

MOLINO STEWART
ENVIRONMENT & NATURAL HAZARDS

Hurstville City Council

**Oatley Aged Care Facility,
Ecological Constraints
Assessment**

Final Report



Oatley Aged Care Facility, Ecological Constraints Assessment

FINAL REPORT

for

Hurstville City Council

by

Molino Stewart Pty Ltd

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1 INTRODUCTION

1.1 INTRODUCTION

Hurstville City Council (Council) seeks to rezone vacant land at River Road, Oatley (adjacent to Myles Dunphy Reserve) for the purposes of aged care accommodation and ancillary services.

This ecological constraints assessment is submitted to Council to provide guidance on ecological constraints for the rezoning and development for an aged care facility on the previous Oatley Bowling Club.



Figure 1 Site location.

1.2 LOCATION

The subject site is located at the southern end of River Road, Oatley. The subject site is bound to the east by the Illawarra Railway Line (including Oatley train station), to the west and south by Myles Dunphy Reserve (MDR) and to the north by residential properties (Figure 2).

River Road is a cul-de-sac road that is approximately eight metres wide that connects with Mulga Road at its northern extent. Residential lots line its eastern side and the MDR is on its western side. This road provides access to a gated, three metre wide driveway to a previous car park for the bowling club. A pedestrian path for access to MDR occurs on the western side of the subject site.

The subject property still includes two lawn bowling greens and a car parking area that was part of the previous bowling club facility. The bowling greens are in the north of the site. A block retaining wall was constructed along the western and southern edges of the bowling greens to create a level surface. Below this is River Road with a drop of over four metres in the southwest corner of the bowling greens.

The car parking area is in the southern part of the grounds with a retaining wall constructed along the western boundary.

The southern boundary is defined by a deep ravine within MDR.

The planting of native and exotic trees and shrubs as landscaping around the perimeter of the car parking area in combination with the retaining walls creates a barrier between the development site and MDR.

Regrowth exotic and native tree and shrubs occur in a narrow strip of vegetation along the eastern boundary next to the railway line. This area also includes a track for access to the train lines. A small clump of trees occurs within the development site near the eastern boundary.

Summary photographs of the development area are presented in Figure 3 .

The subject property is zoned RE1 Public Recreation under the Hurstville Local Environment Plan (HLEP) 2012, and is adjacent to R2 Low Density Residential and SP2 Infrastructure zones (Figure 4).

1.3 THE PROPOSAL

Council seeks to have the vacant land developed for the purposes of aged care accommodation and ancillary services.

The site is currently zoned RE1 Public Recreation under the Hurstville Local Environment Plan (HLEP) 2012 and is classified as 'community land' under the Local Government Act 1993. An amendment to the HLEP 2012 is therefore required to rezone and reclassify the subject site to enable the development of residential aged care/retirement living accommodation.



Figure 2 Location of subject site and surrounding land use



Figure 3 Photographs clockwise from top left; showing the overgrown bowling greens, block retaining walls with small openings along western edge and the entry to the bowling greens from the car park

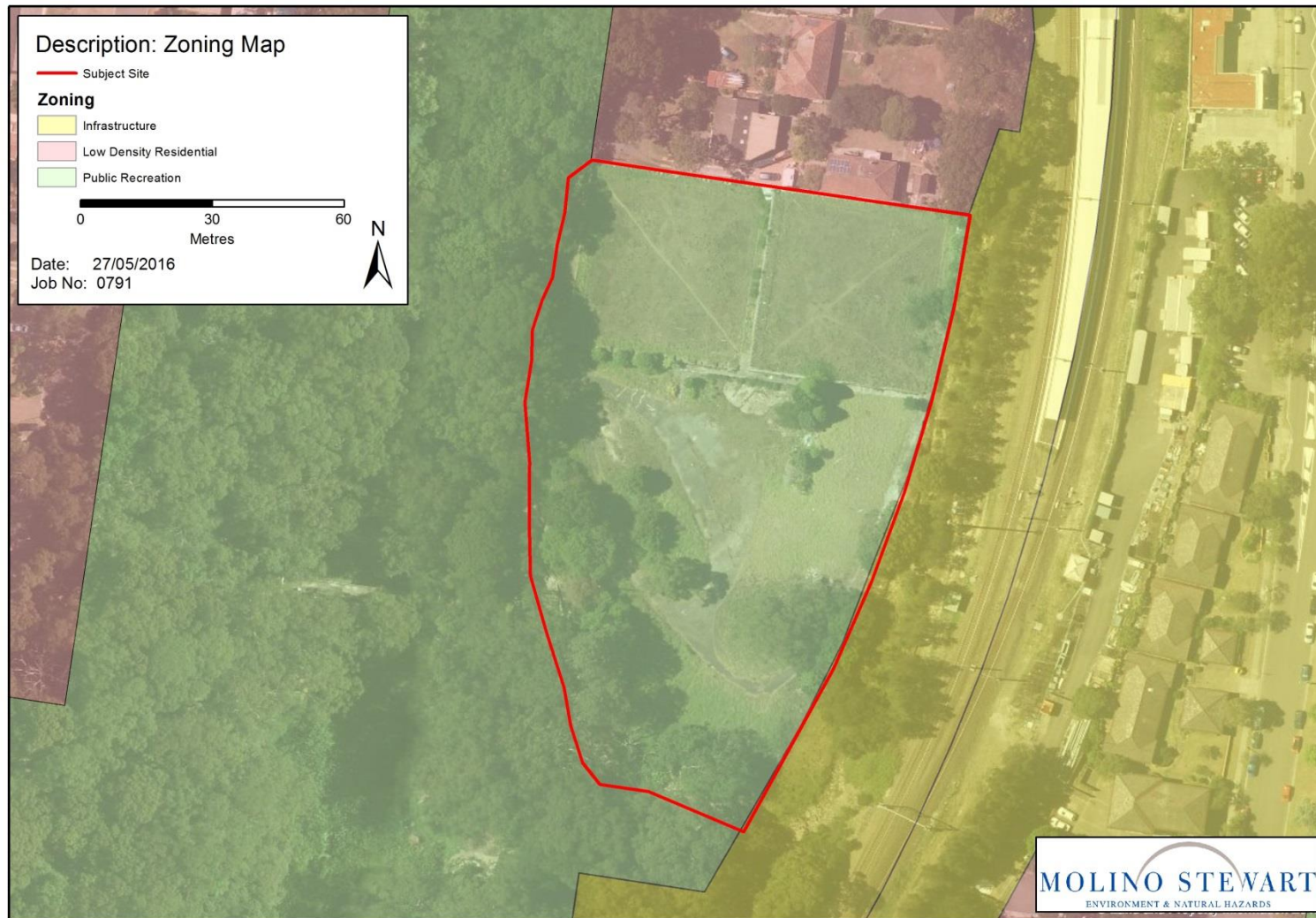


Figure 4 Zoning map of subject site and surrounding area.

2 METHODOLOGY

2.1 LEGISLATION AND GUIDELINES

The Ecological Constraints Assessment was conducted in accordance with the following legislation:

- Part 4 of the NSW Environmental Planning & Assessment (EP&A) Act (1979);
- NSW Threatened Species Conservation (TSC) Act (1995);
- Water Management Act (2000);
- Commonwealth Environmental Protection and Biodiversity Conservation Act (1999);
- State Environmental Planning Policy (SEPP) No. 19 – Protection of Urban Bushland;
- SEPP No. 14 – Coastal Wetlands;
- SEPP No. 26 – Littoral Rainforest;
- SEPP No. 44 – Protection of Koala Habitat, and
- Commonwealth Environmental Protection and Biodiversity Conservation (EPBC) Act (1999).

The Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (DEC, 2004) facilitate informed decision making at the local scale for individual development activities with particular regard to: preliminary flora and fauna determination; and Assessment of Significance. The Guidelines were applied with the following objectives:

- Determining the threatened flora species recorded from the locality;
- Assessing the vascular flora species capable of being identified, searching for threatened flora species and the description of vegetation associations on site;
- Determining the threatened fauna species occurring in the locality;
- Searching for threatened fauna species; and

- Assessing the habitat value of the site for threatened fauna species.

2.2 PERSONNEL

The wildlife survey and assessment was conducted by the following personnel in accordance with the Office of Environment and Heritage (OEH) Scientific Licence and Department of Primary Industries (DPI) Animal Research Authority.

2.2.1 Stephen Cotter

a) Qualifications:

Bachelor of Arts (University of New England) in Australian Plants, Aquatic Ecology, Biogeography

Bachelor of Applied Science (Hons) (Southern Cross University)

Master of Science (Southern Cross University)

Graduate Diploma in Bushfire Protection (University of Western Sydney)

b) Licences / Approvals:

Scientific Licence Number SL100527 (issued under s132c, NPW Act, 1974)

Animal Research Authority (granted by the Director General, Dept. Industry & Investment)

Animal Care and Ethics Committee approval (granted under the Director General's Animal Care and Ethics Committee, Dept. Industry & Investment)

c) Experience:

More than 15 years in private environmental consultancy.

2.3 BACKGROUND RESEARCH

In completing the flora assessment, the following methods were applied:

- Review of previous studies completed in the area;
- Determination of threatened species possibly located in the area by a desktop search of the BioNet Atlas (OEH, 2015);
- A search of records of species listed under the schedules of the Commonwealth EPBC Act were obtained using the protected matters search tool (<http://www.environment.gov.au/topics/about-us/legislation/environment-protection-and-biodiversity-conservation-act-1999/protected>);
- The Native Vegetation Maps of the Sydney Metropolitan area (OEH, 2013) were overlaid on the proposed development site to determine the likelihood of the presence of endangered ecological communities (EECs); and
- Field-based surveys of the subject land comprising random walk and targeted threatened species surveys; and
- Review of bushfire constraints assessment (information provided by Council) and relevant aspects of the Myles Dunphy Reserve and Wetland Plan of Management;

In completing the fauna assessment the following methods were applied:

- A review of previous studies of the area;
- Search of the BioNet Atlas for known occurrences of threatened species in the area;
- Night survey including stag watching;
- Observations of proxy evidence (scats, tracks, diggings);
- Bird surveys
- Call playbacks;
- Motion-detecting camera survey; and
- Bat echo-locational survey.

2.4 HABITAT ASSESSMENT

The habitat assessment focussed on recording the following features. Particular attention was paid to searching for scats, tracks or other signs of fauna activity.

- The presence of mature trees with hollows, fissures and/or other suitable roosting/nesting places;
- The condition, flow and water quality of drainage lines and bodies of water;
- Areas of dense vegetation;
- The presence of hollow logs/debris and areas of dense leaf litter;
- The presence of fruiting flora species;
- The presence of blossoming flora species, particularly winter-flowering species;
- Vegetation connectivity and proximity to neighbouring areas of intact vegetation;
- The presence of caves and man-made structures that may be suitable for bat roost sites; and
- The presence of bulky nests which may belong to raptors.

2.5 FIELD SURVEYS

An initial transverse of the subject property was made by foot to assess the existing vegetation and potential survey zones. The subject property was considered to have three survey zones. The first zone is the '*Cleared grassland/Partially Landscaped Area*' of the bowling club and vehicle parking area. The second survey zone is '*Drainage Line (creek and associated riparian vegetation)*' within the southern extent (Lot 20, DP7124) that occurs within the riparian zone of the stream. The third survey zone is the '*Open Forest*' adjacent to the River Road at the northern extent of MDR. Survey zones 2 and 3 are within MDR.

2.5.1 Flora assessment

The property contains modified native and exotic vegetation within the subject site. A random walk through the subject site of retained vegetation and around the perimeter

was conducted to assess any threatened flora present. The survey was undertaken by Stephen Cotter on 11th February 2016.

2.5.2 Fauna Survey

The subject property adjoins areas of managed native and exotic vegetation and may provide suitable habitat for a number of ground-dwelling and native fauna.

a) Stag Watching

Hollow-bearing trees are suitable habitat for gliders and possums. Stag watches of identified hollow-bearing trees commenced approximately half an hour before sunset, finishing an hour after sunset. A total of one hour was allocated to this survey

b) Spotlighting

Spotlighting was conducted for the mature canopy trees close to the western extent of the subject site in areas of open understorey vegetation to detect ground-dwelling mammals. The subject property is bound on the eastern and northern extent by the existing road and rail network and/or residential development that pose significant edge effects and barriers to fauna movement such that native fauna would only be expected to occur in the western and southern parts of the property where suitable habitat exists. A survey effort of two hours was allocated to spotlighting.

c) Scats, Tracks, Diggings and Other Searches

The area beneath the existing canopy vegetation was assessed for proxy evidence for recent arboreal animals and bird activity.

d) Motion detecting cameras

Two motion detecting cameras were positioned to record fauna activity. One camera was installed within a patch of trees within the proposed development area; the second camera was located near a large sandstone overhang within vegetation to the west of River Road. The cameras operated for

six nights. The location of the motion detecting cameras is shown in Figure 5.

e) Anabat Survey

An Anabat echo-locational detector was positioned within a potential flyway (Figure 5) and remained operating for six nights to record micro-bat activity within the open woodland areas. Data obtained was processed using the AnaLook W software. The method followed the draft recommended standards for assessing insectivorous bats using bat detectors (Australasian Bat Society, n.d.).

f) Trapping

Following the recommendations for Wildlife Surveys provided by the Animal Research Review Panel (ARRP, 2008), it was determined that trapping would not be warranted for the fauna survey.

2.6 LIMITATIONS

2.6.1 Limitations of the flora survey

The flora survey was completed over one day and followed current threatened biodiversity assessment guidelines. Whilst all reasonable attempts have been made to discern the vascular flora present, there is no assurance that other threatened species or communities are not present on the site.

2.6.2 Limitations of the fauna survey

The subject site contains cleared grassland and partially landscaped areas. The use of non-invasive techniques such as motion-detecting cameras and micro-bat echolocation detecting equipment for the ecological assessment was considered appropriate given the modified nature of the site and the limited habitat available.

As many faunal species are cryptic and/or nocturnal and/or wide-ranging and mobile, they may be unlikely to be detected even during seasonal surveys. The fauna assessment is, accordingly, largely an assessment of the potential of the subject site as habitat for

various fauna species. With the exception of species definitely recorded from the site, there is no certainty as to the presence or absence of the species discussed. Therefore it is important to adopt the precautionary principle such that it is assumed that any threatened species is likely to occur at the site if suitable habitat exists.



Figure 5 View of subject site showing location of the camera and Anabat equipment used as part of the biodiversity assessment

3 PREVIOUS STUDIES

The subject property adjoins the area of the Myles Dunphy Reserve and Wetland Plan of Management (MD PoM). Previous studies have been undertaken for both the subject site as well as the adjoining PoM area. The scientific studies prepared as part of the development of the plan of management for this reserve indicate the area to the west of the subject property retains high value resources for environmental protection and biodiversity conservation; catchment protection and water quality; and landscape character and visual amenity.

a) Vegetation Mapping

OEH vegetation mapping indicates that Sydney Sandstone Gully Forest occurs within the Reserve which borders the site on the western side of the subject site. This vegetation community transitions into Estuarine Complex in its southern section nearing Gungah Bay. The surrounding landscape is residential dwelling and cleared of vegetation and does not form a recognised community (Figure 6).

b) Previous Ecological Constraints Assessment

An ecological constraints assessment report for this site was prepared by Ambrose Ecological Services (AES) in 2007. This investigation indicated that existing vegetation on the subject property may provide suitable habitat for one fauna species listed in the schedules of the TSC Act: Powerful Owl. Four other species have been identified as potentially occurring in the area: Superb-fruit Dove, Swift Parrot, Regent Honeyeater and Grey-headed flying fox.

The site also contained potential habitat for a number of threatened flora species including: *Acacia bynoeana*, *Caladenia tessellata* and *Melaleuca deanei*.

None of these species were identified at the time of the investigation.

AES did recognise a highly disturbed environment within the subject site and described the vegetation community present as:

- Cleared and disturbed community and included exotic garden plants and environmental weeds that are now encroaching upon the areas of native vegetation on the edge of the Reserve and within drainage lines.

c) Bushfire Assessment

A bushfire constraints feasibility assessment report was prepared by Travers Bushfire and Ecology (TBE) (2014). This investigation assessed the asset protection zone (APZ) and Bushfire Attack Level (BAL) ratings.

The APZ identifies the minimum setback required for residential subdivision and habitable structures.

The BAL ratings provide an indication of future construction cost if Council chooses to utilise the subject site for future residential development or Special Fire Protection Purpose structures. A section of the north eastern corner of the subject site has been identified as developable for habitable purposes (approximately 0.2 ha).

The bushfire assessment also provided recommendations for emergency evacuation. One option considered was increasing the width of River Road to lower potential radiant heat loads during any evacuation along this route.

d) Reserve and Wetland Plan

A PoM was developed by Parkland Environmental Planners and Woodlots and Wetlands in 2013, which guides Council with the future management of Myles Dunphy Reserve and associated wetlands.

The MD PoM has been prepared with a series of Action Plans linked to the values of MDR and associated wetland. Strategies, actions, priorities, responsibilities and performance measurement are outlined to guide Council's decisions.

Vegetation communities listed in the MD PoM are shown in Figure 7 and include:

- Sydney Turpentine Ironbark Forest including *Syncarpia glomulifera*, *Angophora costata* *Eucalyptus pilularis*

and *E. piperita* in a strip bordering the proposed development site.

- Coastal Shale Sandstone Forest comprising *Corymbia glomulifera*, *Angophora costata*, *Eucalyptus pilularis*, *E. piperita*, *E. resinifera* and *Syncarpia glomulifera*
- Hinterland Riverflat Paperbark Swamp Forest dominated by *Melaleuca linariifolia* and *M. stypheloides*
- Coastal Freshwater Reedland that is mainly *Phragmites australis*

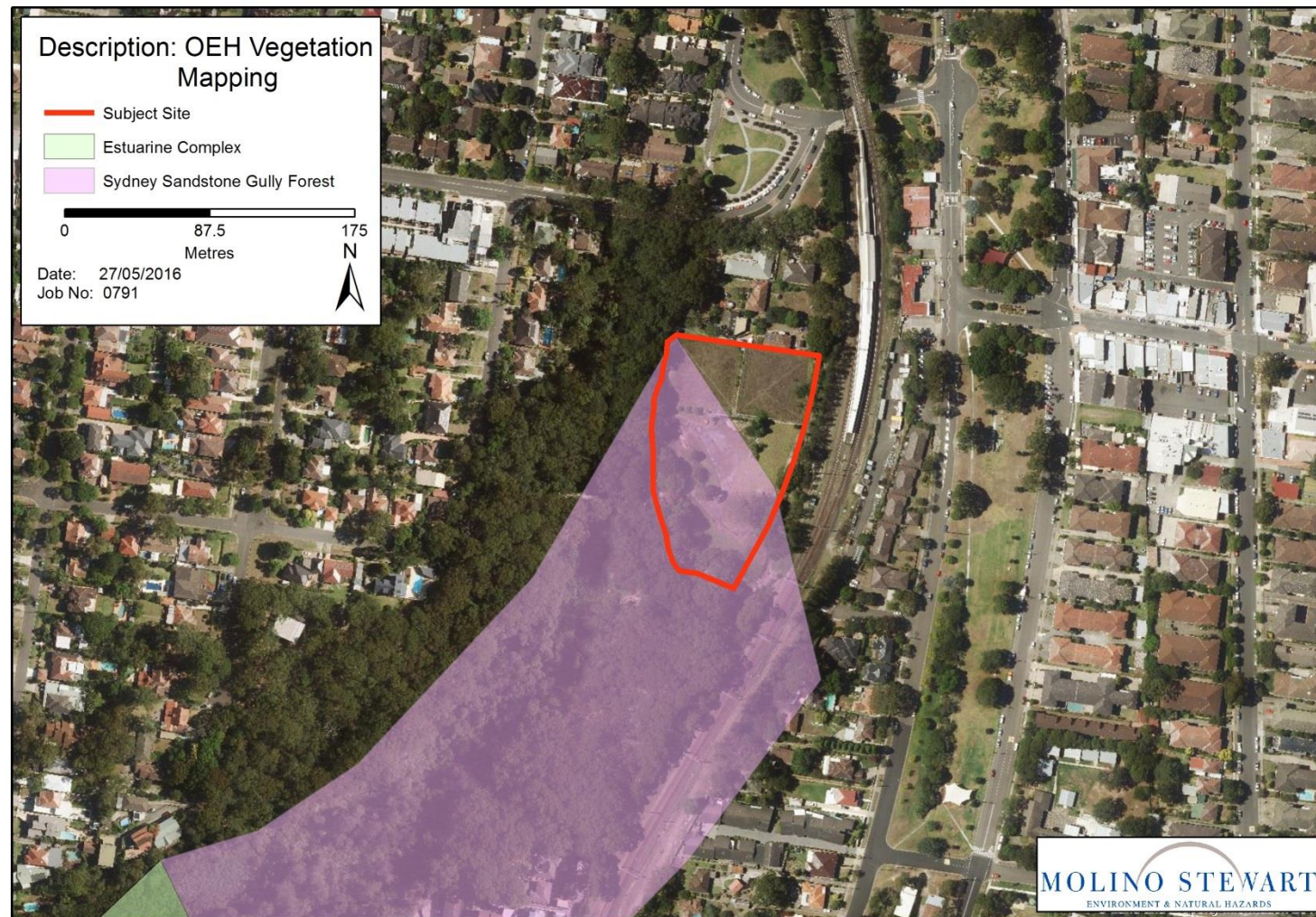


Figure 6 Vegetation mapping of the subject property undertaken by OEH for the Sydney metropolitan area



Figure 7 Vegetation communities listed in the Myles Dunphy Reserve and Wetland Plan of Management

4 EXISTING ENVIRONMENTS

4.1 LANDSCAPE CONTEXT

The site is next to existing residential areas (north) and Oatley train station and the Illawarra Railway Line (east). To the west and south is area that lies within the MD PoM.

The cadastral boundary for the development site remains to be confirmed. At present, the development site is not aligned with any cadastral boundaries.

The development site is divided into a northern and southern section arising from its past function as the Oatley Bowling Club. Figure 1 illustrates the bowling greens in the northern section clearly as two large squares (Lot 14 and 15 on DP7124). The southern section, which has been largely cleared to accommodate vehicle parking, extends approximately 70m south from the bowling greens (Lots 16 to 19 on DP7124).

The western boundary of the development site is defined by a retaining wall that was constructed to provide the car parking area for the bowling green. Pedestrian access to MDR occurs along the access track at the base of this retaining wall. The retaining wall extends from the southern extent of the subject site and ends at the southern end of River Road.

MDR is located along a vegetated gully with a small drainage line flowing through the central part from Mulga Road to the north into Gungah Bay to the south. Coastal sandstone enriched moist forest sheltered forest and sandstone gully forest occurs along this drainage merging into areas of reedland and hinterland paperbark swamp forest before reaching mangrove-fringed vegetation near Gungah Bay.

4.1.1 Drainage corridors

The subject property is located approximately 100m east of a drainage line within MRD that runs north to south-west into Gungah Bay. The drainage is impacted by exotic weeds with

landcare activities to control the spread of Privet and Lantana ongoing.

The retaining wall and the western side of River Road do not have stormwater control structures in place (e.g. gutters) and hence surface runoff flows freely into MDR. No drainage lines have developed from the runoff from River Road or the retaining wall.

The area of proposed development occurs on flat, heavily modified landscape used for vehicle parking and lawn bowls. No observable drainage lines were present on the property although seepage areas were observed in areas of exposed sandstone.

4.2 GEOLOGY, SOILS AND TOPOGRAPHY

The subject site and the portion of the Reserve to the west of the site are within the Lucas Heights soil landscape unit. The soils comprise of Yellow Podzolic soils and Yellow Soloths (Dy2.41); and Yellow earths (Gn2.24) on outer edges. The geology is comprised of interbedded shale, laminate and fine to medium grained quartz sandstone.

The south western portion of the reserve is considered part of the Gynea soil landscape and comprises medium to coarse-grained quartz sandstone with minor shale and laminate lenses (eSpade, 2016). These soils tend to have low erodibility due to high drainage and organic matter binding the sediment.

4.3 THREATENED SPECIES ASSESSMENT

The background search of the BioNet Atlas of NSW Wildlife (NPWS, 2015) and the EPBC Act using the Protected Matters Search Tool indicated that 17 records of threatened flora occurring within 10km of the subject site. The development site does not provide habitat for any of these species. The background search indicated that 26 fauna species have been recorded within 10 km of the development site. Based on the available habitat occurring on the

site or within MDR, this was reduced to five species.

The results of this preliminary assessment of the potential for the subject property to contain habitat for threatened flora and fauna is provided in Appendix A. Targeted surveys were conducted for:

- Greater Broad-nosed Bat
- Grey-headed Flying-fox
- Eastern Freetail Bat
- Powerful Owl
- Red-crowned Toadlet

4.4 SITE SURVEY

A total of 46 flora species were recorded during the random walk across the development site. The majority of the plants were exotic species planted as part of the landscaping for the bowling club. AES recorded 186 species within MDR, including 143 native species

The lists of all species identified during the flora and fauna survey are included in Appendix B.

4.5 VEGETATION COMMUNITY DESCRIPTIONS

No overstorey vegetation communities were present on the development site that could be described using the OEH Biometric Vegetation categories for the Sydney Metropolitan CMA as part of the OEH Vegetation Information System classification scheme (<http://www.environment.nsw.gov.au/research/Visclassification.htm>) due to the modified nature of this area.

4.5.1 Survey zone 1: Cleared grassland/Partially Landscaped Area

This area is significantly modified by the construction of a car parking area for the

bowling club and includes mainly exotic grasses and low shrubs (Figure 8).



Figure 8 Photographs of the bowling green and car parking showing mainly overgrown exotic grassland

Perimeter tree planting around the car park include Jacaranda (*Jacaranda mimosifolia*), Silky Oak (*Grevillea robusta*), Oleander (*Nerium oleander*) and Azalea sp. with regrowth Sweet Pittosporum (*Pittosporum undulatum*) and Cheese Tree (*Glochidion ferdinandi*) occurring along the western boundary (Figure 9).

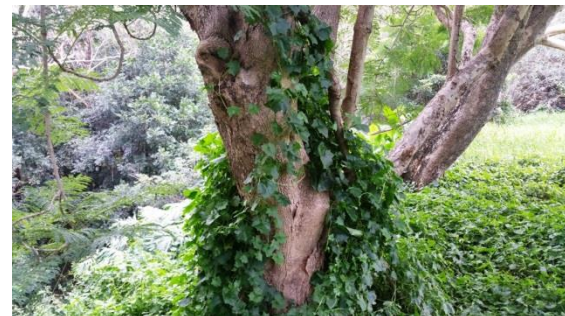


Figure 9 Jacaranda tree at southern margin of development site.

This modified community cannot be described using the Biometric Vegetation Types database due to the absence of native canopy species.

4.5.2 Survey zone 2: Drainage Line (creek and associated riparian vegetation)

A central drainage and associated riparian vegetation through the Reserve comprises patches of reedland surrounded by moist forest and paperbark swamp vegetation. The reedland comprises Black She-oak (*Allocasuarina littoralis*) and Bracken Fern (*Pteridium esculentum*) at the margins of the wetland merging into a Common Reed

(*Phragmites australis*) swamp. Exotic plants are present at the margin (Figure 10).



Figure 10 Reed swamp near the pedestrian crossing of the central drainage channel within Myles Dunphy Reserve

Downstream of the pedestrian footbridge over the central drainage line the riparian vegetation changes from the reedland to Paperbark wetland including *Melaleuca linariifolia* and *M. stypheloides* with an understorey of regrowth Broad-leaved Privet and Lantana. Further downslope the community is influenced by increasing salinity with Grey Mangrove occurring as an early colonising plant. The areas of Privet and Lantana have been subject to manual weed control (Figure 11).

4.5.3 Survey zone 3: Open Forest

The vegetation immediately to the west of River Road and continuing along the western boundary of the development site includes *Syncarpia glomulifera* (Turpentine) and

Angophora costata (Smooth-barked Apple) with occasional *Eucalyptus pilularis* (Blackbutt), *E. piperita* (Sydney Peppermint) and *E. resinifera* (Red Mahogany). The mid-storey trees are dominated by *Pittosporum undulatum* (Sweet Pittosporum) and *Glochidion ferdinandi* (Cheese Tree) and *Allocasuarina torulosa* (Forest Oak) with an open groundcover of mainly leaf litter (Figure 12).



Figure 11 Weed control within the riparian vegetation along the central drainage in Myles Dunphy Reserve



Figure 12 Turpentine - Smooth-barked Apple closed forest within Myles Dunphy Reserve

This association is consistent with Coastal sandstone-enriched Moist forest (S_WSF06) after OEH (2013) and is consistent with the NSW Scientific Committee determination for Sydney Turpentine Ironbark Forest EEC as listed in the MD PoM. This community occurs along the southern margin of the development site

The vegetation communities recorded during the ecological assessment are shown in Figure 13.

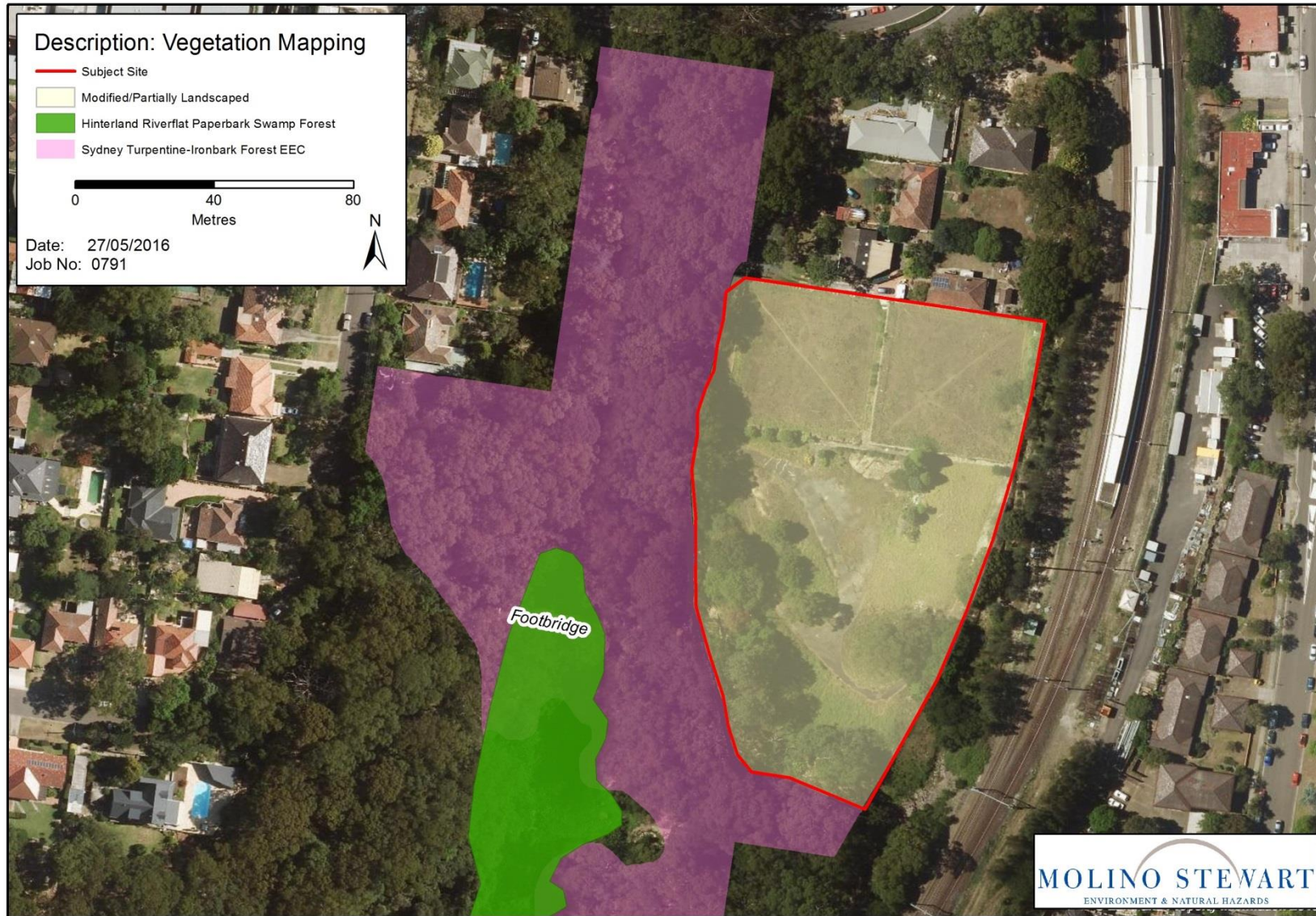


Figure 13 Vegetation communities observed during the ecological assessment of the development site

4.5.4 Threatened Ecological Communities

No threatened ecological communities occur within the proposed development site.

The vegetation within MDR next to the development site is considered representative of Sydney Turpentine Ironbark Forest (STIF) that is listed as an EEC in the schedules of the TSC Act and also as a critically endangered ecological community (CEEC) under the EPBC Act.

The MD PoM also described areas of Coastal Freshwater Reedland along the central drainage. This community may also represent Coastal Freshwater Wetlands EEC. The other vegetation communities within the MDR form part of the sandstone enriched assemblage of communities within southern Sydney. There is a sharp ecotone between the Freshwater wetland and the STIF EEC (Figure 14).



Figure 14 Patch of wetland vegetation up slope of the pedestrian foot bridge showing sharp boundary to surrounding STIF EEC

4.6 THREATENED SPECIES AND POPULATIONS

4.6.1 Flora

No threatened flora was recorded during the survey of the proposed development site area. The area has been significantly modified by past land uses.

No threatened flora was recorded within the surveyed parts of MDR.

4.6.2 Fauna

Analysis of the sonographs recorded using the Anabat equipment indicated it detected three likely and one possible record for species of micro-bats within the adjacent MDR. The activity over a six night survey was relatively high and hence high degree of confidence is placed in the results (Appendix C). Two likely species recorded are listed as threatened in the TSC Act (Greater Broad-nosed Bat and Little Bentwing Bat).

The motion-detecting camera did not record any fauna within the development site and spotlighting was also unsuccessful in detecting arboreal fauna.

No other threatened fauna were recorded during the survey. A discussion of the recorded and potential threatened fauna targeted in the survey is provided below.

a) Greater Broad-nosed Bat

This species was detected from the Anabat survey. The equipment was set up overlooking a small drainage line that flows from beneath the railway line towards MDR. The levelling of the car parking area has created a steep escarpment to the south of the development site. This escarpment includes areas of exposed sandstone overhangs and ledges that could provide habitat for this species. The drainage line provides a flyway towards the central drainage line within MDR with the forest canopy providing foraging resources for this species. The gaps within the block retaining walls surrounding the bowling green and car park may also provide shelter for this species.

b) Little Bentwing Bat

The sonograph for the Little Bentwing Bat does overlap with the Eastern Forest Bat but is distinguished by the presence of the down sweeping tail in the observed sonograph. This species forages within the tree canopy. Suitable habitat is present within MDR but not within the development site

c) Grey-headed Flying-fox

A temporary Grey-headed Flying-fox colony is known within MDR, with the Coastal Paperbark Swamp vegetation providing a seasonal food resource. This area is located greater than 500 metres from the development site. However, landscaping trees planted around the perimeter of the car park, such as the Silky oak (*Grevillea robusta*) may provide a foraging resource.

d) Eastern Freetail-bat

This species was not detected by the Anabat survey but has been recorded within MDR previously. It is not likely to occur within the development site due to the absence of suitable habitat.

e) Powerful Owl

The Powerful Owl has been recorded within the MDR. No trees within the development site or in the vegetation within MDR to the west of River Road contain suitable roosting sites for this species. Whilst the Powerful Owl is unlikely to nest in the local area, it may include the development site as part of a wider hunting range.

f) Red-crowned Toadlet

This species occurs in the groundwater seepage zone often associated with sandstone overhangs. This species was not detected during the frog survey. However, potential habitat occurs within MDR and in areas where groundwater flows through the retaining walls surrounding the development site.

4.7 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Under the EPBC Act, a person must not, without an approval under the Act, take an action that has or will have, or is likely to have, a significant impact on a matter of National Environmental Significance (NES). These matters are listed as:

- The world heritage values of a declared World Heritage property;

- The ecological character of a declared Ramsar wetland;
- A threatened species or endangered community listed under the Act;
- A migratory species listed under the Act; or
- The environment in a Commonwealth marine area or on Commonwealth land.

The EPBC Act does not require Commonwealth approval for the redevelopment of the site. It does, however, suggest that when rezoning land, planning authorities should consider whether to allow actions that could significantly affect NES matters or the environment of Commonwealth land. Matters of NES in NSW are:

- Declared World Heritage Areas;
- Declared Ramsar Wetlands;
- Listed threatened species under the EPBC Act ;
- Listed ecological communities under the EPBC Act; or
- Migratory species listed in the China Australia Migratory Bird Agreement (CAMBA), Japan Australia Migratory Bird Agreement (JAMBA) and Republic of Korea Australia Migratory Bird Agreement (ROKAMBA).

a) Site Assessment

Commonwealth assessment will be required for proposed activities on the site if they affect any matter of NES. The subject site is not a Declared World Heritage Area or does not contain any Declared Ramsar Wetlands.

No listed threatened species were observed during the survey.

b) Migratory Birds

No CAMBA, JAMBA or ROKAMBA species are likely to occur within the development site. The development is removed from the Gungah Bay area by the MDR and any rezoning is unlikely to have a significant impact on any CAMBA, JAMBA or ROKAMBA species should any migratory species arrive in the local area.

c) Koala Habitat Assessment

No records of sighting of koalas have been recorded within the immediate area and the surrounding properties do not provide any suitable habitat for this species. There is no koala feed trees within the development site although habitat is present within MDR. The development site is unlikely to provide core habitat for this species and further assessment is not required.

d) Summary

In light of the considerations discussed above, Commonwealth assessment is not required for the proposed redevelopment of this property. The proposed rezoning would permit development of already modified land and such development not impact on the vegetation communities within MDR.

4.8 GROUNDWATER DEPENDENT ECOSYSTEMS

The development site is not listed as containing groundwater dependent ecosystems in the GDE database (BoM, 2016). There are no significant areas of groundwater seepage within the area and the development resulting from rezoning is not likely to impact significantly on the central drainage corridor through MDR.

4.9 HABITAT CONNECTIVITY

The subject site is adjacent to the MDR. There is currently good connectivity within the reserve, however the subject site is heavily modified to accommodate vehicle parking and does not provide habitat for fauna species in this area.

The proposed redevelopment is not predicted to impact on the existing connectivity within the reserve or vegetation communities in any significant way and will allow fauna to move throughout the reserve.

Table 1 Assessment of Habitat Features of Subject Site

Feature	Assessment
<i>The presence of mature trees with hollows, fissures and/or other suitable Roosting/nesting places</i>	Absent within the development site, abundant within MDR
<i>The presence of Koala food trees</i>	No Koala feed trees occur within the development site but suitable canopy species are present within the reserve.
<i>The presence of caves or hollows suitable for Molossidæ species</i>	The block retaining walls used for the bowling green and car parking areas contain small gaps that may provide roosting sites for cave-dwelling micro-bat species including Greater Broad-nosed Bat. Potential habitat for these micro-bats occurs in area of sandstone overhangs and ledges within MDR and the stormwater culvert beneath the railway line.
<i>The presence of Petauridæ feeding scars</i>	No evidence of feeding scars was observed.
<i>Condition, flow and water quality of drainage lines and bodies of water</i>	No clearly defined water courses were observed on the development site. The central drainage corridor through MDR and the small tributary along the southern margin of the development site contain flowing water.
<i>Areas of dense vegetation.</i>	Areas of dense vegetation do not occur within the development site. The vegetation within MDR is also open with limited native understorey. Areas of dense vegetation within the reserve include those areas affected by weed infestations
<i>Presence of hollow logs/debris and areas of dense leaf litter</i>	Absent from within the development site but abundant within MDR
<i>Presence of fruiting flora species</i>	Landscape planting of native and exotic species around the perimeter of the development site provides seasonal food resources for birds and fauna. Greater availability of potential foraging resources occurs within the reserve
<i>Presence of blossoming flora species, particularly winter-flowering species</i>	Exotic shrubs used in landscaping of the club facilities provide some winter-flowering plants (<i>Azalea</i> sp.) as potential foraging resources.
<i>Vegetation connectivity and proximity to neighbouring areas of intact vegetation</i>	The development site is located at the eastern margin of MDR. The modified and partially landscaped development site does not provide stepping stone habitat and with the railway line on the eastern boundary provides a barrier to the movement of native fauna towards the east of MDR.
<i>Presence of caves and man-made structures that may be suitable for Microchiropteran bat roost sites</i>	The retaining walls surrounding the bowling greens and car parking may provide some shelter habitat for micro-bats. Stormwater culverts beneath the railway line to the south of the development site also provides potential shelter habitat for some

Feature	Assessment
	species, particularly Greater Broad-nosed Bat.
<i>Presence of bulky nests which may belong to raptors</i>	No suitable tall trees occur within the development site or surrounding vegetation within MDR that would provide roost sites for Powerful Owl or other raptors.

5 CONSTRAINTS ASSESSMENT

The following assessment outlines the constraints likely to affect the rezoning application for the redevelopment of the Oatley Bowling Club site.

Discussion in this section should be read in conjunction with Figure 15.

5.1 CADASTRE BOUNDARY

The site area is based on that area formerly occupied by the Oatley Bowling Club, however the cadastral boundary for the proposed development site has yet to be defined.

To the south and the west is the area within the MD PoM. When the MD PoM was developed the eastern boundary of the MD PoM was set such that it excluded the area development site. This boundary is shown on Figure 15.

At present the eastern boundary of MD PoM approximately follows the base of the embankments surrounding the previous car parking area of the bowling club facility. The inclusion of these embankments and retaining walls within the development site would allow Council to place controls on the stabilisation and rehabilitation of these areas as part of any redevelopment. However, doing this would require the development site boundary to slightly encroach into the MD PoM area.

Should the proposed boundary encroach on that area presently covered by the adopted MD PoM, there will need to be appropriate adjustments made to the MD PoM to permit the development proceeding. This is a matter to be further investigated by Council.

Once the site boundaries are defined by Council, there is the requirement for the formalisation of the development site boundary to occur through boundary adjustment and/or amalgamation of existing cadastral boundaries.

A clearly defined boundary for the development is critical for the placement of any buffers necessary for the other constraints such as bushfire.

The boundary shown within this report takes full account of the MD PoM boundary.

5.2 RIPARIAN CORRIDORS

Any activities that are within 40 metres of this prescribed stream would be considered a controlled activity and may require additional approval under the Water Management Act 2000 from DPI Water,

The central drainage corridor through MDR is assessed as a Category 1 stream using the Strahler ordering system and based on drainage lines shown on 1:25,000 topographic maps (SIX Maps, 2016).

Further, under the DPI Water requirements a 10 metre vegetated riparian zone (VRZ) is required either side of a Category 1 waterway, extending from the top of the defined bank. This corridor is already achieved by the width of the MDR along this watercourse (as shown in Figure 15).

As such, any redevelopment works within 40m of the prescribed waterway and particularly an upgrade to River Road which could encroach upon the VRZ buffer would need to consider the DPI Water requirements. The approvals required will depend on the EP&A Act approval pathway applicable.

5.3 BIODIVERSITY

Two species of threatened micro-bats were recorded from the southern part of the development site.

The Greater Broad-nosed Bat is likely to roost within caves but is known to utilise man-made structures such as drainage culverts, derelict buildings and could be utilising some of the gaps within the block retaining walls as shelter habitat. Whilst the Anabat equipment used to detect this species focussed on the ravine along the small drainage line to the south, it is to be confirmed by Council if this is part of the development site or will be retained within MDR.

The other species, the Little Bentwing-bat is also likely to use the culvert or tree canopies for shelter and not likely to be impacted by the

proposed rezoning and future redevelopment of the site.

The vegetation immediately to the west of the development site was assessed as meeting the criteria for consideration as STIF EEC. The vegetation is restricted to along the central drainage upstream of the pedestrian footbridge.

Any redevelopment of the Oatley Bowling Club must consider the potential impacts on the STIF EEC and known threatened species recorded within the MDR including:

- Clearing of STIF EEC vegetation to improve access along River Road
- Trimming of regrowth vegetation for overhead power lines to service the development site
- Increased risk of spread of garden escape plants
- Loss of potential shelter habitat for micro-bats by removing retaining walls
- Loss of foraging resources by clearing Landscape trees plants around perimeter of development site

5.4 BUSHFIRE PROTECTION MEASURES

The bushfire report prepared for the rezoning proposal (Travers 2014) outlines the bushfire protection measures necessary for any redevelopment to comply with the Intent of Measures outlined in the document *Planning for Bushfire Protection*. An aged care facility is considered as a Special Fire Protection Purpose (SFPP) development for which there is a greater emphasis on the separation from any bushfire prone vegetation rather than construction levels of any buildings. As such a separation of 100 metres is required from the edge of the forest vegetation to the south and 50 metres from the riparian (rainforest equivalent) vegetation to the west of the site. This will place any aged care development in the north east corner of the site as shown in Figure 15.

If the redevelopment involves multistorey residential units, the separation distance can be reduced with a corresponding increase in the construction requirements.

The bushfire report outlined the necessary APZ for residential development as being; at a minimum to meet the performance criteria of *Planning for Bushfire Protection*; 18 metres from the riparian vegetation that occurs upstream of the pedestrian footbridge and 49 metres from the forest vegetation to the south of the development site to achieve a BAL of 29kW/m². In both cases the APZ zone must be wholly contained within the development site and not extending into MDR. The APZs are shown on Figure 15. A reduction in the construction requirements is possible with a corresponding increase in the APZ as outlined in the Travers assessment and displayed in Figure 15.

Redevelopment of the site may also require improved emergency access. A number of alternatives were presented within the bushfire report to address safe egress during a bushfire emergency.

One option proposed was to increase the width of River Road and to provide an APZ to the west of this road. This has a number of issues:

- It encroaches onto the defined boundary of the MDR PoM and there may be issues regarding permissibility of such works;
- It would involve the partial clearing of STIF EEC identified along River Road; and
- The road works may also encroach within the 10 m VRZ along the central drainage channel (as discussed in section 5.3).

Alternative egress routes have not been proposed for consideration.

The APZs required for the redevelopment of the area are shown in Figure 15. It should be noted that the Travers report was based on an site boundary that has been subsequently superseded and as such, should be taken as indicative for the purposes of this report.

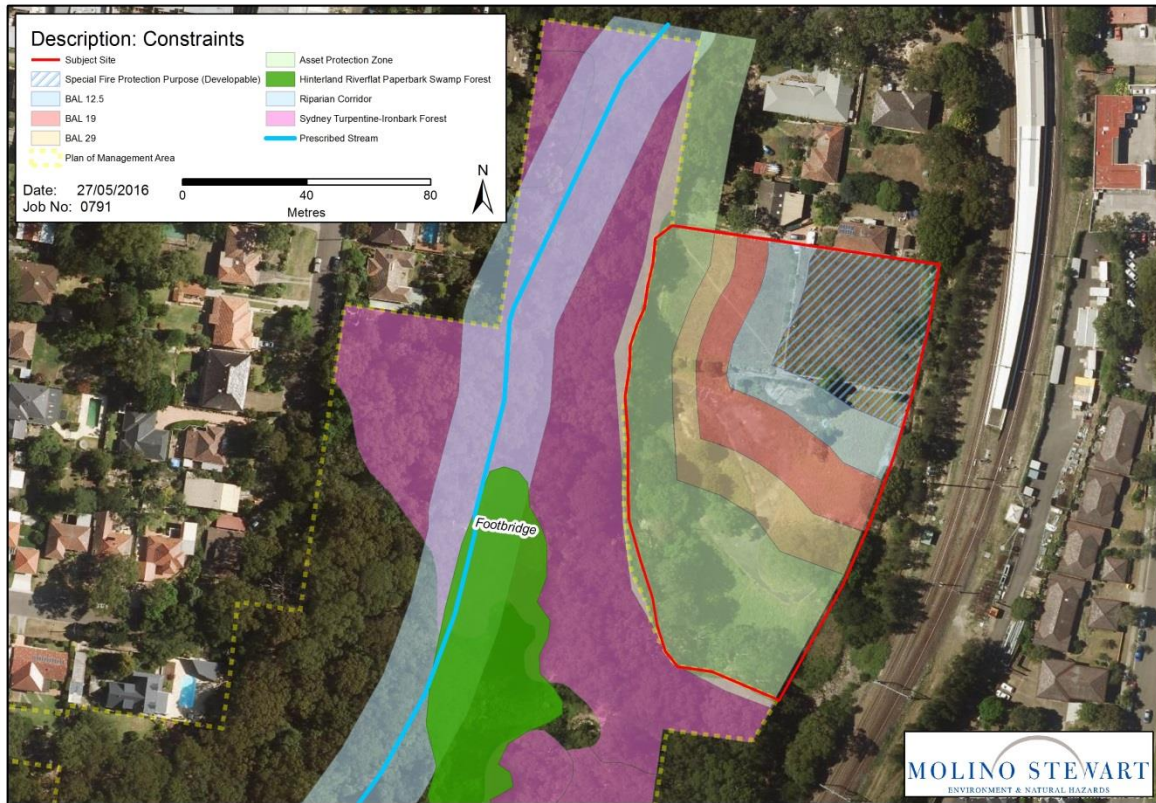


Figure 15 Constraints and associated buffers affecting the proposed redevelopment site

5.5 SITE ACCESS

Development for the purposes of aged care accommodation and ancillary services will require suitable pedestrian access to the site. To achieve this, there will be the need to construct a pedestrian pathway to the site, for which a number of route options are being considered. One possible option is for it to run along the western side of River Road.

Such a route would need to consider potential impacts on the STIF EEC vegetation to the west of River Road, with potential impact on the existing tall shrubs (Cheese Tree and Sweet Pittosporum) present. The proposal could potentially encroach on the structural root zone of existing Turpentine trees.

Such a proposal would need to consider there is potential to harm the STIF EEC and hence an application under Section 91A of the Threatened Species Conservation Act may be required. The proposal would also need to give consideration to requirements relating to the nearby watercourse.

With thoughtful design a pedestrian path is not likely to have a significant impact on the existing vegetation and may enhance access to the MDR as well any proposed development or community facilities. Further, any impacts unable to be mitigated through the location or the design of a pedestrian pathway could be mitigated through weed management or other positive management strategies within the MDR. This could include actions to improve the ecological value of the other EECs (Swamp Sclerophyll Forest EEC, Freshwater Wetland EEC).

6 OPPORTUNITIES AND AMELIORATION MEASURES

The development site has been extensively modified by the previous land use as a bowling club. However, there are a number of potential habitat and foraging resources for threatened species occurring within this site. Any removal of these features would require the provision of additional habitat features within the MDR in compensation of any loss of habitat. Potential opportunities and amelioration measures are discussed below.

6.1 VEGETATION MANAGEMENT

The landscaping trees planted around the perimeter of the car parking area provide seasonal foraging resources. These trees also stabilise the edge of the embankments and support the retaining walls. Mature, non-flammable trees such as the Jacaranda and Plane Trees can also act of ember filters providing additional bushfire protection.

These trees should be retained within the landscaping of any redevelopment of the site.

In compensation for any loss of native vegetation from within the site should redevelopment of the site occur, a vegetation management plan (VMP) should be prepared for compensatory works within MDR in accordance with the MD PoM. This shall improve the existing vegetation condition of the reserve and include:

- Weed management in areas affected by exotic species such as Lantana; and
- Assisted planting of shrub and groundcover species in areas affected by exotic species;

6.2 ROOSTING SITES

The removal of the retaining walls surrounding the development site has the potential for remove roosting sites for threatened micro-bat species. Further investigation is required to assess the likelihood of the small gaps within

the retaining wall being used as roosting sites prior to any removal of these structures.

In compensation of any loss of roosting habitat, artificial micro-bat boxes should be installed within the potential flyways within MDR. Focus should be on increasing the available roosting sites within the small drainage to the south of the development site where the Greater Broad-nosed Bat and Little Bentwing-bat were detected.

6.3 WATER MANAGEMENT

6.3.1 Waterway management plan

A waterway management plan should be prepared that considers potential impacts of any redevelopment of the site to the local drainage system within MDR, including the Coastal Freshwater Reedland located downstream of the pedestrian footbridge.

6.3.2 Controls on Erosion

It is recommended that strategies are developed to limit any erosion during any redevelopment of the site. This should be prepared in consultation with an appropriately qualified person. Erosion control measures need to be fully considered to prevent sedimentation along the drainage corridors within MDR.

6.4 RECOMMENDATION

The proposed rezoning of a modified site partially within MDR is required for the redevelopment of the site as a residential care facility. This redevelopment may involve the clearing of vegetation for bushfire protection measures, access and loss of potential habitat for threatened fauna during any construction works. The impacts of these actions can be mitigated through compensatory measures.

In view of the potential constraints affecting the redevelopment of the site, the following recommendations are made:

- Define the boundaries of the development site within the context of the MD PoM and future site requirements;
- Reorganise the cadastre through boundary adjustment and/or amalgamation to formalise the location development site;
- Avoid clearing of the STIF EEC to the west of River Road to improve access to the development;
- If clearing of the STIF EEC to improve emergency egress cannot be avoided, obtain additional approvals under TSC Act and may require a referral under the EPBC Act;
- If possible retain existing landscape trees at the perimeter of the car parking area (Jacaranda, Silky Oak and Plane trees);
- Prepare 7-part tests for the Assessment of Significance for the threatened species recorded during this assessment, or predicted to occur based on surrounding vegetation of available habitat. Tests should be conducted for:
 - Greater Broad-nosed Bat
 - Little Bentwing-bat
 - Grey-headed Flying-fox
 - Powerful owl
 - Red-crowned Toadlet

7 CONCLUSIONS

Molino Stewart has completed an assessment of the constraints likely to impact any rezoning of the development site and to change permissible land use from community to operational uses. Part of the constraints assessment included a comprehensive biodiversity assessment for the site and surrounding areas within the MDR.

The assessment was conducted in accordance with section 5A of the EP&A Act (1979), and followed the Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (DEC, 2004) and current best practice methods. It included a desktop assessment followed by field survey by a qualified ecologist. The results provide additional and updated information to an earlier assessment of the rezoning proposal conducted in 2007.

Two species of threatened micro-bats were detected to the south of the development site using Anabat surveys. No threatened flora was observed during the survey.

STIF EEC is present to the west of River Road within MDR. Any clearing of this vegetation may require additional approval under the TSC Act and possibly referral under the EPBC Act.

Habitat for micro-bats may be present in the retaining walls surrounding the development and this warrants further investigation

7 part tests for the Assessment of Significance should be considered for a number of species once any development proposal is being assessed.

The impacts of redevelopment of the site can be mitigated through appropriate measures.

8 REFERENCES

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<http://www.environment.nsw.gov.au/eSpadeWebapp/>

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OEH (2013) The Native Vegetation of the Sydney Metropolitan Area. Volume 2: Vegetation Community Profiles. Version 2.0. NSW Office of Environment and Heritage, Sydney.

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Tozer, M.G., Turner, K., Simpson, C., Keith, D.A., Beukers, P., MacKenzie, B., Tindall, D. & Pennay, C. (2006) Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Version 1.0

Travers Bushfire and Ecology (2014) Correspondence to: The Planning Group, Ref A13113-JT/NVD 5 February, 2014.

**APPENDIX A– LIKELIHOOD OF OCCURRENCE
ASSESSMENT TABLE**

Table 2 Threatened flora recorded within 10km of subject property and included in either the TSC Act or EPBC Act

Family	Species	Common Name	Habitat	Likelihood at Subject Site
<i>Casuarinaceae</i>	<i>Allocasuarina diminuta</i> subsp. <i>mimica</i>	Allocasuarina diminuta subsp. mimica L.A.S.Johnson population in the Sutherland and Liverpool local government areas	Occurs along sandstone ridges and upper hillsides in heathy and low open woodland communities	Unlikely
<i>Convolvulaceae</i>	<i>Wilsonia backhousei</i>	Narrow-leafed Wilsonia	This is a species of the margins of salt marshes and lakes	Possible
<i>Dilleniaceae</i>	<i>Hibbertia stricta</i> subsp. <i>furcatula</i>		Known to occur in two populations, one in the southern outskirts of Sydney, and one near Nowra. Broadly dry eucalypt forest and woodland.	Unlikely
<i>Elaeocarpaceae</i>	<i>Tetratheca juncea</i>	Black-eyed Susan	Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion. Found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest.	Unlikely
<i>Ericaceae</i>	<i>Epacris purpurascens</i> var. <i>purpurascens</i>		Found in a range of vegetation communities growing in areas with strong shale soil influence	Unlikely
	<i>Leucopogon exolasius</i>	Woronora Beard-heath	The plant occurs in woodland on sandstone	Unlikely
<i>Fabaceae</i>	<i>Acacia bynoeana</i>	Bynoe's Wattle	Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops.	Unlikely
	<i>Acacia prominens</i>	Gosford Wattle, Hurstville and Kogarah Local Government	Occurs in the Hurstville area and Gosford and scattered	Unlikely

		Areas	Blue Mountains and south of the Snowy river.	
	<i>Acacia pubescens</i>	Downy Wattle	Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravelly soils, often with ironstone. Occurs in open woodland and forest, in a variety of plant communities.	Unlikely
	<i>Acacia terminalis subsp. terminalis</i>	Sunshine Wattle	Coastal scrub and dry sclerophyll woodland on sandy soils in generally sparse and scattered vegetation	Unlikely
<i>Juncaginaceae</i>	<i>Maundia triglochinosoides</i>		Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients.	Possible
<i>Myrtaceae</i>	<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	New England Tablelands in grassy woodlands on infertile soils derived from granite or metasedimentary bedrock	Unlikely
	<i>Melaleuca deanei</i>	Deane's Paperbark	Ridgetop woodland on sandstone in two distinct areas at Berowra and Wedderburn	Unlikely
	<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	Littoral rainforest and coastal scrub	Unlikely
<i>Orchidaceae</i>	<i>Caladenia tessellata</i>	Thick-lipped Spider Orchid	Generally found in grassy sclerophyll woodland on clay loam or sandy soils	Unlikely
<i>Poaceae</i>	<i>Deyuexia appressa</i>		Known only from two pre-1942 records in the Sydney area from wet boggy open communities in Hornsby area	Unlikely
<i>Proteaceae</i>	<i>Persoonia hirsuta</i>	Hairy Geebung	sandy soils in dry sclerophyll open forest, woodland and heath on sandstone	Unlikely

Source: NPWS BioNet Atlas 25th January, 2016, Protected Matters Search Tool, 23rd March, 2016

Table 3 Habitat of threatened fauna species and their likelihood of occurrence

Family	Scientific Name	Common Name	Habitat	Likelihood of Occurrence on Site
Amphibia				
Myobatrachidae	<i>Pseudophryne australis</i>	Red-crowned Toadlet	Inhabits periodically wet drainage lines below sandstone Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter.	Possible
Aves				
Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. Habitat is characterised by the presence of large areas of open water (larger rivers, swamps, lakes, the sea).	Unlikely
	<i>Lophoictinia isura</i>	Square-tailed Kite	Open forests, woodlands, breeds in tall riparian vegetation	Unlikely
	<i>Pandion cristatus</i>	Eastern Osprey	Coastal areas, especially the mouths of large rivers, lagoons and lakes	Unlikely
Apodidae	<i>Hirundapus caudacutus</i>	White-throated Needletail	Recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland	Unlikely
Cacatuidae	<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Favours old growth forest and known to occur in the general locality.	Unlikely

	<i>Lophochroa leadbeateri</i>	Major Mitchell's Cockatoo	Inhabits a wide range of treed and treeless inland habitats, always within easy reach of water.	Unlikely
Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries.	Unlikely
Columbidae	<i>Ptilinopus superbus</i>	Superb Fruit-Dove	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees	Unlikely
Haematopodidae	<i>Haematopus longirostris</i>	Pied Oystercatcher	Favours intertidal flats of inlets and bays, open beaches and sandbanks. Forages on exposed sand, mud and rock at low tide, for molluscs, worms, crabs and small fish. The chisel-like bill is used to pry open or break into shells of oysters and other shellfish.	Unlikely
Laridae	<i>Hydroprogne caspia</i>	Caspian Tern	Found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred.	Unlikely
Meliphagidae	<i>Anthochaera phrygia</i>	Regent Honeyeater	Dry Open Forest and Woodland and riverine sheoak woodlands on the coast	Unlikely
Psittacidae	<i>Glossopsitta pusilla</i>	Little Lorikeet	Tall open forest, woodland, Melaleuca swamp, riparian and open forest	Unlikely

	<i>Lathamus discolor</i>	Swift Parrot	Open Forest and Woodland, particularly Grey Box – Ironbark communities	Unlikely
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper	Found along all coastlines of Australia and in many areas inland. The population when in Australia is concentrated in northern and western Australia	Unlikely
	<i>Gallinago hardwickii</i>	Latham's Snipe	Latham's Snipe occurs in permanent and ephemeral wetlands. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies)	Unlikely
	<i>Limosa lapponica</i>	Bar-tailed Godwit	Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats	Unlikely
	<i>Numenius madagascariensis</i>	Eastern Curlew	Commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass.	Unlikely
	<i>Numenius phaeopus</i>	Whimbrel	Often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats.	Unlikely
Strigidae	<i>Ninox strenua</i>	Powerful Owl	Woodland to Tall moist forest and rainforest	Possible, recorded within Myles Dunphy

				Reserve
Tytonidae	<i>Tyto tenebricosa</i>	Sooty Owl	Dry Sclerophyll Forests and woodlands but requires large tree hollows or caves for nesting	Unlikely
Mammalia				
Molossidae	<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	The Eastern Freetail-bat is found in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures	Possible
	<i>Phascolarctos cinereus</i>	Koala	Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species	Unlikely
Pteropoidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Rainforest, tall sclerophyll forests and woodland	Possible, temporary camp known within Myles Dunphy Reserve
Vespertillioidae	<i>Miniopterus schreibersii</i>	Eastern Bentwing-bat	Caves, old growth forest with tree hollows, known to utilise man-made stormwater management structures and disused buildings for roosting	Unlikely
	<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	Tall wet forests and drier gullies, roosts in tree hollows and feeds along forest edges or streams	Possible

Source: NPWS Wildlife Atlas as at 25th January, 2016, Protected Matters Search Tool, 23rd March 2016.

APPENDIX B – SPECIES RECORDED

Table 4 Flora recorded on subject property

Family	Botanical name	Common Name	Subject Site	Myles Dunphy Reserve
Acanthaceae	<i>Pseuderanthemum variabile</i>	Love Flower		Yes
Adiantaceae	<i>Adiantum aethiopicum</i>	Common Maidenhair fern		Yes
Aizoaceae	<i>Tetreaonia tetragonioides</i>	New Zealand Spinach		Yes
Anacardiaceae	<i>Toxicodendron succedanea*</i>	Rhus Tree		Yes
Anthericaceae	<i>Chlorophytum comosum</i>	Ribbon Plant		Yes
Apiaceae	<i>Centella asiatica</i>	Pennywort		Yes
	<i>Hydrocotyle bonariensis*</i>	Pennywort	Yes	Yes
	<i>Platysace linearifolia</i>	Narrow-leaf Platysace		Yes
Apocynaceae	<i>Nerium oleander*</i>	Oleander	Yes	
Araceae	<i>Alocasia macrorrhizos</i>	Spoon Lily		Yes
Araliaceae	<i>Polyscias sambucifolius</i>	Elderberry Panax		Yes
	<i>Hedera helix*</i>	English Ivy		Yes
Arecaceae	<i>Phoenix canariensis*</i>	Canary Island Palm		Yes
Asparagaceae	<i>Asparagus aethiopicus *</i>	Asparagus Fern	Yes	Yes
	<i>Asparagus asparagoides *</i>	Bridal Creeper	Yes	Yes
Aspleniaceae	<i>Asplenium flabellifolium</i>	Necklace Fern		Yes
	<i>Asplenium bulbiferum</i>	Mother Spleenwort		Yes
Asteraceae	<i>Ageratina adenophora *</i>	Crofton Weed		Yes
	<i>Bidens pilosa •</i>	Cobbler's Peg	Yes	Yes
	<i>Chrysanthemoides mobilifera ssp. rotundata</i>	Boneseed		Yes
	<i>Conyza bonariensis *</i>	Flaxleaf Fleabane	Yes	Yes
	<i>Coreopsis lanceolata *</i>	Coreopsis		Yes
	<i>Delairea odorata *</i>	Cape Ivy		Yes
	<i>Helichrysum diosmifolium</i>	Sago Bush		Yes
	<i>Hypochaeris radicata •</i>	Cats Ears	Yes	Yes
	<i>Pseudoanahalium</i>	Cudweed	Yes	Yes

Family	Botanical name	Common Name	Subject Site	Myles Dunphy Reserve
	<i>involucratum</i>			
	<i>Senecio madagascariensis</i> *	Fireweed	Yes	Yes
	<i>Sonchus oleraceus</i> *	Common Sowthistle	Yes	Yes
Avicenniaceae	<i>Avicennia marina</i>	Grey Mangrove		Yes
Balsaminaceae	<i>Impatiens walleriana</i> *	Busy Lizzie		Yes
Basellaceae	<i>Anredera cordifolia</i> *	Madeira Vine		Yes
Bignoniaceae	<i>Jacaranda mimosifolia</i> *	Jacaranda Tree	Yes	
	<i>Pandorea pandorana</i>	Wonga Vine		Yes
Blechnaceae	<i>Blechnum indicum</i>	Swamp Water Fern		Yes
Caesalpiniaceae	<i>Senna pendula</i> var <i>alabrata</i> *	Easter Cassia		Yes
Campanulaceae	<i>Wahlenberaia communis</i>	Tufted Bluebell		Yes
Caprifoliaceae	<i>Lonicera japonica</i> *	Honeysuckle		Yes
Casuarinaceae	<i>Allocasuarina littoralis</i>	Black She-oak		Yes
	<i>Casuarina alauca</i>	Swamp Oak		Yes
Chenopodiaceae	<i>Einadia hastate</i>	Berry Saltbush		Yes
Clusiaceae	<i>Hypericum gramineum</i>	Small St. John's Wort		Yes
	<i>Hypericum japonicum</i>	Matted St. John's Wort		Yes
Commelinaceae	<i>Commelina cyanea</i>	Scurvy Weed		Yes
	<i>Tradescantia fluminensis</i> *	Wandering Jew	Yes	Yes
Convolvulaceae	<i>Convolvulus erebescens</i>	Australian Bindweed	Yes	Yes
Crassulaceae	<i>Bryophyllum delegoensis</i> *	Mother-of-millions		Yes
Cunoniaceae	<i>Ceratopetalum gummiferum</i>	NSW Christmas Bush		Yes
Cyatheaceae	<i>Cyathea australis</i>	Rough Tree Fern		Yes
Cyperaceae	<i>Cyperus eragrostis</i> *	Umbrella Sedge		Yes
	<i>Gahnia</i> sp.	Tall Saw Sedge		Yes
	<i>Isolepis inundatus</i>	Swamp Club-rush		Yes
	<i>Lepidosperma laterale</i>	Variable Swordsedge		Yes
Dennstaedtiaceae	<i>Pteridium esculentum</i>	Bracken	Yes	Yes

Family	Botanical name	Common Name	Subject Site	Myles Dunphy Reserve
	<i>Hypolepis muelleri</i>	Harsh ground-fern		Yes
<i>Dilleniaceae</i>	<i>Hibbertia diffusa</i>	Guinea Flower		Yes
<i>Dicksoniaceae</i>	<i>Calochlaena dubia</i>	False Bracken Fern		Yes
<i>Dryopteridaceae</i>	<i>Nephrolepis cordifolia</i> *	Fishbone Fern		Yes
<i>Doryanthaceae</i>	<i>Dorythanes excelsa</i>	Gymea Lily	Yes	
<i>Elaeocarpaceae</i>	<i>Elaeocarous reticulates</i>	Blueberry Ash		Yes
<i>Euphorbiaceae</i>	<i>Breynia oblongifolia</i>	Breynia		Yes
	<i>Glochidion ferdinandi</i>	Cheese Tree	Yes	Yes
	<i>Poranthera microphylla</i>	Small Poranthera		Yes
	<i>Omalanthus populifolius</i>	Bleeding Heart	Yes	Yes
	<i>Phyllanthus aasstroemii</i>	Blunt Spurge		Yes
<i>Fabaceae</i>	<i>Daviesia corimbosa</i>	Clustered Bitter Pea		Yes
	<i>Desmodium sp.</i>	Tick Trefoil		Yes
	<i>Dillwynia retorta</i>	Twining Glycine		Yes
	<i>Dillwynia sieberi</i>	Egg & Bacon Pea		Yes
	<i>Hardenberaia violacea</i>	False Sarsaparilla		Yes
	<i>Hovea sp.</i>			Yes
	<i>Kennedia rubicunda</i>	Red Kennedy Pea		Yes
	<i>Pultenaea daphnoides</i>	LarQe-leaf Bush-pea		Yes
	<i>Pultenaea stipularis</i>	Fine-leaf Bush-pea		Yes
<i>Geraniaceae</i>	<i>Geranium so.</i>			Yes
<i>Goodeniaceae</i>	<i>Goodenia hederacea</i>	Violet-leaved Goodenia		Yes
	<i>Goodenia ovata</i>	Hop Goodenia		Yes
<i>Haloragaceae</i>	<i>Gonocarous teucrioides</i>	Germander Raspwort		Yes
<i>Iridaceae</i>	<i>Schizanthus pinnatus</i> *	Poor Man's Orchid		Yes
<i>Juncaceae</i>	<i>Juncus usitatus</i>	Common Rush	Yes	Yes
<i>Lamiaceae</i>	<i>Plectranthus sp.</i>			Yes
<i>Liliaceae</i>	<i>Ullium formosanum</i> *	Taiwan Lily		Yes
	<i>Dianella caerulea var producta</i>	Blue Flax Lily		Yes

Family	Botanical name	Common Name	Subject Site	Myles Dunphy Reserve
<i>Lomandraceae</i>	<i>Dianella revolute</i>	Mauve Flax Lily		Yes
	<i>Lomandra glauca</i>	Pale Mat-rush		Yes
	<i>Lomandra longifolia</i>	Spiky-headed Mat-rush	Yes	Yes
	<i>Lomandra multiflora ssp multiflora</i>	Many-flowered Mat-rush		Yes
<i>Lobeliaceae</i>	<i>Pratia ourourascens</i>	Whiteroot		Yes
	<i>Lobelia alata</i>	Angled Lobelia		Yes
	<i>Sida rhombifolia</i>	Paddy's Lucerne		Yes
<i>Malvaceae</i>	<i>Brachychyton acerifolius</i>	Illawarra Flame Tree		
<i>Menispermaceae</i>	<i>Sarcofjetalum harvevanum</i>			Yes
	<i>Stephania iaoonica</i>			Yes
<i>Mimosaceae</i>	<i>Acacia falcate</i>		Yes	Yes
	<i>Acacia linifolia</i>			Yes
	<i>Acacia lonaifolia</i>			Yes
	<i>Acacia myrtifolia</i>			Yes
	<i>Acacia oarramattensis</i>		Yes	Yes
	<i>Acacia suaveolens</i>			Yes
	<i>Acacia terminalis</i>			Yes
	<i>Acacia ulicifolia</i>			Yes
<i>Moraceae</i>	<i>Ficus rubiainosa</i>	Port Jackson Fig		Yes
<i>Myrsinanaceae</i>	<i>Rapanea variabilis</i>	Muttonwood		Yes
	<i>Rapanea howittiana</i>	Turnipwood		Yes
<i>Myrtaceae</i>	<i>Acmena smithii</i>	Lilly pilly	Yes	Yes
	<i>Angophora costata</i>	Sydney Red Gum	Yes	Yes
	<i>Corvmbia gummifera</i>	Red Bloodwood		Yes
	<i>Eucalyptus pilularis</i>	Blackbutt		Yes
	<i>Eucalvotus ounctata</i>	Grey Gum		Yes
	<i>Eucalvptus resinifera</i>	Red Mahogany		Yes
	<i>Kunzea ambiaua</i>	Tick Bush		Yes
<i>Leptospermum trinervium</i>	Paperbark Teatree			Yes

Family	Botanical name	Common Name	Subject Site	Myles Dunphy Reserve
	<i>Melaleuca ericifolia</i>	Swamp Paperbark		Yes
	<i>Melaleuca lineariifolia</i>	Snow-in-summer		Yes
	<i>Syncarpia alomulifera</i>	Turpentine	Yes	Yes
<i>Ochnaceae</i>	<i>Ochna serrulata*</i>	Mickey Mouse Plant	Yes	Yes
<i>Oleaceae</i>	<i>Ligustrum lucidum*</i>	Large-leaved Privet	Yes	Yes
	<i>Ligustrum sinense*</i>	Small-leaved Privet	Yes	Yes
	<i>Notolaea lonaifolia</i>	Large Mock-olive		Yes
	<i>Olea europea var africanus</i>	African Olive		Yes
<i>Onagraceae</i>	<i>Epilobium sp.</i>	Willow Herb		Yes
<i>Orchidaceae</i>	<i>Dipodium roseum</i>	Pink Hyacinth Orchid		Yes
	<i>Dipodium punctatum</i>	Cascading Orchid		Yes
	<i>Pterostylis sp</i>			Yes
	<i>Acianthis sp.</i>			Yes
<i>Platanaceae</i>	<i>Platanus x acerifolia*</i>	Plane tree	Yes	
<i>Philesiaceae</i>	<i>Eustrephus latifolius</i>	Wombat Berry		Yes
<i>Phormiaceae</i>	<i>Dianella longifolia var longifolia</i>	Smooth Flax Lily		Yes
	<i>Dianella revoluta var revoluta</i>	Spreading Flax Lily		Yes
<i>Pittosporaceae</i>	<i>Bursaria spinosa</i>	Blackthorn		Yes
	<i>Billardiera scandens</i>	Apple Berry		Yes
	<i>Pittosporum revolutum</i>	Hairy Pittosporum		Yes
	<i>Pittosporum undulatum</i>	Sweet Pittosporum	Yes	Yes
<i>Poaceae</i>	<i>Arundo donax *</i>	Giant Bamboo		Yes
	<i>Austrodanthonia fulva</i>	Wallaby Grass		Yes
	<i>Austrodanthonia tenuior</i>	Wallaby Grass		Yes
	<i>Digitaria parviflora</i>	Smallflower Fingergrass		Yes
	<i>Echinochloa crus-gali *</i>	Barnyard Grass		Yes
	<i>Echinopogon caespitosus</i>	Hedgehog Grass		Yes
	<i>Erhata erecta *</i>	Panic Veldtgrass	Yes	Yes
	<i>Entolasia marginata</i>			Yes

Family	Botanical name	Common Name	Subject Site	Myles Dunphy Reserve
	<i>Entolasia stricta</i>	Wiry Panic		Yes
	<i>Eragrostis curvula</i>	African Lovegrass	Yes	Yes
	<i>Imperata cylindrica</i>	Blady Grass	Yes	Yes
	<i>Microlaena stipoides</i> var <i>stipoides</i>	Weeping Meadow Grass		Yes
	<i>Oplismenus sp</i>	Basket Grass		Yes
	<i>Paspalum dilatatum</i> *	Paspalum	Yes	Yes
	<i>Paspalum urvillei</i> *	Vasey Grass		Yes
	<i>Pennisetum clandestinum</i> *	Kikuyu	Yes	Yes
	<i>Phragmites australis</i>	Common Reed		Yes
	<i>Poa annua</i> *	Winter Grass		Yes
	<i>Themeda australis</i>	Kangaroo Grass		Yes
<i>Polygonaceae</i>	<i>Acetosa sagittata</i> *	Turkey Rhubarb		Yes
	<i>Persicaria decipiens</i>	Slender Knotweed		Yes
	<i>Persicaria lapathifolia</i>	Knotweed		Yes
	<i>Samolus repens</i>	Creeping Brookweed		Yes
<i>Proteaceae</i>	<i>Banksia serrata</i>	Old Man Banksia		Yes
	<i>Banksia spinulosa</i>	Hair-pin Banksia		Yes
	<i>Grevillea mucronulata</i>	Green Spider-flower		Yes
	<i>Grevillea robusta</i>	Silky Oak	Yes	
	<i>Grevillea sericea</i>	Pink Spider-flower		Yes
	<i>Hakea dactyloides</i>	Broad-leafed Hakea		Yes
	<i>Hakea sericea</i>	Bushy Needlebush		Yes
	<i>Isopogon anemonifolius</i>	Drumsticks		Yes
	<i>Lomatia silaifolia</i>	Wild Parsley		Yes
	<i>Persoonia levis</i>	Smooth Geebung		Yes
	<i>Persoonia linearis</i>	Narrow-leaf Geebung		Yes
<i>Pteridaceae</i>	<i>Pteris tremula</i>	Tender Brake		Yes
<i>Ranunculaceae</i>	<i>Clematis glycinoides</i>	Old Man's Beard		Yes
<i>Rhamnaceae</i>	<i>Pomaderris sp.</i>			Yes

Family	Botanical name	Common Name	Subject Site	Myles Dunphy Reserve
Rosaceae	<i>Eriobotrya japonica</i> *	Loquat		Yes
Rubiaceae	<i>Pomax umbellata</i>	Pomax		Yes
Santalaceae	<i>Exocarpus cupressiformis</i>	Native Cherry		Yes
Sapindaceae	<i>Dodonaea triquetra</i>	Native Hop Bush		Yes
Scrophulariaceae	<i>Veronica plebeia</i>	Trailing Speedwell		Yes
Smilacaceae	<i>Smilax glycyphyla</i>	Native Sarsaparilla		Yes
Solanaceae	<i>Cestrum aurantiacum</i> •	Lady-of-the-night		Yes
	<i>Cestrum parqui</i> •	Green Poisonberry		Yes
	<i>Solanum nigrum</i> *	Black Nightshade	Yes	Yes
Stylidiaceae	<i>Stylidium sp.</i>	Trigger Plant		Yes
Thelypteridaceae	<i>Christella dentata</i>	Downy wood fern		Yes
Thymelaeaceae	<i>Pimelea linifolia</i> ssp <i>linifolia</i>	Rice Flower		Yes
Tropaeolaceae	<i>Tropaeolum majus</i> *	Nasturtium		Yes
Urticaceae	<i>Parietaria judaica</i> *	Asthma Weed		Yes
Verbenaceae	<i>Lantana camara</i> *	Lantana		Yes
	<i>Verbena bonariensis</i> *	Purple Top	Yes	Yes
Violaceae	<i>Viola hederacea</i>	Native Violet		Yes
Vitaceae	<i>Cayratia clematidea</i>	Slender Grape		Yes
Xanthorrhoeaceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush	Yes	Yes
	<i>Lomandra multiflora</i>	Many-flowered Mat-rush		Yes
	<i>Lomandra oblique</i>	Twisted Mat-rush		Yes
	<i>Xanthorrhoea SP.</i>	Grass Tree		Yes
Zingiberaceae	<i>Hedvchium aardneranum</i> *	Wild Ginger		Yes

* Introduced species

Table 5 Fauna List

<i>Scientific Name</i>	Common Name	Myles Dunphy Reserve	Subject Site	Detection method for this assessment
Amphibians				
<i>Crinia signifera</i>	Common Eastern Froglet	Yes	Yes	Frog call
Aves				
<i>Columba leucomela</i>	White-headed Pigeon	Yes		
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	Yes		
<i>Alisterus scapularis</i>	Australian King-Parrot	Yes		
<i>Platycercus elegans</i>	Crimson Rosella	Yes	Yes	Observed
<i>Platycercus eximius</i>	Eastern Rosella	Yes	Yes	Observed
<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo	Yes		
<i>Ninox strenua</i> #	Powerful Owl	Yes		
<i>Podargus strigoides</i>	Tawny Frogmouth	Yes		
<i>Dacelo novaeguinea</i>	Laughing Kookaburra	Yes	Yes	Heard
<i>Manorina melanocephala</i>	Noisy Miner	Yes	Yes	Observed
<i>Anthochaera carunculata</i>	Red Wattlebird	Yes		
<i>Anthochaera chrysopepla</i>	Little Wattlebird	Yes		
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill	Yes		
<i>Malurus cyaneus</i>	Superb Fairy-wren	Yes	Yes	Observed
<i>Gerygone sp.</i>	Australian warbler species	Yes		
<i>Eopsaltria australis</i>	Eastern Yellow Robin	Yes		
<i>Petroica rosea</i>	Rose Robin	Yes		
<i>Pardalotus punctatus</i>	Spotted Pardalote	Yes		
<i>Rhipidura fuliginosa</i>	Grey Fantail	Yes		
<i>Rhipidura rufifrons</i>	Rufous Fantail	Yes		
<i>Dicrurus bracteatus</i>	Spangled Drongo	Yes		
<i>Pachycephala pectoralis</i>	Golden Whistler	Yes		
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	Yes		
<i>Strepera graculina</i>	Pied Currawong	Yes	Yes	Observed
<i>Cracticus torquatus</i>	Grey Butcherbird	Yes		

<i>Gymnorhina tibicen</i>	Australian Magpie	Yes	Yes	Heard
<i>Corvus coronoides</i>	Australian Raven	Yes		
<i>Zosterops lateralis</i>	Silvereye	Yes		
Reptiles				
<i>Amphibolurus muricatus</i>	Jacky Lizard	Yes		
<i>Lampropholis guichenoti</i>	Grass Sun-skink	Yes		
<i>Lampropholis delicata</i>	Garden Sun-skink	Yes		
<i>Eulamprus quoyi</i>	Eastern Water Skink	Yes		
<i>Tiliqua scincoides</i>	Common Blue-tongue	Yes		
<i>Pseudonaja textilis</i>	Eastern Brown Snake	Yes		
Mammals				
<i>Trichosurus vulpecula</i>	Common Brushtail Possum	Yes		
<i>Tadarida australis</i>	White-striped Freetail Bat	Yes		
<i>Chalinobates gouldii</i>	Gould's Wattled Bat	Yes	Yes	Anabat
<i>Vespertilio pumilus</i>	Eastern Forest Bat	Yes		
<i>Vulpes vulpes</i> *	Red Fox	Yes		
<i>Felis catus</i> *	Cat	Yes		

Species listed as threatened in schedule of TSC Act

* Introduced species

APPENDIX C– BAT SONOGRAPHS

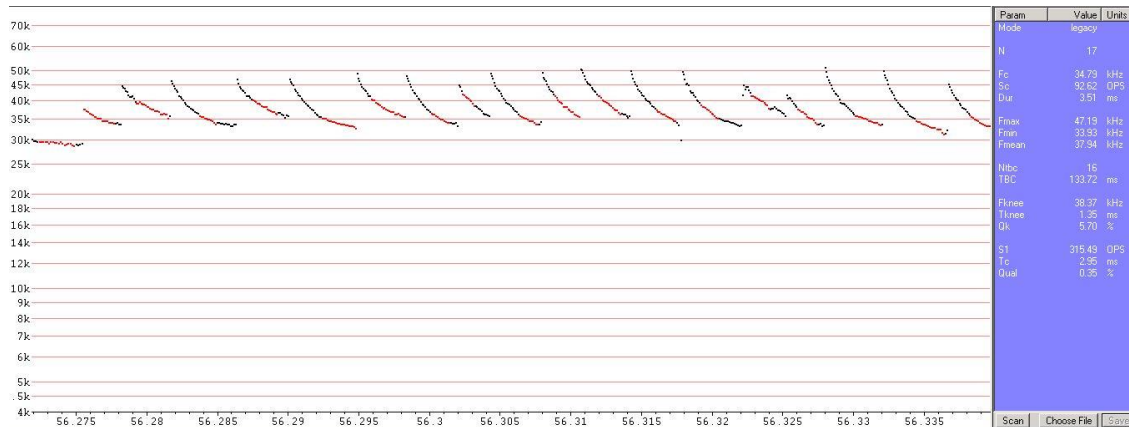
Eastern Broad-nosed Bat

Characteristic frequency within the Sydney Basin of F_c 33 to 36 kHz

Pulse shape has a curved, often with up-sweeping tail.

Single pass recorded on each of several nights survey indicating this species was in search mode foraging in the general area of the detector

Possible identification based on F_c and pulse shape



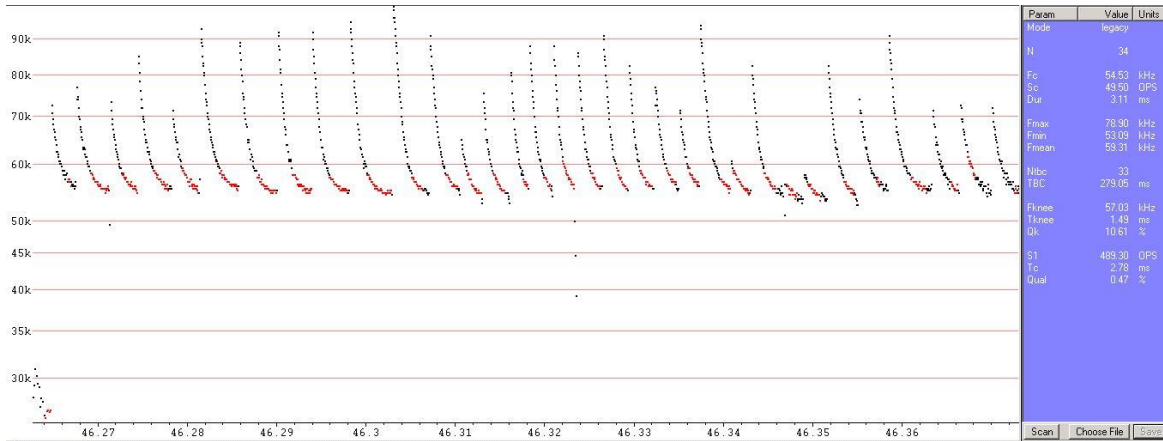
Little Bentwing Bat

Characteristic frequency within the Sydney Basin of F_c 54 to 64 kHz

Recorded sonograph (below) shows F_c in range 55kHz; considered probably identification

Pulse shape is curved and often steep and can be distinguished from Eastern Forest Bat by the presence of the down sweeping tail.

Vulnerable species (TSC Act)

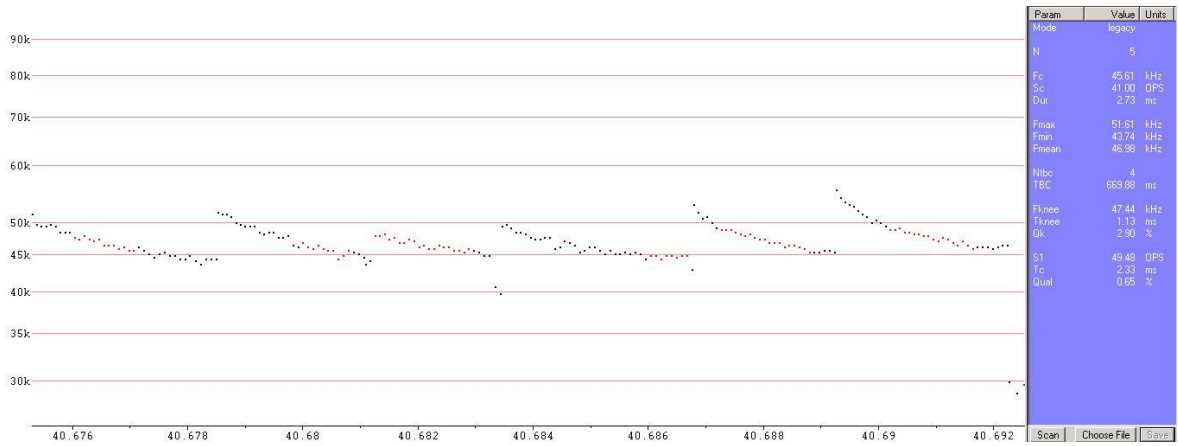


Southern Forest Bat

Characteristic frequency within the Sydney Basin of F_c 43.5 to 46 kHz

Pulse shape is flat, sometimes with short up-sweeping tail.

Probable identification based on F_c and pulse shape

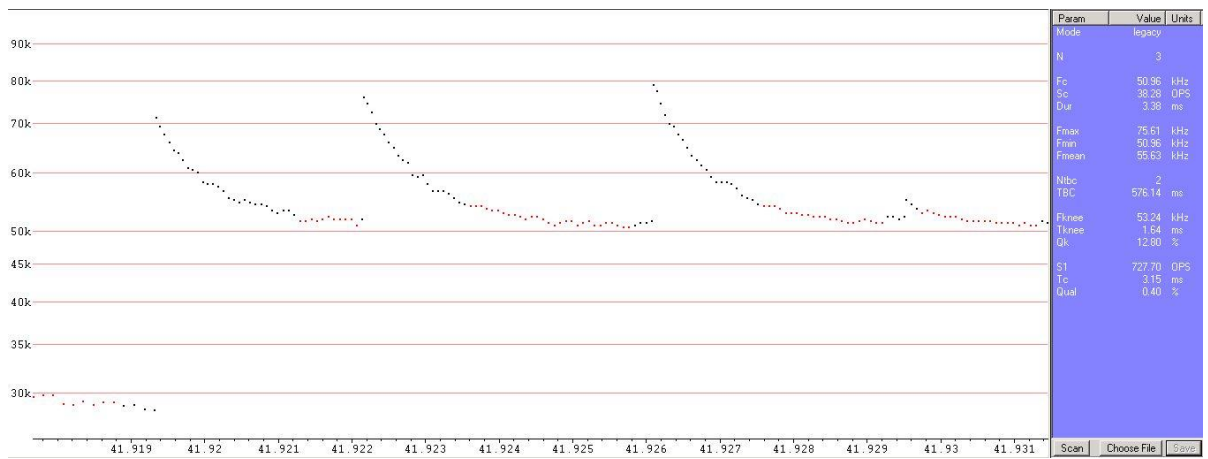


Little Forest Bat

Characteristic frequency within the Sydney Basin of F_c 48.5 to 53 kHz

Pulse shape is curved with up-sweeping tail

Possible identification based on F_c , poor signal obtained

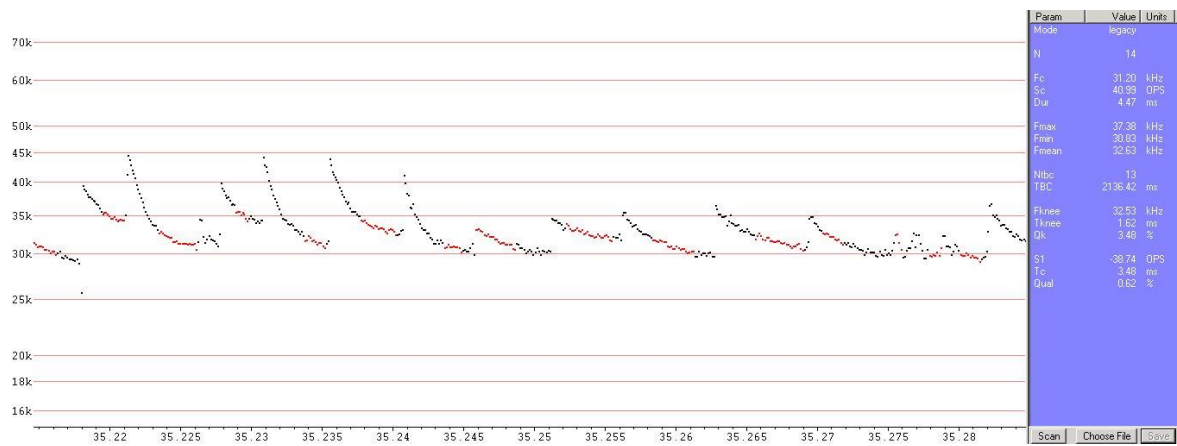


Gould's Wattled Bat

Characteristic frequency within the Sydney Basin of F_c 27.5 to 32.5 kHz

Pulse shape is curved, with or without down sweeping tail. Consecutive pulses alternate in frequency and shape with in typical search phase.

Positive identification with clear alternating pulses within characteristic frequency



Greater Broad-nosed Bat

Characteristic frequency within the Sydney Basin of F_c 32 to 36.5 kHz

Pulse shape is curved may have short down sweeping tail. Consecutive pulses alternate in frequency and shape with in typical search phase.

Possible identification with present of occasional down-sweeping tail and long pre-characteristic section

Characteristic frequency is within the key range but species profile for the Sydney Basin is not well defined.

Vulnerable species (TSC Act)

