation".

Notwithstanding that the proposal is intended on clearing native vegetation and as such this is considered a KTP, however, the proposal involves the intention to clear native vegetation, and as such this is considered a KTP, the proposal is limited to the removal of a small portion of already highly degraded, fragmented and isolated native vegetation. As such this proposal is considered a small contribution to this KTP.

Appendix 8

Pimelea spicata Report



EPS

THREATENED SPECIES SURVEY REPORT

Pimelea spicata

ENVIRONMENTAL PROPERTY SERVICES

11009
September 2014

EXECUTIVE SUMMARY

This report outlines the survey assessment requirements for determining the presence of a particular threatened flora species at the Glenfield Waste Services (GWS) site undertaken in December 2013. The objective of the survey was to determine the presence of the flora species *Pimelea spicata* (Spiked-rice flower) listed as endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and as endangered in the schedules of the NSW *Threatened Species Conservation Act 1995*.

This species is endemic to NSW with a relatively scattered distribution occurring in two disjunct areas, the Cumberland Plain (western Sydney) and coastal Illawarra (south of Sydney) (DEC 2005) in the Sydney Basin Bioregion.

The vegetation within the GWS site has been subject to extensive and in some places, ongoing disturbances and is highly modified. Through previous ecological reports the vegetation present within this portion of the site has been surveyed and determined to consist primarily of remnant trees of *Eucalyptus moluccana* and to a lesser extent *Eucalyptus tereticornis* and *Eucalytpus crebra* being of one age class and one stratum. The site has been regularly mown, slashed and managed such that a predominantly cleared understorey occurred across the investigation area.

A targeted survey was undertaken for this species during optimal climatic and seasonal conditions with surveyors following the required methodology as outlined in the NSW Office of Environment and Heritage guidelines. The survey effort has been documented and the results and conclusions are outlined further throughout this report.

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Appendix

1 INTRODUCTION

1.1 Background

This report has been prepared by Environmental Property Services (EPS) in response to the requirements outlined in a letter received from the Office of Environment and Heritage (OEH) department on the 8th November 2013. OEH had requested that a targeted survey be conducted for the threatened species *Pimelea spicata* in order to determine its presence within the southern parcel of land at the Glenfield site. A species profile can be found in Appendix 1 which gives a description of its morphology and habitat preferences.

1.2 Study Area

The study area consists of the southern parcel of land within the Glenfield site with surveys occurring primarily within what has been determined by the EPS ecologist as being suitable habitat for this species. A map showing the location and area surveyed can be seen in Figure 2-1.

Table 1-1: Summary of the southern parcel of land details

Summary of southern parcel of land details	
Lot and Deposited Plans	Lot 91 DP1155962; Lot 3 DP735524; Lot 3 DP 736881; Lot 1 DP113201; Lot 2 DP 333578
Address	2 Cambridge Avenue, Glenfield NSW 2167
Grid Reference	Zone 56, 306519E 6239570N
Local Government Area	Campbelltown
Catchment Management	Sydney Metropolitan
Primary existing Land Use	Recycling of waste & rail and electricity infrastructure
Current Zoning	Zone 1(a) Rural A Zone, Zone 6(b) Regional Open Space Zone & Zone & 5(b) Special Uses Arterial Roads Zone

1.3 Aims and Objectives

The aim of this assessment was to determine the presence of the threatened flora species *Pimelea spicata* using the methodology outlined in the Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (Working Draft) (DEC 2004) and the Department of Environment & Climate Change NSW threatened species assessment guidelines August 2007.

2 METHODOLOGY

2.1 Methodology

2.1.1 Targeted Searches

All methodology has been conducted in accordance with the Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (Working Draft) (DEC 2004). In order to determine the presence/absence of this species on the site, the random meander technique and by systematically walking along designated transects was used for the southern parcel of land at the Glenfield site (see Figure 2-1). The Environmental Impact Assessment Guidelines – *Pimelea spicata* (NPWS, 2004) state that *P. spicata* needs to be the subject of a specific targeted survey using the random meander method, favouring suitable habitat areas with a survey effort of at least one hour per hectare of suitable habitat.

The area determined suitable habitat was estimated to be approximately 12 hectares in size. Survey efforts included one hour of targeted surveys per hectare of suitable habitat; therefore surveys occurred for 6 hours per person totalling 12 hours, on the 17th December 2013. Two surveyors traversed the site each holding a handheld GPS in order to show the tracks travelled for replication purposes and for any recordings if the species were to be identified on site.

2.1.2 Reference Site

To comply with the OEH requirements a number of enquiries were made regarding known reference sites for this particular species. Contact was made with two employees from the Australian Botanic Gardens, Mt Annan. Both were able to provide information that the species was flowering in a number of locations in Penrith and in the woodlands at Mt Annan at the time of inspection. It was also discussed that at that time, the climatic and seasonal conditions were optimal for flowering to be occurring. Contact was also made with a Bushland Officer from Camden City Council and he also confirmed that the species was flowering at a site within the Camden Golf Course. A field meeting was set up and EPS staff were shown the location of the site and able to visually examine this species in flower on the 17th December 2013.

2.1.3 Survey Conditions

Table 2-1: Climate data

Date	Temp	Wind	Cloud	Rain
17 December 2013	19°C - 29°C	Still	Clear	None

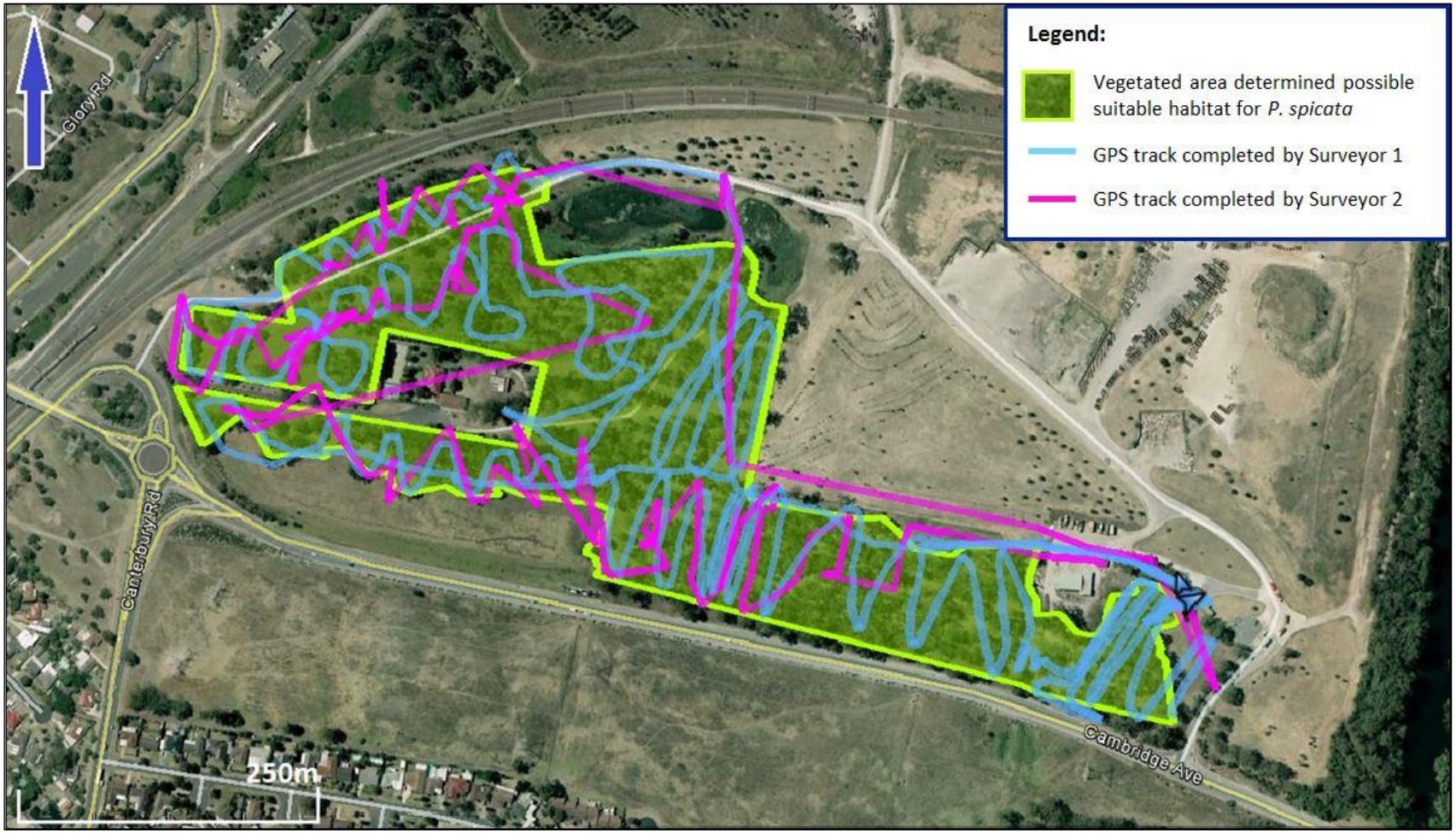


Figure 2-1: Field survey effort for *Pimelea spicata* using the Random Meander Technique.

3 RESULTS & CONCLUSION

The threatened species *Pimelea spicata* was not observed in any of the areas deemed suitable habitat during the field survey. The survey effort has been in accordance with the Methods outlined in the Environmental Impact Assessment Guidelines for *Pimelea spicata* and the 2004 draft OEH guidelines. From this it is concluded that the habitat in the southern parcel of the Glenfield site is not suitable for the presence of this species.

4 REFERENCES

Department of Environment and Conservation (2005) *Pimelea spicata* R.Br. Recovery Plan. Department of Environment and Conservation (NSW), Hurstville NSW.

Department of Environment and Conservation (2004) Environmental Impact Assessment Guidelines – *Pimelea spicata* R.Br. National Parks and Wildlife Service (NPWS), Hurstville NSW.

Department of Environment & Climate Change NSW (2007) Threatened species assessment guidelines – The assessment of significance, Sydney NSW.

Appendix 1

Pimelea spicata - Profile

Pimelea spicata – profile

Scientific name: *Pimelea spicata*
Conservation status in NSW: Endangered
Commonwealth status: Endangered
Profile last updated: 22 Jul 2013

Description

The Spiked Rice-flower is a shrub to 50 cm tall that may be erect or somewhat spreading in habit. The leaves are opposite and elliptical, to 20 mm long by 8 mm wide, and usually held outwards from the stem. The white, pink-tinged flowers are tubular, to 10 mm long, with four spreading petals. They may appear at any time of the year, but are mostly seen in summer as they are probably related to rainfall. Inflorescences start as dense clusters (like most rice flowers) and then extend along an elongating stem as the inflorescences age.

Distribution

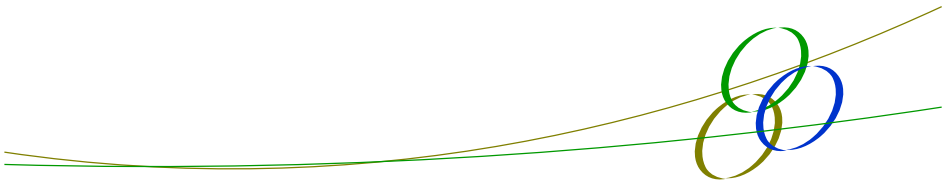
Once widespread on the Cumberland Plain, the Spiked Rice-flower occurs in two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama).

Habitat and ecology

- In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils.
- On the Cumberland Plain sites it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark.
- The co-occurring species in the Cumberland Plain sites are grey box (*Eucalyptus moluccana*), forest red gum (*E. tereticornis*) and narrow-leaved ironbark (*E. crebra*). Blackthorn (*Bursaria spinosa*) is often present at sites (and may be important in protection from grazing) and kangaroo grass (*Themeda australis*) is usually present in the groundcover (also indicative of a less intense grazing history).
- In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a better developed shrub and grass understorey. Coastal headlands and hilltops are the favoured sites. The IIllawarra populations usually occur in one of two communities a woodland or a coastal grassland. Woodland sites are dominated by forest red gum (*E. tereticornis*) and stringybark (*E. eugenioides*), with a groundcover dominated by kangaroo grass (*Themeda australis*) and matrush (*Lomandra longifolia*). The grassland sites are dominated by kangaroo grass (*Themeda australis*) and matrush (*Lomandra longifolia*), with blady grass (*Imperata cylindrica*). A shrubby layer, where present, is dominated by coastal wattle (*Acacia sophorae*) and coast rosemary (*Westringia fruticosa*) with coast banksia (*Banksia integrifolia*).
- Mature plants spread over short distances through underground rhizomes, and this can assist them to recover from disturbances like fire and irregular grazing. However, the age plants must be, and what proportion recover, is largely unknown.
- Flowers may be self-pollinating, although fruit production is variable. Fruit are not dispersed well, with most seedlings germinating close to the adult (within 30cm or so according to P. Hogbin). A soil seedbank develops and is maintained in the presence of a suitable disturbance regime.

Appendix 9

Flora Recorded During Field Surveys



Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
Acanthaceae	*Brunoniella australis*[PD9,PD10,PD28,PD29]	Blue Trumpet	2	1									
Adiantaceae	*Cheilanthes sieberi* subsp. *sieberi* [C9,PD10,PD28,PD29]	Poison Rock Fern	1										
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed										X	
Apiaceae	*Cyclospermum leptophyllum*	Slender Celery								1			
Apocynaceae	*Araujia sericifera*	Moth Vine	1		1		1	1	1				
Asparagaceae	*Asparagus asparagoides*	Bridal Creeper						2		2			
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	1		2		2	2	2		X		
Asteraceae	*Calotis lappulacea*	-		1						2			
Asteraceae	*Chondrilla juncea*	Skeleton Weed		1	1							X	
Asteraceae	*Cirsium vulgare*	Spear Thistle	2	2	2	2		1	2	2			
Asteraceae	*Conyza* sp.	-		1						1			
Asteraceae	*Coronidium scorpioides*	-	1										
Asteraceae	*Cotula australis*	-		3			2						
Asteraceae	*Cymbonotus lawsonianus*[PD10]	Bears-ear								1			
Asteraceae	*Hypochaeris glabra*	Smooth Catsear	2	4b			3	2		2			
Asteraceae	*Senecio madagascariensis*	Fireweed	2	3	3	2	2		3	2		X	
Asteraceae	*Soliva sessilis*	Jojo	2			2							
Asteraceae	*Sonchus oleraceus*	Common Sowthistle	2	2	3	1	2	1	3	2			
Asteraceae	*Taraxacum officinale*	Dandelion	2		2	2	3		2	2			
Asteraceae	*Vittadinia cuneata* [PD29]	Fuzzweed		1									
Asteraceae	*Vittadinia muelleri*	-	1										
Brassicaceae	*Capsella bursa-pastoris*	Shepherds purse					1						
Brassicaceae	*Sisymbrium officinale*	Hedge Mustard											X
Caryophyllaceae	*Cerastium glomeratum*	Mouse-ear Chickweed	2	2			1	1	2				
Caryophyllaceae	*Paronychia brasiliana*	Brazilian Whitlow					4b						

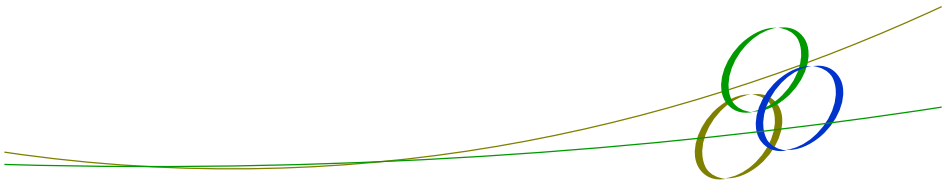
Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
Casuarinaceae	*Casuarina cunninghamiana*	River Oak											X
Casuarinaceae	*Casuarina glauca*	Swamp Oak											X
Crassulaceae	*Bryophyllum delagoense*	Mother-of-millions									X		
Chenopodiaceae	*Einadia hastata* PD10,PD28,PD29	Berry Saltbush	1										
Chenopodiaceae	*Einadia polygonoides* PD9,PD29	-					4b			3			
Chenopodiaceae	*Einadia trigonos* subsp. *stellulata* PD9,PD28,PD29	Fishweed	1				2	2					
Clusiaceae	*Hypericum japonicum*	-							2				
Convolvulaceae	*Dichondra repens* PD9,PD10,PD28,PD29	Kidney Weed	3	3	2	1	2	2	2	3			
Cyperaceae	*Carex inversa* PD9,PD28,PD29	-						2	2				
Cyperaceae	*Cyperus gracilis* PD9,PD28,PD29	-	2							2			
Cyperaceae	*Cyperus congestus*	-										X	
Euphorbiaceae	*Chamaesyce drummondii*	Caustic Weed								1			
Fabaceae	*Glycine microphylla* PD9,PD10,PD28,PD29	-	2			1	2	2	1	1			
Fabaceae	*Medicago* sp.	Medic					3						
Fabaceae	*Trifolium repens*	White Clover				2							
Fumariaceae	*Fumaria bastardii*	Bastards Fumitory					2			2			
Geraniaceae	*Geranium solanderi* var. *solanderi* PD9	Native Geranium							4b				
Juncaceae	*Juncus subsecundus*	-									X	X	
Lamiaceae	*Plectranthus parviflorus* PD28	Cockspur Flower						1					
Loranthaceae	*Amyema gaudichaudii* PD29	-											X
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow	1		1		2		2	1			
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	1	1	1	1	2	2	2	1		X	
Mimosaceae	*Acacia decurrens* PD29	Black Wattle									X		
Myrtaceae	*Angophora subvelutina* U9,U10PD29	-							4b				

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
Myrtaceae	*Eucalyptus crebra* U9,PD10,PD28,PD29	Narrow-leaved Ironbark				4b							
Myrtaceae	*Eucalyptus moluccana* PD9,PD10,PD28,PD29	Grey Box	5	4b	5	4b	4b	4b		5	X	X	
Myrtaceae	*Eucalyptus tereticornis* PD9,PD10,PD28,PD29	Forest Red Gum				4b		4b	4b		X		
Myrtaceae	*Melaleuca decora*[PD29]	-	4b								X		
Oleaceae	*Olea europaea* subsp. *cuspidata*	African Olive	2	4b	4b			4b	2	2	X		
Orchidaceae	*Cymbidium suave*	Native Cymbidium							1				
Oxalidaceae	*Oxalis corniculata*	Yellow Wood Sorrel			1								
Oxalidaceae	*Oxalis perennans* PD9,PD10,PD28,PD29	-	2	2			1						
Oxalidaceae	*Oxalis sp.*									1			
Pittosporaceae	*Bursaria spinosa* var. *spinosa* [PD9,PD10,PD28,PD29]	Blackthorn		2	1		1			1			
Plantaginaceae	*Plantago lanceolata*	Ribwort	3	3	3	2	3	3	6	3			
Plantaginaceae	*Plantago varia*	-	2	1									
Poaceae	*Austrodanthonia fulva*[PD29]	Wallaby Grass	2										
Poaceae	*Austrostipa elegantissima*	Feather Speargrass	2							4b			
Poaceae	*Bromus catharticus*	Prairie Grass			4b	3	4a	3					
Poaceae	*Chloris gayana*	Rhodes Grass											X
Poaceae	*Chloris ventricosa* PD9,PD10,PD28,PD29	Tall Chloris	3	2	2	2	2			2			
Poaceae	*Echinopogon ovatus* C9PD28,PD29	Forest Hedgehog Grass						1					
Poaceae	*Ehrharta erecta*	Panic Veldtgrass			4b			3	3	3			
Poaceae	*Entolasia marginata* [PD29]	Bordered Panic	2							2			
Poaceae	*Eragrostis leptostachya*[PD10,PD29]	Paddock Lovegrass											X
Poaceae	*Lolium perenne*	Perennial Ryegrass			2								
Poaceae	*Microlaena stipoides* var. *stipoides* C9,PD10,PD28,PD29	Weeping Rice Grass	6	5	4a	3	4b	2	4a	4a			

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
Poaceae	*Panicum simile* [PD29]	Two Colour Panic								2			
Poaceae	*Paspalum dilatatum*	Paspalum									X		
Poaceae	*Setaria parviflora*	Slender Pigeon Grass		2	5		2					X	
Poaceae	*Sporobolus africanus*	Parramatta Grass			2								
Polygonaceae	*Rumex brownii*	Swamp Dock			1								
Polygonaceae	*Rumex* sp.	Dock					1	1			X		
Primulaceae	*Anagallis arvensis*	Scarlet Pimpernel					2			1			
Rubiaceae	*Asperula conferta*[PD28,PD29]	Common Woodruff							4a				
Solanaceae	*Lycium ferocissimum*	African Boxthorn							1	1			
Solanaceae	*Physalis peruviana*	Cape Gooseberry	1					1					
Solanaceae	*Solanum campanulatum*	-	2		1					2			
Solanaceae	*Solanum chenopodioides*	Whitetip Nightshade		1	1			2		2			
Solanaceae	*Solanum nigrum*	Black Nightshade	1		1				1	1	X		
Typhaceae	*Typha* probably *domingensis*	Narrow-leaved Cumbungi									X		

Appendix 10

Fauna Recorded During Field Surveys



Type/Species	Location/Habitat
Amphibians	
Common Eastern Froglet *Crinia signifera*	Siltation Dam, wet soak/drainage area
Striped Marsh Frog *Limnodynastes peronii*	Siltation Dam
Whistling Tree Frog *Litoria verreauxii verreauxii*	Siltation Dam, wet soak/drainage area
Birds	
Australasian Grebe *Tachybaptus novaehollandiae*	Siltation Dam
Australian Magpie *Gymnorhina tibicen*	Throughout investigation area
Australian Raven *Corvus coronoides*	Throughout investigation area
Australian Wood Duck *Chenonetta jubata*	Siltation Dam
Australian White Ibis *Threskiornis molucca*	Siltation Dam
Black Swan *Cygnus atratus*	Siltation Dam
Common Myna *Acridotheres tristis* *	Throughout investigation area
Common Starling *Sturnus vulgaris* *	Flying over site
Eastern Rosella *Platycercus eximius*	Throughout investigation area
Eurasian Coot *Fulica atra*	Siltation Dam
Galah *Cacatua roseicapilla*	Throughout investigation area; in trees with hollows
Great Egret *Ardea alba*	Siltation dam
Grey Butcherbird *Cracticus torquatus*	Throughout investigation area
Intermediate Egret *Ardea intermedia*	Siltation dam
Laughing Kookaburra *Dacelo novaeguineae*	Throughout investigation area
Little Corella *Cacatua sanguinea*	Flying over investigation area
Little Pied Cormorant *Microcarbo melanoleucos*	Siltation dam
Magpie Lark *Grallina cyanoleuca*	Throughout investigation area
Noisy Miner *Manorina melanocephala*	Throughout investigation area
Pied Cormorant *Phalacrocorax varius*	Siltation Dam
Purple Swamphen *Porphyrio porphyrio*	Siltation Dam
Rainbow Lorikeet *Trichoglossus haematodus*	Woodland near dam
Red Wattlebird *Anthochaera carunculata*	Woodland
Red-whiskered Bulbul *Pycnonotus jocosus* *	Throughout investigation area
Spotted Pardalote *Pardalotus punctatus*	Throughout investigation area

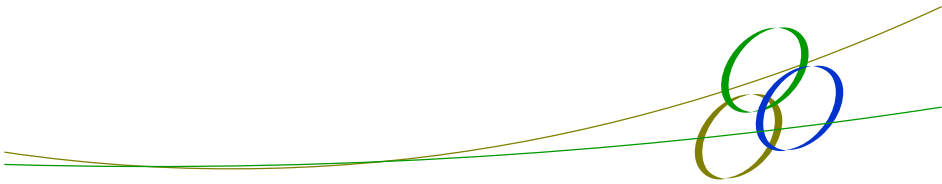
Type/Species	Location/Habitat
Spotted Turtledove *Streptopelia chinensis* *	Throughout investigation area
Sulphur-crested Cockatoo *Cacatua galerita*	Throughout investigation area
White-faced Heron *Egretta novaehollandiae*	Siltation Dam; flying over site
White-necked Heron *Ardea pacifica*	Siltation Dam
Willie Wagtail *Rhipidura leucophrys*	Next to dam
Yellow-faced Honeyeater *Lichenostomus chrysops*	Throughout investigation area, in trees
Mammals	
Common Ringtail Possum *Pseudocheirus peregrinus*	In tree, within investigation area
Chocolate wattled bat *Chalinolobus morio*	Woodland area / dam
Eastern bentwing bat *Miniopterus schreibersii oceanensis*	Woodland area / dam
East-coast freetail bat *Mormopterus (Micronomus) norfolkensis*	Woodland area / dam
Eastern freetail bat *Mormopterus (Ozimops) ridei*	Woodland area / dam
Eastern forest bat *Vespadelus pumilus*	Woodland area / dam
Gould's wattled bat *Chalinolobus gouldii*	Woodland area / dam
Grey-headed Flying Fox *Pteropus poliocephalus*	In tree at edge of woodland next to dam
Little bentwing bat *Miniopterus australis*	Woodland area / dam
Yellow-bellied sheathtail bat *Saccolaimus flaviventris*	Woodland area / dam
White-striped freetail bat *Tadarida australis*	Woodland area / dam

Note: * denotes introduced species

Species in **bold** text are threatened at a Commonwealth or State level.

Appendix 11

Microchiropteran Bat Data (Anabat)



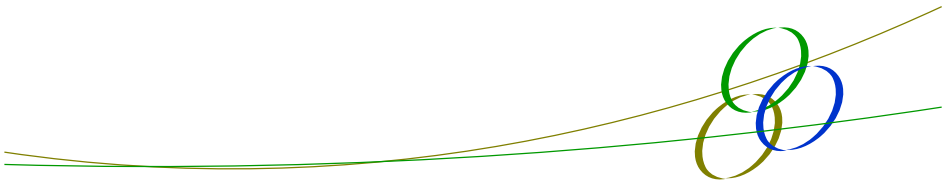
Call #	Date	Frequency of call (kHz)	Species (frequency range)	Certainty of ID definite/probable/possible
1	20/06/12	47 – 47.5	*Vespadelus regulus* (43.5-46) *Miniopterus schreibersii oceanensis* (44 – 47.)5	Possible *Vespadelus regulus* or possible *Miniopterus schreibersii oceanensis*.
2	20/06/12	45 - 45.5	*Vespadelus regulus* (43.5-46) *Miniopterus schreibersii oceanensis* (44 – 47.5)	Probable *Miniopterus schreibersii oceanensis*. See comment 1
3	20/06/12	28 -32.5	*Chalinolobus gouldii* (27.5 – 32.5)	Definite *Chalinobus gouldii.*
4	20/06/12	40.5 – 42.5	*Vespadelus* sp.	Probable *Vespadelus* sp.
5	22/06/12	46.5 – 47.5	*Miniopterus schreibersii oceanensis* (44 – 47.5)	Probable. See comment 2
5	22/06/12	42.5 – 43.5	*Vespadelus* sp.	Probable See comment 2
6	22/06/12	42 - 45	*Miniopterus schreibersii oceanensis* (44 – 47.5) and *Vespadelus darlingtoni* (40 - 43)	Probable *Miniopterus schreibersii oceanensis*
7	22/06/12	47- 48	*Miniopterus schreibersii oceanensis* (44 – 47.5)	Probable
8	22/06/12	40	*Falsistrellus tasmaniensis* (35.5 – 39)	Possible. See comment 3

Comments

1. Time between calls slightly variable.
2. Two bats calling simultaneously.
3. Frequency a touch high but call shape separates from other species in this range.

Appendix 12

Hollow Bearing Tree Assessment

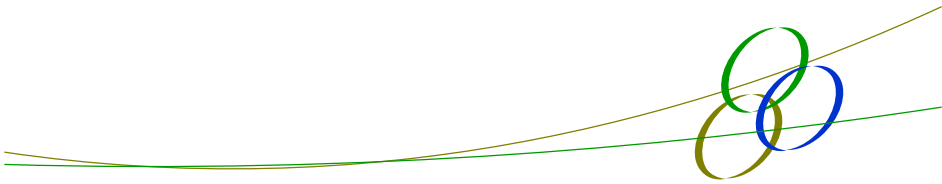


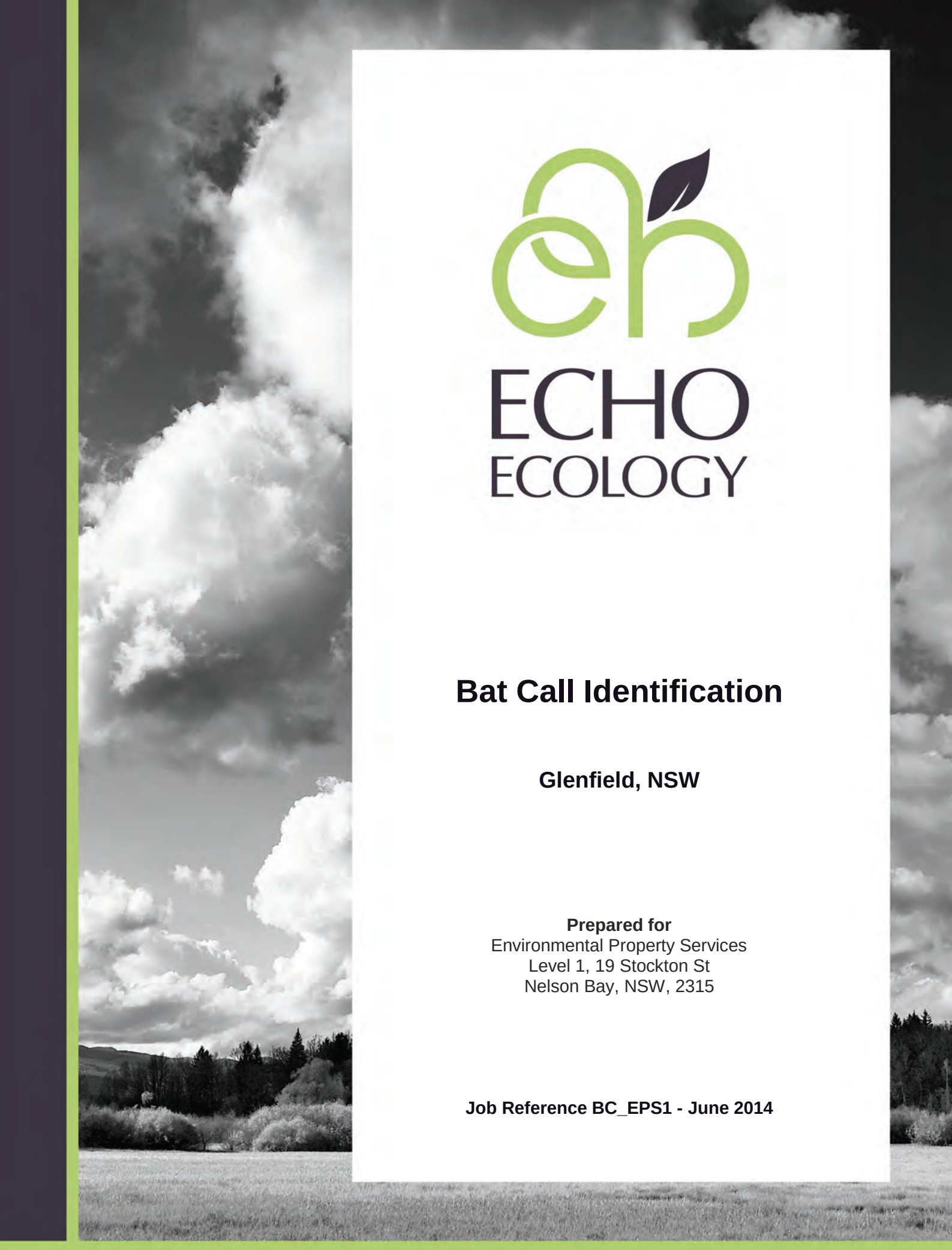
Tree ID	Easting	Northing	Species	DBH (cm)	No. Hollows
1	306340	6373660	Dead Tree	40	1 – Trunk Hollow
2	306704	6239378	*E. tereticornis*		3-4 Branch Hollows
3	306681	6239390	*E. tereticornis*		
4	306681	6239396	*E. moluccana*		1 – Trunk Hollow at ground level
5	306650	6239453	*E. moluccana*		1 – Trunk Hollow, vertical spout
6	306587	6239488	*E. moluccana*		5 – Hollows (potential ringtail possum)
7	306565	6239466	*E. moluccana*		1-2 Hollows
8	306532	6239476	*E. moluccana*		3-4 Hollows (horizontal limbs)
9	306530	6239495	*E. moluccana*	85	1 – Hollow, vertical spout
10	306448	6239491	*E. moluccana*	30	1 – Hollow
11	306427	6239494	*E. moluccana*	40	1 – Hollow
12	306414	6239506	*E. moluccana*	40	1 – Trunk Hollow
13	306375	6239512	*E. moluccana*		1 – Open Vertical Spout
14	306356	6239508	*E. moluccana*	30	1 – Trunk Hollow
15	306310	6239511	*E. moluccana*	60	1 – Trunk Hollow (partially dead tree)
16	306259	6239490	*E. moluccana*	100	1 – Horizontal Hollow Branch
17	306260	6239482	*E. moluccana*		Old termite nest, top been removed to form cup shape
18	306233	6239499	*E. moluccana*	35	Hollow trunk (European Bees present)
19	306165	6239524	*E. moluccana*	35	1 – Dead Vertical Branch
20	306094	6239532	*E. moluccana*	50	1 – Trunk Hollow
21	306081	6239540	*E. tereticornis*	100	1 – Trunk Hollow (no scratches present)
22	306542	6239655	*A. floribunda*	50	1 – Branch end hollow
23	306494	6239525	*E. moluccana*	40	1 – Trunk Hollow – 3m above ground
24	306498	6239507	*E. tereticornis*	50	2 – Trunk Hollows
25	306503	6239531	*E. moluccana*	50	2 – branch hollows (spout)
26	306487	6239579	*E. moluccana*	60	6 – Dead Branch Hollows – Galah present
27	306528	6239597	*E. moluccana (dead)*		6 – Trunk Hollows
28	306524	6239611	*E. moluccana*	70	7 – Branch Hollows
29	306520	6239626	*E. moluccana*	70	8 – Branch ends

30	306465	6239620	*E. moluccana*	80	10 – Branch Hollows; 1 – Trunk Hollow (white feathers at base of tree)
31	306501	6239692	*E. tereticornis*	80	1 – Trunk (fork) Hollow
32	306506	6239693	*E. tereticornis*	75	2 – Branch Hollows
33	306452	6239678	*E. moluccana*	90	7 – Branch Hollows
34	306431	6239671	*E. moluccana*	35	2 – Branch Hollows
35	306407	6239672	*E. moluccana*	100	3 – Branch Hollows; 1 – Trunk Hollow (Galah Present, feathers on ground)
36	306386	6239634	*E. moluccana*	85	5 – Trunk Hollows
37	306433	6239541	*E. moluccana*	80	9 – Branch Hollows; 2 – Trunk Hollows
38	306433	6239419	*E. moluccana*	60	3 – Branch Hollows

Appendix 13

Bat Call Identification Report





ECHO ECOLOGY

Bat Call Identification

Glenfield, NSW

Prepared for
Environmental Property Services
Level 1, 19 Stockton St
Nelson Bay, NSW, 2315

Job Reference BC_EPS1 - June 2014

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This report has been prepared to document the analysis of digital ultrasonic bat echolocation calls received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by

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PhD, B.Env.Sc.

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1.0 INTRODUCTION

This report has been commissioned by Environmental Property Services to analyse bat echolocation call data (Anabat, Titley Electronics) collected from Glenfield, NSW. Data was provided electronically to the author. This report documents the methods involved in analysing bat call data and the results obtained only.

2.0 METHODS

The identification of bat echolocation calls recorded during surveys was undertaken using AnalookW (Version 4.0r) software. The identification of calls was undertaken with reference to Pennay and others (2004) and through the comparison of recorded reference calls from the Sydney Basin. Reference calls were obtained from the NSW database and from the authors personal collection.

Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species
- Probable - Pass identified to species level and there is a low chance of confusion with another species
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality
- Unknown - Either background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

Call sequences that were less than three pulses in length were not analysed and were assigned to 'Unknown' and only search phase calls were analysed. Furthermore, some species are difficult to differentiate using bat call analysis due to overlapping call frequencies and similar shape of plotted calls and in these cases calls were assigned to species groups.

The total number of passes (call sequences) per unit per night was tallied to give an index of activity.

It should be noted that the activity levels recorded at different sites may not be readily able to be compared. Such comparisons are dependent on many variables which need to be carefully controlled during data collection and statistically analysed. Influential variables include wind, rain, temperature, duration of recording, season, detector and microphone sensitivity, detector placement, weather protection devices etc.

2.1 Characteristics Used to Differentiate Species

Miniopterus australis was differentiated from *Vespadelus pumilus*, by characteristic frequency or the presence of a down-sweeping tail on pulses. Call sequences which had a majority of pulses containing an up-sweeping tail were assigned to *Vespadelus pumilus*.

Calls from *Mormopterus* sp. were differentiated by the presence of mainly flat pulses. *Mormopterus norfolkensis* was differentiated from *Mormopterus* species 2 in long call sequences where pulses alternated, often with a downward sloping tail.

Chalinolobus gouldii was differentiated from other species by the presence of curved, alternating call pulses.

Scotorepens orion, *Scoteanax rueppellii* and *Falsistrellus tasmaniensis* were unable to be differentiated from one another.

Myotis macropus, Nyctophilus geoffroyi and *Nyctophilus gouldi* were unable to be differentiated from one another.

Tadarida australis were differentiated from other bat species on the basis of characteristic frequency.

3.0 RESULTS

A total of 474 call sequences were recorded, of which 303 call sequences were able to be analysed (ie were not 'noise' files or bat calls of short length). Of the bat calls, 106 call sequences (35 %) were able to be confidently identified (those classified as either definite or probable identifications) to species level (Table 3-1). Species recorded confidently within the site include:

- *Chalinolobus gouldii* (Gould's wattled bat)
- *Mormopterus norfolkensis* (East-coast freetail bat)
- *Mormopterus* species 2 (Eastern freetail bat)
- *Tadarida australis* (White-striped freetail bat)
- *Vespadelus pumilus* (Eastern forest bat)

Additionally, the following bat species potentially occurred within the site, but could not be confidently identified (those calls classified as possible or as a species group):

- *Falsistrellus tasmaniensis* (Eastern falsistrelle)
- *Miniopterus australis* (Little bentwing bat)
- *Miniopterus schreibersii oceanensis* (Eastern bentwing bat)
- *Myotis macropus* (Large-footed myotis)
- *Nyctophilus geoffroyi* (Lesser long-eared bat)
- *Nyctophilus gouldi* (Gould's long-eared bat)
- *Scoteanax rueppellii* (Greater broad-nosed bat)
- *Scotorepens orion* (Eastern broad-nosed bat)
- *Vespadelus darlingtoni* (Large forest bat)
- *Vespadelus regulus* (Southern forest bat)

It should be noted that additional bat species may be present within the site but were not recorded by the detectors and habitat assessment should be used in conjunction with these results to determine the likelihood of occurrence of other bat species.

Table 3-1 below summarises the results of the bat call analysis.

Table 3-1: Results of bat call analysis (number of passes per site per night)

IDENTIFICATION	Anabat 1 25/05/2014	Anabat 1 26/05/2014	Anabat 1 27/05/2014	Anabat 1 28/05/2014
DEFINITE				
Chalinolobus gouldii	-	-	1	-
Mormopterus norfolkensis	1	4	2	-
Mormopterus species 2	8	13	5	-
Tadarida australis	12	9	7	-
PROBABLE				
Chalinolobus gouldii	-	1	-	-
Mormopterus norfolkensis	3	1	2	2
Mormopterus species 2	8	8	14	-
Tadarida australis	-	3	1	-
Vespadelus pumilus	-	-	1	-
POSSIBLE				
Mormopterus norfolkensis	1	1	2	-
Mormopterus species 2	-	-	2	-
Tadarida australis	-	1	-	-
SPECIES GROUPS				
Chalinolobus gouldii / Mormopterus norfolkensis / Mormopterus species 2	16	22	35	2
Chalinolobus gouldii / Mormopterus species 2	7	13	8	-
Falsistrellus tasmaniensis / Scotorepens orion	-	1	-	-
Falsistrellus tasmaniensis / Scotorepens orion / Scoteanax rueppellii	1	3	2	-
Miniopterus australis / Vespadelus pumilus	-	-	2	-
Miniopterus schreibersii oceanensis / Vespadelus darlingtoni / Vespadelus regulus	1	5	2	-

IDENTIFICATION	Anabat 1 25/05/2014	Anabat 1 26/05/2014	Anabat 1 27/05/2014	Anabat 1 28/05/2014
Mormopterus norfolkensis / *Mormopterus* species 2	7	23	37	1
Myotis macropus / *Nyctophilus geoffroyi* / *Nyctophilus gouldi*	1	-	-	-
Vespadelus darlingtoni / *Vespadelus regulus*	1	-	-	-
UNKNOWN				
'Noise' files	11	13	5	-
Unknown	45	52	43	2
TOTAL	**123**	**173**	**171**	**7**

4.0 SAMPLE CALLS

A sample of the calls actually identified from the site for each species is given below.

Figure 4-1: *Chalinolobus gouldii* definite call

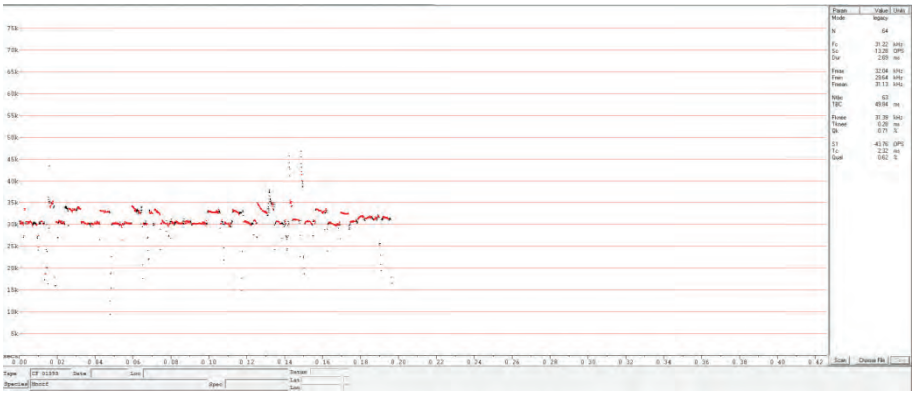

Figure 4-2: *Mormopterus norfolkensis* definite call

Figure 4-3: *Mormopterus* species 2 definite call

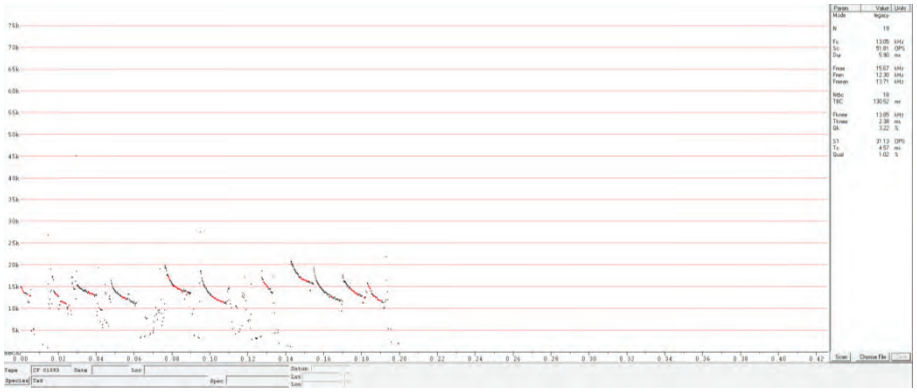

Figure 4-4: *Tadarida australis* definite call

Figure 4-5: *Vespadelus pumilus* probable call

5.0 REFERENCES

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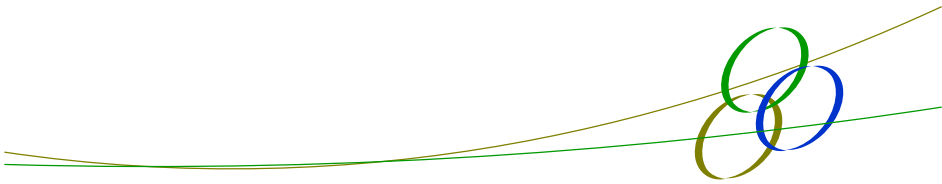
Appendix 14

Fieldwork Dates Overview



Fieldwork activity	By	Date	Time (hr)	year
Preliminary Site investigation	EPS	28th March	Not specified	2012
Diurnal bird Survey	EPS	30th May	0900-1300	2012
Diurnal bird Survey	EPS	21st June	0800-1400	2012
Nocturnal arboreal mammals, birds and microchiropteran Bat Surveys	EPS	20th & 21st June	Night hours x2 separate 1hr searches	2012
Preliminary floristic surveys	EPS	30th May & 12th July	Not specified	2012
Amphibian and Reptile surveys	EPS	30th May	0900-1300	2012
Amphibian and Reptile surveys	EPS	21st June	0800-1400	2012
Targeted Flora Survey *Pimelea spicata*	EPS	17th December	1000-1600	2013
Nocturnal arboreal mammal surveys	EPS	29th April	1800-2000	2014
Nocturnal arboreal mammal surveys	EPS	25th June	1730-2030	2014
Microchiropteran bat recordings	EPS	29th April, 25th, 26th & 27th June	Recorded during night hours	2014
Diurnal Bird surveys	EPS	29th April	1430-1630	2014
Diurnal Bird surveys	EPS	30th April	0800-1000	2014
Nocturnal bird surveys	EPS	29th April	1800-2000	2014
Nocturnal bird surveys	EPS	25th June	1730-2030	2014
Amphibian and Reptile surveys	EPS	29th April	1430-1630	2014
Amphibian and Reptile surveys	EPS	30th April	0800-1000	2014
Amphibian and Reptile surveys	EPS	29th April	1800-2000	2014
Amphibian and Reptile surveys	EPS	25th June	1730-2030	2014
Targeted fauna survey (Green & Golden Bell Frog and Cumberland Plain Land Snail)	EPS	29th April	1430-1700	2014
Targeted fauna survey (Green & Golden Bell Frog and Cumberland Plain Land Snail)	EPS	30th April	0800-1100	2014
Dip netting for tadpoles & searches targeting Green & Golden Bell Frog	EPS	24th February	1700-2100	2015
Diurnal Bird surveys	EPS	24th February	1700-1930	2015

Fieldwork activity	By	Date	Time (hr)	year
Call Playback survey for Green & Golden Bell Frog	EPS	24th February	1930-2105	2015
Micro-chiropteran bat surveys	EPS	24th February	1930-2105	2015
Dip netting for tadpoles & searches targeting Green & Golden Bell Frog	EPS	25th February	1700-2100	2015
Diurnal Bird surveys	EPS	25th February	1700-2000	2015
Call Playback survey for Green & Golden Bell Frog	EPS	25th February	1900-2035	2015
Micro-chiropteran bat surveys	EPS	25th/26th February	Over 1 night from 1900 on the 25th	2015
Dip netting for tadpoles & searches targeting Green & Golden Bell Frog	EPS	26th February	1730-2100	2015
Diurnal Bird surveys	EPS	26th February	1730-1900	2015
Call Playback survey for Green & Golden Bell Frog	EPS	26th February	1900-2020	2015
Micro-chiropteran bat surveys	EPS	26th/27th February	Over 1 night from 1900 on 26th	2015
Micro-chiropteran bat surveys	EPS	27th/28th February	Over 1 night from approximately 1900 on the 27th	2015
Dip netting for tadpoles & searches targeting Green & Golden Bell Frog	EPS	28th February	1730-2100	2015
Diurnal Bird surveys	EPS	28th February	1730-1930	2015
Call Playback for Green & Golden Bell Frog	EPS	28th February	1845-2030	2015
Micro-chiropteran bat surveys	EPS	28th February	1900-2100	2015