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Transport Construction Authority
Locked Bag 6501
St Leonards NSW 2065

Ref/Job No: 10SYDECO073

26 November 2010

Dear Michael,

RE: Preliminary Assessment of the Ecological Values of the M2 and Bundara Reserve Sites of the North Ryde Station Precinct - Part 3A and SSS Application

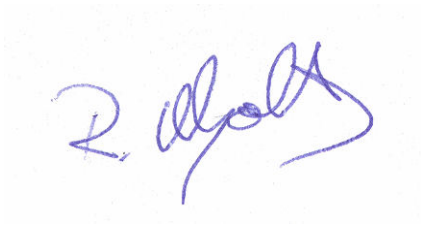
The Transport Construction Authority (TCA) is currently in the process of finalising a master plan for the development of the North Ryde Station Precinct (including two areas referred to as the M2 and RTA Sites) and other adjoining State Government owned properties in the vicinity of the new North Ryde Station.

A variety of options are being considered in the master plan concept. These include options for:

- residential, retail and commercial development;
- development of access roads, walkways and other relevant infrastructure;
- creation of aesthetic landscapes;
- retention, protection and rehabilitation of important bushland and riparian areas; and
- integration of a variety of sustainability measures.

This letter report provides a preliminary assessment of the ecological attributes and habitat potential of the M2 Site and Ryde City Council's Bundara Reserve (which is adjacent to but excluded from the RTA Site) based on previous environmental investigations and studies; as well as a site survey carried out in 2008. The report discusses the ecological constraints on site and recommendations in relation to avoidance and mitigation as well as restoration of ecological attributes.

Should you have any questions regarding this information, please do not hesitate to contact me on 9993 0566.



Robert Mezzatesta
Manager, Sydney

BACKGROUND AND STUDY AREA

Residential retail and commercial development, and the construction of related infrastructure to support these, may impact on existing bushland areas within and adjacent to the proposed development site. TCA is specifically interested in the impacts of such development on the ecological values of the North Ryde Station Precinct within two identified areas of remnant bushland. These are within the area known as the "M2 Site", specifically in the northern parts of this area; as well as Ryde City Council's Bundara Reserve, located on the eastern side of Delhi Road adjacent to the RTA Site.

This brief report documents ecological constraints posed by these areas in order to establish their environmental legislative context under existing planning instruments and to facilitate TCA's finalisation of the master plan for development.

Figure 1 identifies lands being considered as part of the Open Space Strategy, and identifies the sites subject to this investigation and report.

LEGISLATIVE REQUIREMENTS

A variety of environmental legislative and planning instruments will require consideration. The following include key instruments that may be relevant to the site.

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) establishes a process for assessing the environmental impact of activities and developments where 'matters of national environmental significance' (NES) may be affected. Under the Act, any action which "has, will have, or is likely to have a significant impact on a matter of national environmental significance" is defined as a "controlled action", and requires approval from the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA) which is responsible for administering the EPBC Act.

The endangered ecological community Sydney Turpentine Ironbark Forest (STIF) occurs within the Bundara Reserve (Tozer *et al.* 2006) and is listed under the EPBC Act as a MNES.

Actions that may have a significant impact on one or more matters of NES need to be referred to the Department under the EPBC Act. The EPBC Act referrals process can produce one of three outcomes:

i. Non-controlled action (NCA): Assessment and approval under the EPBC Act is **not required**. The project may proceed without further approval under the EPBC Act.

ii. Non-controlled action – specified manner (NCA-SM): Assessment and approval under the EPBC Act is **not required** provided the action is undertaken in a specific way (similar to conditions).

iii. Controlled Action (CA): The project will, or is likely, to have a significant impact on one or more matters of national environmental significance. The project **will require** full assessment and approval before it can proceed.

This initial assessment outlines when a referral to the Commonwealth Department of Environment, Water, Heritage and Arts (DEWHA) may be required.

Environmental Planning and Assessment Act 1979 (EP&A Act)

The NSW *Environmental Planning and Assessment Act 1979* Act is the NSW planning legislation that provides for development of various kinds through parts of the legislation. Subsidiary instruments of the legislation regulate land use and development and other activities generally within the state and/or through interactions with other legislation. The current project will involve changes to land use zoning and a development approval process requiring consideration of various legislations, plans and policies under Part 3A of the Act; with the Minister being

the determining authority. If the Minister declares that the proposal meets the requirements for a major project, and therefore would be considered under Part 3A; the proposal would be assessed in terms of the 'maintain or improve' criteria for ecological values rather than a test of significance under the Act. The specific terms and items to be considered would then be determined by the Director General's requirements.

Threatened Species Conservation Act 1995 (TSC Act)

The *Threatened Species Conservation Act 1995* Act provides for the Conservation of Biodiversity values in NSW. It does this through a program of mechanisms that operate or relate to 'schedules' that list categories of various threatened 'entities'. A number of categories of threatened entities exist and which must be considered and assessed when undertaking developments and or other activities that may affect them. The categories include critically endangered, endangered, vulnerable and extinct flora and fauna species. They also include Endangered Populations of flora or fauna species that may otherwise be widespread and not threatened generally outside of a specified geographic area, and Endangered or Vulnerable Ecological Communities (EEC) that are assemblages of plant and/or animal species comprising individual species that may not be in or of themselves threatened.

This preliminary assessment identifies potential constraints to development in relation to threatened species, populations and communities listed under the Act.

Water Management Act 2000 (WM Act)

Under the *Water Management Act 2000* a watercourse or waterfront land (as therein defined) may require Controlled Activity (CA) approval from the NSW Office of Water where in-stream or adjacent works may affect a water course itself or its riparian zone are proposed.

Other

The following instruments will also need to be considered as part of a rezoning application but were not considered further within the scope of this project report.

- Ryde Local Environment Plan (LEP) 2010
- City of Ryde Development Control Plan 2010

Figure 1 Open Space Strategy

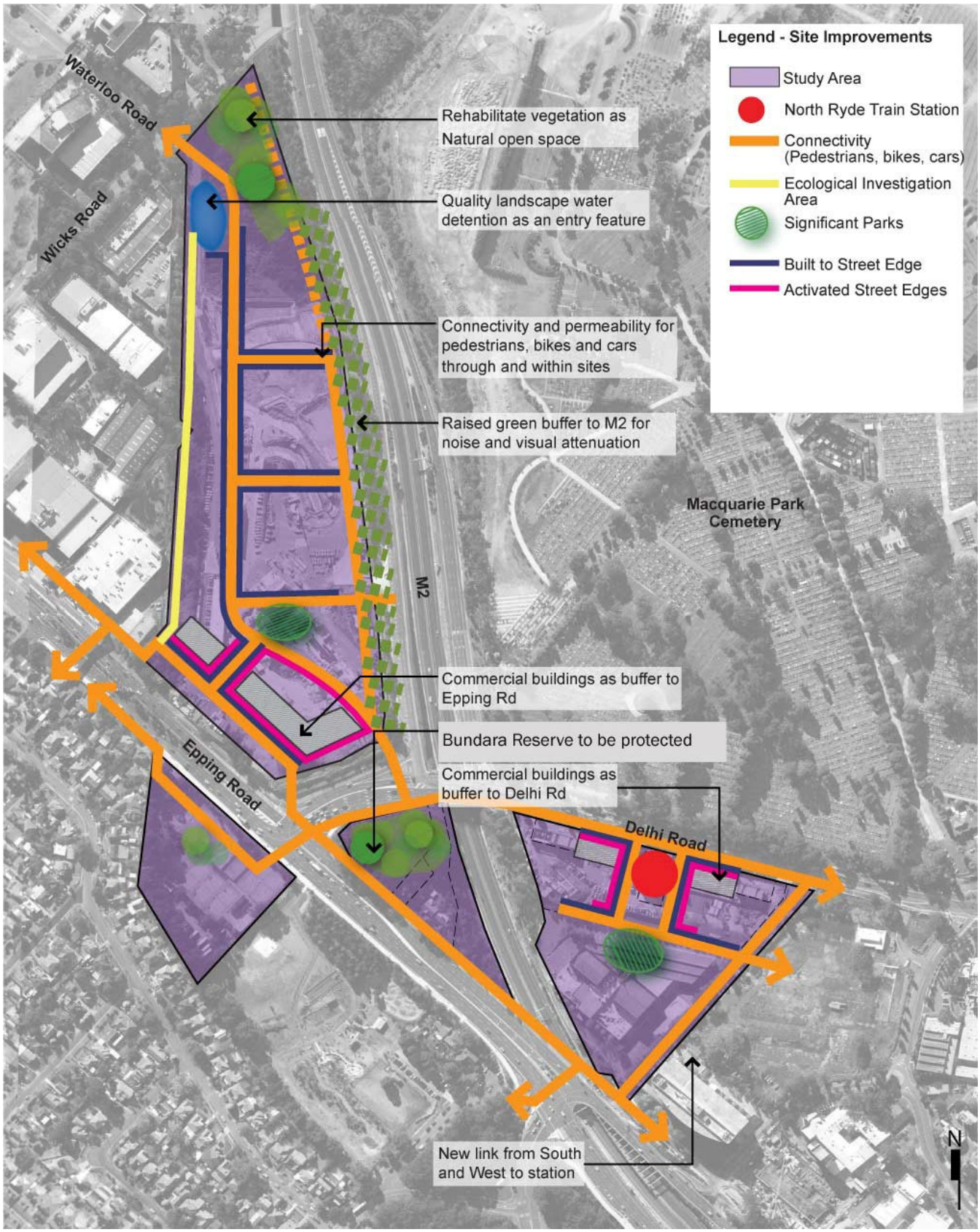


Figure 2 – Site Improvements

ASSESSMENT METHODS

Prior to field survey, relevant literature on the area was reviewed to gather information on the vegetation communities, flora and fauna of the area. A search of the Atlas of NSW Wildlife and EPBC Protected Matters search tool was also performed for the study area on 4/11/08 and 9/10/08, respectively. The searches for the study area used latitude -33.7937 and longitude 151.1350 as their centre with a radius of 10 km. Following these spatial searches for potential ecological values, likelihood of occurrences were assessed for each of the threatened species, endangered populations and communities 'flagged' as occurring within or in the vicinity of the study area, based on the habitat characteristics of the study sites (Appendix A).

Field survey was conducted on 13th October 2008. During field survey, random traverses of the M2 Site and Bundara Reserve were undertaken to collect site-specific data pertaining to the vegetation communities and habitat values for threatened flora and fauna with the potential to occur on the two sites (see Appendix A for a list of potentially occurring species, populations and communities). In addition to undertaking the random traverses, targeted active searches for reptiles and amphibians were undertaken by turning and carefully replacing rocks and logs. All visible flora and fauna species detected during the site searches were identified and recorded and notes on habitat taken.

In total, field survey took approximately 20 person hours to complete. The survey team included Tammy Haslehurst, Ross Wellington, and Dr. Enhua Lee. Weather conditions leading up to and during the survey were dry, and mild to warm.

A further assessment was carried out by Eco Logical Australia in 2009 in relation to weed control works along the western (fence line) boundary of the M2 Site. A site inspection to support this assessment, including search for Red Crown Toadlet (RCT), was carried out on 4th May 2009 for 8 hours by Ross Wellington.

INFORMATION REVIEW AND DATA AUDIT

ELA were provided with relevant sections of previous investigation reports that have been recently undertaken for the two study sites. These include:

- Urban Bushland in the Ryde LGA – Oculus Architecture and Urban Design 2001

  This report documents the extent of vegetation predicted to have occurred prior to European settlement in NSW and identifies the main vegetation community types considered as occurring within the LGA. Whilst indicative and perhaps predictive these broad vegetation maps do not take into account local variations at a small scale and the influence of smaller tributaries to the main Lane Cove River drainage nor other slope, aspect and soil landscape influences.

  This report identifies or predicts Sydney Turpentine Ironbark Forest (STIF) as occurring on both the Bundara Reserve as well as on the M2 Site.

- EIS/Investigations Report – Ambrose Ecological

  This report documents flora and fauna survey findings for the M2 Site that were conducted in support of the initial development for the Epping to Chatswood Rail Link (ECRL) and that necessitated the use of the bulk of the M2 Site for tunnelling and construction works.

  Diurnal surveys were conducted by two people for two hours and nocturnal surveys were undertaken by two people for 1.5 hours on two consecutive nights. The study detected no threatened species and the report concluded no significant impact on any threatened species but identified potential habitat for ten threatened fauna species. The ten species identified included: Red-crowned Toadlet *Pseudophryne australis*, Barking Owl *Ninox connivens*, Powerful Owl *Ninox strenua*, Sooty Owl *Tyto tenebricosa*, Glossy Black Cockatoo *Calyptorhynchus lathami*, Swift Parrot *Lathamus discolor*, Superb Parrot *Polytelis swainsonii*, Large-eared Bat, *Chalinolobus dwyeri,* Large Bent-wing Bat *Miniopterus schreibersii* and Large-footed Myotis *Myotis macropus*.

  A section 5A assessment ('8-part test') was undertaken for each of these species within the Parramatta Rail Link Technical Report (Chapter 7 - Ambrose 2001) and concluded that no significant impact would be likely on any of the identified threatened species. However a subsequent targeted survey during warmer months and following heavy rain apparently detected up to 10 RCT calling from the adjacent property to the west of the M2 Site (Chapter 8 Ambrose 2001). A communication with Stephen Ambrose verified the identity of records of the RCT that were reported during the original assessment for the Parramatta Rail Link and the details and circumstances of the original observations, (Pers. Comm., May 2009). It was further recommended that monitoring of the population should take place to assess potential changes to persistence of the species during the works carried out on the M2 Site during construction of the ECRL. The area of the M2 Site between the reported RCT sightings on the adjoining property is heavily disturbed and consists of a sealed bitumen access road and a concrete dish drain separating the adjoining site from the vegetated section of the northern section of the M2 Site.

  Our own assessment of these threatened fauna species would have eliminated the Superb Parrot that has a natural distribution west of the divide along main drainage lines to the Riverina. Atlas records for Sydney are believed to be aviary escapee records. Barking Owl records are very scarce and the few from the Sydney area are nearly all ten or more years old. Sooty Owls are another unlikely species and none have been recorded for the Sydney area for more than 12 years and were from more appropriate heavily vegetated habitat areas to the north west. Neither species would be likely to occur in the highly fragmented and small patch size areas of the subject land. The Swift Parrot is a migratory species that often utilises winter flowering eucalypts and could conceivably utilise resources on either site whilst undertaking these migratory movements. The Glossy Black Cockatoo may also utilise the sites on occasion to feed on the *Allocasuarina torulosa* seed pods but there were only a few specimens and none showed any signs of feeding activity. Records for the species are more likely to be from observations of them utilising more concentrated browse feed available on substantial stands of *Allocasuarina* along the slopes of the Lane Cove River.

Consequently only the micro-bat species and the RCT are considered as being likely to require further potential habitat considerations.

- Bundara Reserve Flora and Fauna Monitoring – Biosphere Ecological Consultants.

  Ryde City Council (RCC) commissions periodical flora and fauna monitoring reports for its reserves. The Autumn/Spring monitoring results table was made available for inclusion in the considerations for this study. However no individual flora species of conservation concern were identified and only one threatened fauna species, the Grey-headed Flying Fox (*Pteropus poliocephalus*) (GHFF); which is both TSC and EPBC listed; was apparently detected flying over the Bundara Reserve site.

  Our desk top assessment also indicated that the GHFF was a likely occurrence in the vicinity although unlikely to be highly dependent on the foraging opportunities provided by the two sites; particularly the M2 Site that has lost most of its flowering eucalypts, and its riparian zone is dominated by introduced species. Bundara Reserve does have stands of eucalypts that could provide occasional foraging habitat for the GHFF but its relatively close proximity to extensive areas of contiguous bushland reduces any likelihood of the species being dependent on Bundara Reserve vegetation.

  Our site inspection produced a similar flora species list (see Appendix B) to that of Biosphere Ecological Consultants but detected fewer bird and mammal species given its brief duration and lack of a nocturnal component. Our opportunistic reptile survey has added two additional species to the Reserves fauna list.

  Independently, Council's environmental officer has indicated that the Bundara Reserve may provide a roost site for Powerful Owls (C. Riley Pers. Comm.), however no obvious scats or accumulations of owl droppings were observed. Powerful Owls in contrast to some other forest owl species are known to be able to utilise a mosaic of vegetation patches as components of its larger territory. Powerful Owls are also known to be more likely to tolerate and adapt to the disturbance of the urban periphery. Consequently anecdotal reports of Powerful Owls in Bundara Reserve are not unreasonable. No trees with suitable nesting hollows for Powerful Owls were detected on either site.

- Monitoring Survey for Red-crowned Toadlet, M2 Site - Biosphere Ecological Consultants

  Monitoring of the population of RCT at the M2 Site was carried out during the rail construction phase for three survey periods (Biosphere Environmental Consultants 2006a, b and 2007). Over 2005 and February 2006 RCT were detected as calling and in September 2006 2 RCTs and 2007, 1 RCT were observed.

Based on our desktop spatial analysis, two threatened ecological communities, one endangered fauna population, two threatened flora populations, 61 threatened fauna species, and 51 species of threatened flora were predicted as potentially occurring within a 10 km radius of the study site (this included migratory species under the EPBC Act; Appendix A).

We then gave consideration to the following factors in order to accurately predict species potentially occurring on site:

- the area of available habitat;
- location and assessed availability of suitable habitat/habitat components within the two sites;
- distance from large lakes, estuaries and/or major watercourses;
- known ecological requirements of the species and sensitivity to disturbance; and
- our expert opinion.

The number of species considered by ELA to require specific consideration (these are sometimes referred to as 'subject' species by the DECCW) is outlined in Appendix A. The majority of the fauna and flora species (84 out of a total 112 predicted) are considered not to or unlikely to occur on site and are therefore not considered further in this report.

This preliminary assessment estimates that 17 species of threatened fauna and 11 threatened plant species have the potential to occur on the site (Appendix A). The majority of these species are wide ranging, migratory, 'fly over' or transient visitors to the site with little likelihood of significant reliance on the sites habitats for survival.

Site inspections gave due consideration to the species that had potential to occur but within the limitations of the scope of survey effort and methodology intended for a constraint analysis of the site. No specific targeted surveys were undertaken for threatened fauna but habitat values were assessed. For example no ultrasound anabat surveys were undertaken for microbat species nor were there nocturnal spot light surveys and whilst flora surveys were undertaken to a level to determine vegetation community status a full floristic analysis was not completed.

ENVIRONMENTAL VALUES

Bundara Reserve

Vegetation Communities and Condition

A refined GIS based desktop assessment identified the EEC Sydney Turpentine Ironbark Forest (STIF) as occurring within the Bundara Reserve (Tozer *et al.* 2006) and which also supports the findings of Oculus (2001).

Characteristic tree species in STIF are *Syncarpia glomulifera*, *Eucalyptus globoidea*, *Eucalyptus resinifera*, *Eucalyptus paniculata*, *Angophora costata* and *Angophora floribunda*. The determination by the NSW Scientific Committee for this community also provides a considerable inclusive list of characteristic flora species but notes that the composition varies considerably from site to site and notes that the composition is influenced by patch size and history of disturbance.

Our field assessment of the Bundara Reserve identified fifty-seven flora species (Appendix B) as present with the dominant canopy species in this patch predominantly including Turpentine (*Syncarpia glomulifera*) and Grey Ironbark (*Eucalyptus paniculata*), although Sydney Red Gum (*Angophora costata*), Grey Gum (*E. punctata*), Tallowood (*E. microcorys*) and Sydney Blue Gum (*E. saligna*) also occurred. Common mid-storey species included Sweet Pittosporum (*Pittosporum undulatum*), Parramatta Wattle (*Acacia parramattensis*), Forest Oak (*Allocasuarina torulosa*), *Ozothamnus diosmofolius* and the occasional Lilly Pilly (*Syzygium* sp.). Common under-storey species included Bordered Panic (*Entolasia marginata*), Wombat Berry (*Eustrephus latifolius*), Kidney Weed (*Dichondra repens*), *Microlaena stipoides*, Kangaroo Grass (*Themeda australis*) and *Oplismenus sp*.

Consequently our site assessment agrees with the existing vegetation mapping (Tozer *et al.* 2006) and also conforms to the determination of the vegetation as being the EEC Sydney Turpentine Ironbark Forest (STIF).

The community within Bundara Reserve was considered to be in moderate to good condition with a diversity of native species present in all strata. However, the community included some weed species, such as Panic Veldtgrass (*Ehrharta erecta*) and some planted ornamental species, mainly along the boundaries of the reserve. Notwithstanding the weed species, the community was dominated by native species and had good structural elements present. Historically, there may have been some thinning of the midstorey layers and other disturbance may also have occurred, but canopy cover was high, with projected crown cover of approximately 30%. The area of significant vegetation at the site is shown in Figure 3.

Fauna

Six species of birds were identified during a brief field survey of Bundara Reserve: Sulphur Crested Cockatoo (*Cacatua galerita*), Noisy Minor (*Manorina melanocephala*), Galah (*Cacatua roseicapilla*), Rainbow Lorikeet (*Trichoglossus haematodus*), Magpie Lark (*Grallina cyanoleuca*) and Pied Currawong (*Strepera graculina*). In addition, 5 species of reptile were recorded in the Reserve: Weasel Skink (*Saproscincus mustelina*), Eastern Water Skink (*Eulamprus quoyii*) and two sunskink species (*Lampropholis delicata and Lampropholis guichenoti*) along with indirect indications of the presence of the Common Blue Tongue (*Tiliqua scincoides*). All of the species observed are native species and considered to be common in the Sydney area. No other fauna groups or any threatened fauna species were recorded within Bundara Reserve.

Figure 3 – Significant Vegetation

M2 Site

Vegetation Communities:

Desktop GIS data assessment indicates that possibly two vegetation communities may occur at the M2 Site. These are: Sandstone Ridgetop Woodland (Tozer *et al.* 2003) and Hinterland Sandstone Gully Forest (Tozer *et al.,* 2006). A summary of the key structural and floristic features of these communities is provided and discussed below. Neither of these two vegetation communities constitutes an EEC.

1. Coastal Sandstone Ridgetop Woodland

Coastal Sandstone Ridgetop Woodland is found on ridgetops where soils are sandy and shallow and on dry exposed slopes on Hawkesbury Sandstone. Considerable variation can be seen in the structure and floristics of this bushland. This community occurs predominantly on sandstone ridgetops and plateaux, but may extend to the floor of shallow gullies. Coastal Sandstone Ridgetop Woodland is structurally variable and may lack a tree stratum (Tozer, *et al.* 2003). In Ryde, this community occurs in a few locations on exposed sandstone ridges and at the tops of gullies (Ryde City Council 2008). This vegetation community is not considered to constitute any currently listed EEC under state or Commonwealth legislation.

Floristically canopy species comprise of Scribbly Gums, Red Bloodwood (*Corymbia gummifera*), Smooth-barked Apple (*Angophora costata*), Narrow-leaved Apple (*Angophora bakeri*) and Sydney Peppermint (*Eucalyptus piperita*); and understorey species are diverse and comprise of shrubs and herbs including Banksias and Hakeas.

2. Hinterland Sandstone Gully Forest

Hinterland Sandstone Gully Forest (HSGF) (sometimes also classified as Western Sandstone Gully Forest in some vegetation classification schemas) is an open eucalypt forest with an abundant sclerophyll shrub stratum and a groundcover dominated by sedges. This forest type surrounds the Cumberland plain, occurring along the western portion of the Hornsby and Woronora plateaux and in the lower Blue Mountains. Within this distribution Hinterland Sandstone Gully Forest occurs on lower slopes of dry sandstone gullies up to 600m ASL where average annual rainfall ranges from 850 to 1300mm. Hinterland Sandstone Gully Forest grades into Sandstone Riparian Scrub immediately adjacent to creeklines and is replaced by Coastal Sandstone Ridgetop Woodland or Wingecarribee-Burragorang Sandstone Forest on upper slopes and exposed positions. As rainfall increases toward the coast, it is replaced by Coastal Sandstone Gully Forest (Tozer *et al.* 2006).

Extensive areas of this vegetation community occurs in Wollemi and Yengo national parks, north-west of Sydney and it also forms a narrow band surrounding the Cumberland Plain from Lapstone south to Picton, and from Wilton north-east to Holsworthy and to the northeast including the Hornsby Plateau and the study site. Consequently this vegetation community does not constitute any currently listed EEC under state or Commonwealth legislation.

Floristically the community is comprised of *Angophora costata, Corymbia gummifera, Banksia serrata, Eucalyptus piperita;* shrubs include *Persoonia linearis, P. levis, Phyllanthus hirtellus, Leptospermum trinervium, Lomatia silaifolia, Banksia spinulosa, Platysace linearifolia, Ceratopetalum gummiferum, Acacia ulicifolia, Acacia terminalis;* climbers such as *Billardiera scandens* and groundcover consisting of *Entolasia stricta, Pteridium esculentum, Dianella caerulea, Smilax glyciphylla, Xanthosia pilosa, Lomandra longifolia, Lepidosperma laterale, Lomandra obliqua*.

The remnant vegetation on site is also similar to Western Sandstone Gully Forest and is similar in composition and structure to Hinterland Sandstone Gully Forest, however, this community is not identified in *the Native Vegetation of the Cumberland Plain Interpretation Guidelines* (NPWS 2002). Western Sandstone Gully Forest is described in the *Cumberland Plain Interpretation Guidelines* (NPWS 2002) and has been confirmed as a variant of Hinterland Sandstone Gully Forest by Tozer (pers comm.).

Floristically this variation classification is dominated by *Angophora costata, Corymbia gummifera* and *E. pilularis*, with *E. punctata* occurring sporadically on mid-slopes. A sparse layer of smaller trees is usually present, and

dominated by *Ceratopetalum gummiferum* and *Allocasuarina littoralis*. The shrub and ground strata are also sparse and often contain slightly fewer species relative to ridgetop communities. Shrub species include *Acacia terminalis, Leptospermum trinervium, Persoonia linearis* and *Banksia spinulosa* var. *spinulosa*. In the ground stratum, the fern species *Pteridium esculentum* is invariably present, along with the climber *Smilax glyciphylla*. These species were seldom recorded in other communities. Other species frequently recorded in the ground stratum include *Entolasia stricta, Dianella caerulea, Lomandra obliqua, L. longifolia, L. gracilis, Lepidosperma laterale* and *Gonocarpus teucrioides* (Tozer, *et al.* 2003).

Vegetation condition assessment

The vegetation on the M2 Site was highly degraded and the majority of tree species present across the site are dead. However, a small number of Red Mahogany (*Eucalyptus resinifera*) specimens were present at the site and Flax-leaved Paperbark (*Melaleuca linariifolia)* were recorded in the sub-canopy in the north western part of the site. In the northernmost section of the site, adjacent to the creekline, introduced Camphor Laurel (*Cinnamomum camphora*) dominate the canopy with the occasional Flax-leaved Paperbark.

The understorey in this area is heavily invaded with Privet (*Ligustrum* spp.) and Lantana (*Lantana camara*) with a small number of native species. The majority of the native species present are non diagnostic species that are common to a variety of vegetation communities and were detected throughout. For example, Sweet Pittosporum (*Pittosporum undulatum*), *Acacia parramattensis*, Kidney Weed *(Dichondra repens*), Needlebush (*Hakea teretifolia*), Tick Bush (*Kunzea ambigua*), *Microlaena stipoides, Entolasia stricta, Dianella caerulea* var. *producta*, *Lomandra longifolia* and *Gahnia* sp. The exotic grass Panic Veldtgrass (*Ehrharta erecta)* was also common throughout the groundlayer of this community and Wandering Jew (*Tradescantia albiflora*) was common adjacent to the creekline.

The area within approximately 30 metres north of the existing construction water quality pond is dominated by exotic species and therefore is no longer likely to represent a native vegetation community. However, further north of this area, a degraded remnant of native vegetation remains.

Given the highly degraded nature of the vegetation community and that the majority of the canopy species have died, it is difficult to assign a specific vegetation community category without undertaking detailed floristic plot based surveys on site, on adjacent properties and along the water course. It is possible that the vegetation community element down slope may differ from the vegetation community along the drainage line itself. Soil landscape mapping indicates the lower portions of the site falls within the Lucas Heights landscape group which is characterised as occurring on gently undulating crests and ridges without rock outcropping and occurs commonly on the Hornsby Plateau. Soils are characterised as hard setting Yellow Podzolic Soils, Yellow Soloths and Yellow Earths (Chapman and Murphy, 1989).

It is considered likely that Sandstone Ridgetop Woodland merging with Sydney Turpentine Ironbark Forest (STIF) would once have been present in the now cleared area of the elevated southern portion of the site. This upper slope section of the site is mapped as occurring within the Glenorie Soil Landscape Group (Chapman and Murphy, 1989).

Based on a combination of factors it is therefore considered that the area of native vegetation downslope (to the north) of the water quality control pond constitutes Western Sandstone Gully Forest. This community is not listed as an EEC under State or Commonwealth legislation.

Our assignation is based on the key characteristic species that are present, the position of the vegetation on the M2 Site in the landscape (i.e. adjacent to a drainage line and not on a ridge top or upper slope), as well as the changes in soil type. Furthermore, the canopy and sub-canopy species recorded at the M2 Site, Red Mahogany and Flax-leaved Paperbark are not listed in the characteristic species list for the Sandstone Ridgetop Woodland community (Ryde City Council 2008) and although *Eucalyptus resinifera* is not listed as a key characteristic of Western Sandstone Gully Forest, it is noted as one of the trees recorded less frequently in this community. It is also noted in *Native Plants of the Ryde District* (Kubiak 2005) that Red Mahogany can occasionally be found in sandstone areas, possibly sometimes growing on sandstone lenses.

The disturbed nature of the site and presence of species common to a number of communities has made identifying the community at the site difficult and it is therefore recommended that more detailed floristic surveys, including a plot based, quadrat analysis be undertaken at the site and where it occurs on adjoining lands to precisely verify the vegetation community / communities present for any proposed rehabilitation works. However in either case the vegetation does not constitute an EEC under State or Commonwealth legislation.

Nevertheless, the vegetation does provide significant ecological values despite the extent of weed infestation. It likely contributes to a local mosaic of vegetation patches that provide for the persistence of a variety of native fauna species in the locality and more generally within the Ryde LGA. Riparian vegetation will also contribute to stream water quality and provides other natural system functions.

The vegetation along the drainage line and from about 30 metres below the existing water quality control pond is vegetation that could be rehabilitated from its current weedy condition. This area is shown as that part of the significant vegetation identified in Figure 3 within the boundaries of the study area. The vegetation also continues outside of the study area adjacent to the M2 as shown in Figure 3.

Fauna

Seven species of bird were identified opportunistically during a brief field survey of the 'M2 Site'. These included the Noisy Minor (*Manorina melanocephala*), Pied Currawong (*Strepera graculina*), Straw-necked Ibis (*Threskiornis spinicollis*), White-faced Heron (*Egretta novaehollandiae*), Superb Fairy-wren (*Malurus cyaneus*), Silvereye (*Zosterops lateralis*) and Spotted Pardalote (*Pardalotus punctatus*). In addition, 3 reptile species were detected within the site: Eastern Water Skink (*Eulamprus quoyii*), sunskink or litter skink (*Lampropholis delicata*) and Eastern Water Dragon (*Physignathus lesueurii*); and two amphibian species: Brown-striped Marsh Frog (*Limnodynasters peronii*) and Common Toadlet (*Crinia signifera*). All of the species observed are native species and considered to be common in the Sydney area. No other fauna groups or any threatened fauna species were recorded within the M2 Site.

Surveys for the RCT revealed that habitat for the species is moderate to poor quality with a high level of disturbance and considerable weed infestation.

The RCT was found opportunistically occupying areas of artificial habitat along the western boundary of the M2 Site that would appear to be mimicking natural microhabitat features known to be favoured by the species in other settings (ELA 2009). This is an interesting observation because the RCT is usually lost as an element of the fauna from areas with heavy weed infestation normally coincident with elevated nutrient levels (NPWS, 2000). That the species has persisted, despite the adjacent major construction works on the M2 Site, is also a somewhat novel circumstance. RCT have a patchy distribution in areas where they occur and appear to favour areas of sandstone as well as where shale lenses occur amongst or adjacent to sandstone. They are predominantly a ridgetop species but will often also utilise the benched areas just below sandstone outcrop ridges that typify the geomorphology of Sydney Sandstone. The species is also known to occupy shallow valleys that may be found adjoining more typical sandstone outcrop areas.

The species is sensitive to poor water quality that is often associated with urban developments as well as the changed runoff regimes created by hard stand surfaces. Weed infestation can often be generally indicative of elevated nutrient levels from urban areas and is likely to be one of the direct causes for the species disappearance at the urban bushland interface.

Habitat

The habitat on the M2 Site is likely to provide resources for some fauna species and a small number of threatened species. Although it is unlikely that the site would provide important resources for any threatened species, any bushland in an urban setting has some value providing bushland resources for fauna as they become scarcer.

Table 1 summarises the key habitat features found in each section of the study area, identifies the vegetation type in which they are present and the species for which each feature would provide habitat.

Table 1: Fauna habitat at the sites

Habitat Feature	Vegetation Type	Species
Bundara Reserve		
Hollow-bearing Tree / Stag	STIF	Birds, mammals, microchiropteran bats
Stag	STIF	Birds
Autumn / winter-flowering Eucalypts	STIF	Birds & bats, in particular Swift Parrot and GHFF
Flowering Myrtaceous trees and shrubs	STIF	Foraging resources for birds, mammals and GHFF
Fallen timber	STIF	Small mammals & reptiles
Leaf litter	STIF	Amphibians, reptiles, ground-dwelling mammals
Allocasuarina torulosa	STIF	Glossy Black Cockatoo
Decorticating bark		Microchiropteran bats, reptiles
Common lerp infested species		Swift Parrot and other bird species.
M2 Site		
Stag	HSGF	Birds, particularly birds of prey
Sandstone Watercourse	HSGF	Amphibians, birds, reptiles, microchiropteran bats
Dense shrubs	HSGF	Small birds and birds common to urban environments, ground-dwelling mammals.
Flowering Myrtaceous trees and shrubs	HSGF	Foraging resources for birds and mammals
Fallen timber	HSGF	Small mammals, reptiles & insects
Leaf litter	HSGF	Amphibians, reptiles, ground-dwelling mammals
Decorticating bark	HSGF	Microchiropteran bats, reptiles
Sandstone Watercourse		Amphibians, birds, reptiles, microchiropteran bats
Dense exotic shrub and vine layers		Small birds and birds common to urban environments.

CONSTRAINTS

Bundara Reserve

The vegetation within the Bundara Reserve has been confirmed through this study as being an example of moderate to good quality Sydney Turpentine Ironbark Forest (STIF) Endangered Ecological Community (EEC). It is estimated that only 0.5% of this vegetation type remains of the original extent of its distribution (Oculus, 2001). The size of the vegetation patch is approximately 0.5 ha in area and at this relatively small patch size already has a significant edge to area ratio. Consequently any proposed overpasses or walkways through or impacting on the vegetation patch would exacerbate edge effects (weed invasion/disturbance) and fragment the patch causing potentially significant degradation of the vegetation community.

If a walkway option through the reserve were to be pursued it would likely be considered an impact upon the EEC that may not meet the "maintain or improve" criteria. Similarly overpass options that were to significantly impinge on the Bundara Reserve vegetation or dissect it would have likely similar consequences for referral to DECCW for concurrence. As STIF is also listed under the EPBC Act, proposals that were also considered to be significantly impacting on it (and meet the criteria under the Act) would also need referral to the Commonwealth for determination and possibly approval.

Overpass concepts should be confined to an area abutting the very edge of the reserve and limited to the landscaped batter on the northern Delhi Road side of the reserve so no detrimental effects on the STIF are envisaged. This would require that disturbances be confined to the area outside the existing log fence that demarcates the northern reserve boundary.

No threatened flora or fauna were detected within the Bundara Reserve. The site could be utilised by some mobile threatened species but none of these occasional potential visitors are likely to rely on the habitat values of the site in any significant way. Avoiding impacts on STIF would also avoid causing impact to any of the potential threatened species habitat values of the site. On the southern side Bundara Reserve abuts a privately owned currently occupied residential allotment and three others (RTA owned) all fronting Epping Road.

Assuming that the existing privately owned residential property were to become available for other development options, buffering along the southern boundary of Bundara Reserve may become an issue. Ideally a maximised band of sympathetic revegetation along this boundary would reduce disturbances to the STIF vegetation community within the reserve and reduce weed invasion along a disturbance boundary. Bali (2005) provides a discussion paper summarising the various issues relating to a consistent approach to providing buffers along linear infrastructure such as roads. The general conclusion appears to indicate that buffers should be developed on a case by case basis due to the range of variable factors such as slope, aspect, size and the values being buffered. Our conclusion is that a reasonable buffer would likely be 4-10 metres, depending on the design of the proposal.

M2 Site

The majority of the site has limited or no native remnant vegetation value and possesses no evident ecological constraints to the open space strategy, shown in Figure 1.

The existing construction sediment/water quality control pond more or less demarcates the totally disturbed southern part of the site from the northern vegetated section of the site. The sediment/water quality control pond, which was established for the construction of the ECRL, provides some habitat values for aquatic birds and other species that, because of their mobility, are able to opportunistically utilise the pond. However, the pond does not provide any irreplaceable ecological values that are considered likely to constrain the modification of this concrete lined structure.

This ecological assessment has also identified and documented the heavily weed infested and degraded state of the vegetation communities in the northern portion of the M2 Site. The vegetation for a distance of approximately 30m north of the pond is so heavily degraded and weed affected (almost 100% weeds) that it also provides little if

any ecological constraint to design concepts that might involve extending the development footprint to this part of the site.

Despite the difficulty in categorically assigning the on site vegetation north of the pond to a particular vegetation community, the possibility of it representing an EEC can be ruled out. Our analysis has tentatively assigned the vegetation to Western Sandstone Gully Forest. It is noted that vegetation community classification is difficult for small disturbed remnants such as these.

There is a small area on the western boundary of the M2 Site where there have been confirmed sightings of RCT presence and Figure 3 identifies the area of RCT habitat. The RCT is listed as a vulnerable species under the TSC Act and a maintain or improve assessment for management of the existing population will be required once the Masterplan layout is finalised.

Closer to the drainage line, the vegetation, though still heavily weed infested, consists of a much higher proportion of native plant species. The northern vegetated section of the site has the potential, with significant effort, to be rehabilitated to a patch of native vegetation.

This northern most segment of vegetation is also likely to be constrained by flood affectation and riparian zone considerations required under the *Water Management Act 2000* (administered by the NSW Office of Water (NOW)).

Works requiring consideration could include:

- In-stream works
- Laying pipes & cables in watercourses
- Construction of outlet structures
- Clearing of vegetation in riparian corridors
- Construction of watercourse crossings

These works may require that TCA undertake the preparation and implementation of a vegetation management plan in accordance with the NOW guidelines at:
http://www.water.nsw.gov.au/Water-licensing/Approvals/Controlled-activities/Controlled-activities/default.aspx

A number of dead trees (stags) scattered throughout this lower section of the site may have habitat values in the form of a few small spouts or hollows (no large hollows were detected). Removal of these trees, if needed, would require targeted surveys for utilisation by threatened microbat species that potentially utilise this part of the site.

The construction of an access road from Waterloo Road into the M2 Site would result some removal of Western Sandstone Gully Forest and has the potential to impact on the drainage line. However, impacts in the area just north and east of the existing water quality control pond are likely to only remove primarily exotic vegetation adjacent to the detention basin. The removal of Western Sandstone Gully Forest for the Waterloo Road access would need to be offset through rehabilitation/regeneration works in the north of the site and riparian zone of the drainage line. Management of indirect measures such as runoff from the proposed road and areas upslope on the site as well as weed invasion would be required in the areas upslope of the proposed road to avoid further impact on the remnant riparian vegetation downslope.

RECOMMENDATIONS

Bundara Reserve

- Avoid any walkway/access options that extend through the Bundara Reserve causing fragmentation or disturbance to the high conservation significance STIF vegetation EEC in the reserve.
- Position and anchor any overpass walkway options within the existing road reserves, pedestrian walkways, or existing landscaped batter slopes and, by so doing, avoid the risk of the requirements for further offset.
- Avoid any other options that disturb the STIF EEC within Bundara Reserve.
- Prepare a vegetation management plan for the areas of the Reserve subject to indirect impact adjacent to the RTA Site and proposed overpass development that takes into account appropriate recovery plan actions for this vegetation community (including management of weeds). This might also include some interpretive signage and other information to elevate community awareness and involvement in the management of the reserves significant vegetation.
- Consider whether STIF is present on private lands, and buffer and setback any future development on the southern side of Bundara Reserve with a combination of approximately 5m vegetated buffer and an appropriate setback for construction options (and consider options for STIF if present on private lands).

M2 Site

- Incorporate leading practice design principles such as WSUD into the Masterplan concept.
- Include within design considerations a 'green corridor' as stepping stones throughout the site to provide connectivity across the site and between other offsite vegetation. This corridor should be at least 10 metres in width but this may be varied and combined with other WSUD and detention structures open space and landscaping. Generally the wider a corridor is the more likely it is of being functional and the site would appear to be capable of supporting a 10-30 metre buffer that could be varied north south across the site.
- Endeavour to link on site water management to the green corridor theme if possible as this will likely result in colonisation and/or its increased use.
- Develop and implement a Vegetation Management Plan (VMP) for the vegetation that extends from approximately 30 metres north of the existing pond. This management plan should incorporate NOW guideline concepts as well as appropriate management regimes for the vegetation community determined to be present.
- Note that there are limited ecological constraints existing to tree removal on the southern two thirds of site but there may be some restriction on tree removal to the north of the site subject to assessment of potential use by microbat species.
- Long term survival of the existing RCT population element on the subject land is unclear and would likely require active management to maintain. This may include habitat creation within the landscape design options of open space or green space areas in an adjacent to the western boundary of the M2 Site.
- Any disturbance to vegetation in the northern third of the site arising from intersection / road design, or other possible proposal considerations such as pedestrian and / or cycleway access and stormwater detention will require further ecological assessment.

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APPENDIX A
Endangered ecological communities and threatened species predicted for the region.

A search of the Atlas of NSW Wildlife and EPBC Protected Matters search tool was performed on 4/11/08 and 9/10/08, respectively. The searches for the study area used latitude -33.7937and longitude 151.1350 as their centre with a radius of 10 km.

The results from both searches were compiled into a list of potentially occurring species, with the exception of the listed marine fish, reptile and mammal species and sea bird species from the EPBC Protected Matters search, which were considered to not be relevant to the study site.

The likelihood of occurrence was considered for all listed species, and is given for each species under the 'Likely' column. The terms for likelihood of occurrence are defined below:

- "yes" = the species was or has been observed on the site
- "likely" = a medium to high probability that a species uses the site
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- "unlikely" = a very low to low probability that a species uses the site
- "no" = habitat on site and in the vicinity is unsuitable for the species.

TSC Status = Listing under the *Threatened Species Conservation Act 1995*
EPBC Status = Listing under the *Environment Protection and Biodiversity Conservation Act 1999*
Ex = Extinct
CE = Critically Endangered
E = Endangered
V = Vulnerable
M = Migratory
Mar = Marine
JAMBA / CAMBA / ROKAMBA = Protected under the Japan and Australia Migratory Bird Agreement, China and Australia Migratory Bird Agreement, or the Republic of Korea and Australia Migratory Bird Agreement.

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Threatened Ecological Communities					
Sydney Turpentine Ironbark Forest (including Turpentine Ironbark Margin Forest)	Sydney Turpentine Ironbark Forest (including Turpentine Ironbark Margin Forest)	E	CE	Yes	Occurs close to the shale/sandstone boundary on the more fertile shale influenced soils, in higher rainfall areas on the higher altitude margins of the Cumberland Plain, and on the shale ridge caps of sandstone plateaus. A transitional community, between Cumberland Plain Woodland in drier areas and Blue Gum High Forest on adjacent higher rainfall ridges.
Blue Gum High Forest	Blue Gum High Forest	CE		Potential	Occurs only in areas where rainfall is high (above 1100 millimetres per year) and the soils are relatively fertile and derived from Wianamatta shale. In lower rainfall areas, it grades into Sydney Turpentine-Ironbark Forest
Ray-finned fish					
Macquaria australasica	Macquarie Perch	E	E	Unlikely	Occurs widely in riverine and lake habitats. In Sydney basin only known from Cataract and Cordeaux River catchments. Upland streams and migrates upstream to gravel beds to spawn.
Prototroctes maeaena	Australian Grayling		V	Unlikely	Freshwater streams and rivers draining to the sea. Clear gravelly streams and from estuarine reaches substantial distances inland.
Frogs					
Heleioporus australiacus	Giant Burrowing Frog	V	V	Unlikely	The vegetation is typically woodland, open woodland and heath and may be associated with 'hanging swamp' seepage lines and where small pools form from the collected water
Litoria aurea	Green and Golden Bell Frog	E	V	Unlikely	Large permanent freshwater wetlands, with dense stands of reeds
Litoria littlejohni	Littlejohn's Tree Frog, Heath Frog	V	V	No	Habitats include dams, creeks and lagoons. Favours higher woodland areas
Mixophyes balbus	Stuttering Frog, Southern Barred Frog	E	V	No	Found in mountain areas in rainforest
Mixophyes iteratus	Giant Barred Frog, Southern Barred Frog	E	E	No	Found in coastal riverine rainforest and upland areas such as Border Ranges and Conondale Range.

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Pseudophryne australis	Red-crowned Toadlet	V		Likely	Hawkesbury sandstone and may be found beside temporary creeks, gutters and soaks, and under rocks and logs. Breeds in damp leaf litter that become inundated with heavy rain
Reptiles					
Hoplocephalus bungaroides	Broad-headed Snake	E	V	No	Occur under large exfoliating slabs of sandstone and rock crevices in areas of undisturbed bushland, usually on tops of cliffs. Commonly found in rock on rock situations in this context also includes crevices in cliff faces
Varanus rosenbergi	Rosenberg's Goanna	V		No	Found in coastal heaths, humid woodlands and wet and dry sclerophyll forests. Shelters in burrows, rock hollows or crevices. Known to lay eggs in burrow in termite mound.
Birds					
Apus pacificus	Fork-tailed Swift		M, Mar	Potential	Aerial, over open country, from semi-deserts to coasts, sometimes forests and cities
Ardea alba	Great Egret, White Egret		M, Mar	Potential	Shallows of rivers, estuaries, tidal mudflats, freshwater wetlands, larger dams
Ardea ibis	Cattle Egret		M, Mar	Potential	Stock paddocks, pastures, croplands, garbage tips, wetlands, tidal mudflats
Botaurus poiciloptilus	Australasian Bittern	V		Unlikely	Boggy marsh, wetland margins
Burhinus grallarius	Bush Stone-curlew	E		Unlikely	Well wooded floodplain forests, amongst fallen timber
Calidris tenuirostris	Great Knot	V		No	Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons
Callocephalon fimbriatum	Gang-gang Cockatoo	V		Potential	Wetter forests, and woodlands, from sea level to 2000m on divide. From timbered foothills and valleys to suburban gardens
Callocephalon fimbriatum - endangered population	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	E		Potential	Wetter forests, and woodlands, from sea level to 2000m on divide. From timbered foothills and valleys to suburban gardens.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		Unlikely	Eucalypt forests and woodlands and forage in Allocasuarina. Nest in tree hollows

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Charadrius leschenaultii	Greater Sand-plover	V		No	Almost entirely restricted to coastal areas in NSW, occurring mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks
Charadrius mongolus	Lesser Sand-plover	V		No	Tidal mudflats and sandflats, gently sloping sandy and shelly beaches, saltmarsh, estuaries, mangroves.
Ephippiorhynchus asiaticus	Black-necked stork	E		No	Coastal wetlands, mangroves, tidal mudflats, floodplains, open woodlands.
Erythrotriorchis radiatus	Red Goshawk	E	V	Unlikely	In NSW, the Red Goshawk is mainly found along or near watercourses, in swamp forest and woodlands on the coastal plain
Falco hypoleucos	Grey Falcon	V		Unlikely	Lightly treed inland plains, gibber deserts, sandridges, pastoral lands and timbered watercourses.
Gallinago hardwickii	Latham's Snipe, Japanese Snipe		M, Mar	Unlikely	Soft wet ground or shallow water with tussocks and other green and dead growth. Wet drainage areas
Haliaeetus leucogaster	White-bellied Sea-Eagle		M, Mar, JAMBA	No	Rivers, large dams. Roost and nest on large platforms built in large Eucalypts
Hirundapus caudacutus	White-throated Needletail		M, Mar, JAMBA/ CAMBA/ ROKAMBA	Potential	Open space above canopy. Forages over large areas
Ixobrychus flavicollis	Black Bittern	V		Unlikely	Boggy marsh, wetland margins
Lathamus discolor	Swift Parrot	E	E, Mar	Unlikely	Forests, woodlands, plantations, banksias, street trees and gardens on the mainland
Limnicola falcinellus	Broad-billed Sandpiper	V		No	Tidal mudflats, reefs, saltmarsh, freshwater wetlands, sewerage ponds.
Limosa limosa	Black-tailed Godwit	V		No	Tidal mudflats, estuaries, sandspits, shallow river margins, sewage ponds.
Merops ornatus	Rainbow Bee-eater		M, Mar, JAMBA	Unlikely	Open woodlands with sandy, loamy soils, dunes, cliffs, mangroves, golf courses
Monarcha melanopsis	Black-faced Monarch		M, Mar	Potential	Rainforests, eucalypt woodlands, coastal shrubs, damp gullies in rainforest, eucalypt forest and more open woodland when migrating
Myiagra cyanoleuca	Satin Flycatcher		M, Mar	Unlikely	Heavily vegetated gullies in forests, and taller woodlands of coastal south-east Australia. Also occurs in various sites during migration including farms and parks

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Nettapus coromandelianus	Cotton Pygmy-Goose	E		No	Freshwater lakes, lagoons, swamps and dams, particularly those vegetated with waterlilies and other floating and submerged aquatic vegetation
Ninox connivens	Barking Owl	V		Unlikely	Open forests, woodlands, dense scrubs, other large trees near watercourses, also open grasslands
Ninox strenua	Powerful Owl	V		Potential	Pairs occupy large, probably permanent home ranges in forests to woodlands. Nest in large hollow
Pandion haliaetus	Osprey	V		Unlikely	Coasts, estuaries, bays inlets.
Pluvialis fulva	Pacific Golden Plover		M, JAMBA /CAMBA / ROKAMBA	No	Tundra, fields, beaches and tidal flats
Ptilinopus superbus	Superb Fruit-Dove	V		Potential	Rainforests and fringes, scrubs, mangroves, wooded stream margins, lantana thickets, isolated figs, pittosporums, lilly pillies and blackberries.
Rhipidura rufifrons	Rufous Fantail		M, Mar	Potential	Undergrowth of rainforests/wetter eucalypt forests/gullies. Also occurs in various random sites during migration including farms and parks
Rostratula australis	Australian Painted Snipe		V	No	Well vegetated margins of wetlands
Rostratula benghalensis s. lat.	Painted Snipe		M, Mar, JAMBA	No	Well vegetated margins of wetlands
Sterna albifrons	Little Tern	E	M, Mar	No	Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers
Stictonetta naevosa	Freckled Duck	V		No	Open wetlands with fringing vegetation, particularly lignum
Tyto novaehollandiae	Masked Owl	V		Unlikely	Occurs in forests, open woodlands, farmlands with large trees. Roosts in large hollow
Xanthomyza phrygia	Regent Honeyeater	E	E, M	Unlikely	Dry open forests, woodlands, especially red ironbark, yellow box, yellow gum
Mammals					
Cercartetus nanus	Eastern Pygmy-possum	V		No	Eastern forests and woodlands and feed mostly on the pollen and nectar from banksias, eucalypts and understorey plants and will also eat insects, seeds and fruit

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Chalinolobus dwyeri	Large-eared Pied Bat, Large Pied Bat	V	V	Potential	Roosts in caves, mines. Uncommon but observed in wet and dry eucalypt forests
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Unlikely	Occurs in wide variety of habitats in large remnants. Dens in tree hollows, hollow log or rock crevice
Dasyurus viverrinus	Eastern Quoll	E		No	Occurs in wide variety of habitats in large remnants. Dens in tree hollows, hollow log or rock crevice.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Potential	Forages in sclerophyll forests from great dividing range to coast. Prefer wet habitats where trees are more than 20m high. Roost in hollow trunks of trees.
Isoodon obesulus obeseulus	Southern Brown Bandicoot	E	E	Unlikely	Variety of habitats from heathland, shrubland, dry eucalypt forest with heathy understorey, sedgeland and woodland
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		Potential	Forages above the canopy and eats mostly moths. Roosts in caves, old mines, road culverts
Mormopterus norfolkensis	Eastern Freetail-bat	V		Potential	Inhabits dry and wet sclerophyll forests, coastal woodland. Roosts in tree hollows and buildings. Have been found roosting under the bark of trees.
Petaurus australis	Yellow-bellied Glider	V		Unlikely	Patchily distributed in wet sclerophyll forest
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	No	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north
Phascolarctos cinereus	Koala	V		No	Widespread in sclerophyll forest and woodlands. Requires relatively large home ranges
Potorous tridactylus tridactylus	Long-nosed Potoroo	V	V	Unlikely	Known from coastal heathy woodland but also occurs in rainforest, wet sclerophyll and coastal wallum. Dense cover for shelter adjacent to open areas for foraging
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Potential	Roosts in large camps and disperses nightly up to 20km to feed in flowering eucalypts
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		Potential	Occur in all habitats, from wet and dry sclerophyll forest, open woodland. Insectivorous and forage above the tree canopy. The species roosts in tree hollows and tend to be solitary for most of the year.

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Plants					
Acacia bynoeana	Bynoe's Wattle	E	V	Potential	Found in heath and woodland on sandy soils. Scattered from coast to mountains, uncommon
Acacia gordonii		E	E	Unlikely	Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops
Acacia pubescens	Downy Wattle	V	V	Potential	Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with ironstone
Acacia terminalis subsp. *terminalis*	Sunshine Wattle	E	E	No	Very limited distribution between Botany Bay to the northern foreshore of Port Jackson
Caladenia tessellata	Thick-lipped Spider-orchid, Daddy Long-legs	E	V	Unlikely	Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil
Callistemon linearifolius	Netted Bottle Brush	V		Potential	Grows in dry sclerophyll forest on the coast and adjacent ranges
Camarophyllopsis kearneyi		E		Potential	Its occurrence appears to be limited to the Lane Cove Bushland Park
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	Unlikely	Favours swamp fringes, scrubby swamp fringes to steep bare hillsides in tall eucalypt forests
Darwinia biflora		V	V	Potential	Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone
Darwinia peduncularis		V		Unlikely	Occurs in open forest, on or near rocky outcrops on shallow sandy soils.
Deyeuxia appressa		E	E	Unlikely	A highly restricted NSW endemic known only from two pre-1942 records in the Sydney area, in Bankstown and Killara
Dillwynia tenuifolia		V	V	Unlikely	In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.
Epacris purpurascens var. purpurascens		V		Potential	Found in a range of habitat types, most of which have a strong shale soil influence

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Eucalyptus camfieldii	Camfield's Stringybark, Heart-leaved Stringybark	V	V	Unlikely	Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V		Unlikely	Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite
Eucalyptus pulverulenta	Silver-leafed Gum	V	V	Unlikely	Grows in shallow soils as an understorey plant in open forest, typically dominated by Brittle Gum (Eucalyptus mannifera), Red Stringybark (E. macrorhynca), Broad-leafed Peppermint (E. dives), Silvertop Ash (E. sieberi) and Apple Box (E. bridgesiana)
Eucalyptus scoparia	Wallangarra White Gum	E		Unlikely	Found in open eucalypt forest and woodland on well-drained granite hilltops, slopes and rocky outcrops
Galium australe	Tangled Bedstraw	E		Unlikely	In NSW Tangled Bedstraw has been found in moist gullies of tall forest, Eucalyptus tereticornis forest, coastal Banksia shrubland, and Allocasuarina nana heathland
Genoplesium baueri	Bauer's Midge Orchid	V		Unlikely	Grows in sparse sclerophyll forest and moss gardens over sandstone
Genoplesium plumosum	Tallong Midge Orchid	E	E	Unlikely	Occurs exclusively in heathland, generally dominated by Violet Kunzea (Kunzea parvifolia), Common Fringe-myrtle (Calytrix tetragona) and parrot-peas (Dillwynia spp.)
Grammitis stenophylla	Narrow-leaf Finger Fern	E		Unlikely	Moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest
Grevillea caleyi	Caley's Grevillea	E	E	No	All sites occur on the ridgetop between elevations of 170 to 240m asl, in association with laterite soils and a vegetation community of open forest, generally dominated by Eucalyptus sieberi and E. gummifera
Grevillea parviflora		V	V	Unlikely	Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks
Haloragodendron lucasii	Hal	E	E	No	Reported to grow in moist sandy loam soils in sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Hibbertia puberula		E		No	Has not been seen for over 40 years. Early records of this species are from the Hawkesbury River area and Frenchs Forest in northern Sydney, South Coogee in eastern Sydney, the Hacking River area in southern Sydney, and the Blue Mountains. Occurs on sandy soil often associated with sandstone
Hygrocybe anomala var. ianthinomarginata		V		Unlikely	Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible
Hygrocybe aurantipes		V		Unlikely	Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible
Hygrocybe austropratensis		E		Unlikely	Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible
Hygrocybe collucera		E		Unlikely	Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible
Hygrocybe griseoramosa		E		Unlikely	Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible.
Hygrocybe lanecovensis		E		Unlikely	Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible
Hygrocybe reesiae		V		Unlikely	Associated with alluvial sandy soils of the Hawkesbury Soil Landscapes with naturally low fertility and erodible
Hygrocybe rubronivea		V		Unlikely	Associated with alluvial sandy soils of the Hawesbury Soil Landscapes
Hypsela sessiliflora		E	Ex	Unlikely	Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone
Lasiopetalum joyceae		V	V	Unlikely	Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River
Leptospermum deanei		V	V	Potential	Woodland on lower hill slopes or near creeks. Sandy alluvial soil or sand over sandstone

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Melaleuca biconvexa	Biconvex Paperbark	V	V	Unlikely	Grows in damp places, often near streams; coastal districts and adjacent tablelands from Jervis Bay north to the Port Macquarie district.
Melaleuca deanei	Deane's Melaleuca	V	V	Unlikely	Marshy heath on coastal sandstone plateaus
Microtis angusii	Angus's Onion Orchid	E	E	Unlikely	It is not easy to define the preferred natural habitat of this orchid as the Ingleside location is highly disturbed
Persoonia hirsuta		E	E	Unlikely	Range from the Georges River to Gosford. The species is found on open forest and heath, in sandy soils or very rarely on shales.
Persoonia mollis subsp. maxima		E		Unlikely	Occurs in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. These habitats support relatively moist, tall forest vegetation communities, often with warm temperate rainforest influences
Persoonia nutans	Nodding Geebung	E	E	Unlikely	Confined to aeolian and alluvial sediments and occurs in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland
Pimelea curviflora var. curviflora		V	V	Potential	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands
Pomaderris prunifolia var. prunifolia	P. prunifolia in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	E		Unlikely	Known from only three sites within the listed local government areas, at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown
Pterostylis nigricans	Dark Greenhound	V		Unlikely	Coastal heathland with Heath Banksia (Banksia ericifolia), and lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils

Scientific Name	Common Name	Status		Likelihood	Habitat
		TSC Act	EPBC Act		
Syzygium paniculatum	Magenta Lilly Pilly	V		Potential	On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities
Tetratheca glandulosa		V	V	Potential	Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches
Tetratheca juncea	Black-eyed Susan	V	V	Unlikely	Occurs on predominantly low nutrient soils with dense understorey of grasses. Open woodland with Angophora constata and Corymbia gummifera as dominant canopy.
Thesium australe	Austral Toadflax, Toadflax	V	V	Unlikely	Occurs in grassland or grassy woodland
Wahlenbergia multicaulis	Tadgell's Bluebell in the LGAs of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	E		Potential	Forests, woodland, scrub, grassland and the edges of watercourses and wetlands.
Wilsonia backhousei	Narrow-leafed Wilsonia	V		No	This is a species of the margins of salt marshes and lakes, both coastal and inland

APPENDIX B – FLORA SPECIES LIST

Species Name	Common Name	Bundara Reserve	M2 Site
*Acacia decurrens**	Black Wattle	x	
*Acacia elata**	Mountain Cedar Wattle	x	
Acacia parramattensis	Parramatta Wattle	x	x
Acacia stricta	Straight Wattle	x	
Adiantum aethiopicum	Common Maidenhair	x	
Allocasuarina torulosa	Forest Oak	x	
Angophora costata	Sydney Red/Rusty Gum	x	
*Asparagus asparagoides**		x	x
*Avena fatua**			x
Banksia ericifolia	Heath-leaved Banksia		x
*Briza subaristata**		x	
*Bromus catharticus**	Prairie Grass		x
Bursaria spinosa	Native Blackthorn	x	x
Cassytha glabella			x
*Cinnamomum camphora**	Camphor Laurel		x
*Cirsium vulgare**	Spear Thistle		
Commelina cyanea	Native Wandering Jew	x	
*Conyza bonariensis**	Flaxleaf Fleabane		x
Cordyline sp.		x	
Desmodium varians		x	
Dianella caerulea var *producta*		x	x
Dichondra repens	Kidney Weed	x	x
Dodonaea triquetra		x	x
Echinopogon sp.		x	
*Ehrharta erecta**	Panic Veldtgrass	x	
Elaeocarpus reticulatus	Blueberry Ash	x	
Entolasia sp.			x
Entolasia marginata	Bordered Panic	x	
Eucalyptus microcorys	Tallowwood	x	
Eucalyptus paniculata	Grey Ironbark	x	
Eucalyptus punctata	Grey Gum	x	
Eucalyptus resinifera	Red Mahogany		x
Eucalyptus saligna	Sydney Blue Gum	x	
Eustrephus latifolius	Wombat Berry	x	
Exocarpos cupressiformis	Native Cherry	x	
*Foeniculum vulgare **	Fennel		x
Gahnia sp.			x
Geranium sp.		x	
*Grevillea robusta**	Silky Oak	x	x
Hakea teretifolia	Needlebush		x
Hardenbergia violacea	False Sarsaparilla	x	
Hedera helix			x
Hibiscus sp.		x	
Kunzea ambigua	Tick Bush		x
*Lantana camara**	Lantana		x

Species Name	Common Name	Bundara Reserve	M2 Site
Leptospermum spp.		x	
Leucopogon juniperinus	Prickly Heath	x	
*Ligustrum lucidum**	Large Leaved Privet		x
*Ligustrum sinense**	Small Leaved Privet		x
Lindsaea linearis	Screw Fern	x	x
*Lolium perenne**			x
Lomandra filiformis		x	
Lomandra longifolia	Spiny-headed Mat-rush	x	x
Lomandra multiflora		x	
Lophostemon confertus	Brush Box	x	
Melaleuca linariifolia	Flax-leaved Paperbark		x
Melaleuca styphelioides	Prickly-leaved Tea Tree	x	
Microlaena stipoides		x	x
Morus alba	White Mulberry	x	
*Ochna serrulata**	Mickey Mouse Plant	x	x
Oplismenus sp.		x	x
Ozothamnus diosmifolius	White Dogwood	x	
Pandorea pandorana	Wonga Wonga Vine	x	
*Pampas Grass**	Cortaderia selloana		x
Pimelea linifolia		x	
Pittosporum undulatum	Sweet Pittosporum	x	x
Platycerium bifurcatum	Elkhorn		x
Platylobium formosum		x	
Poranthera microphylla			x
Pratia purpurascens	Whiteroot		x
Rubus sp.		x	
*Senna pendula**			x
*Senecio madagascariensis**	Fireweed		x
Smilax glyciphylla	Sweet Sarsparilla	x	
Syncarpia glomulifera	Turpentine	x	
Syzygium sp.		x	
Themeda australis	Kangaroo Grass	x	
*Tradescantia albiflora**			x
Tricoryne elatior			x
Trifolium sp.*		x	x
Tylophora barabata		x	
Veronica plebeia	Trailing Speedwell	x	
Viola odorata		x	
Zieria smithii		x	

Note: * = exotic species