RYDE
FLORA and FAUNA
STUDY
2006

Brush Farm Park
Darvall Park
Lambert Park
Field of Mars Reserve

Biosphere Environmental Consultants Pty Ltd

Contents

1.0 Executive Summary

1.1 Rationale of the Fauna Study

This report was commissioned by Ryde City Council to determine "base-line" biodiversity levels in four reserves: Darvall Park in Denistone, Brush Farm Park and Lambert Park in Eastwood and the Field of Mars Reserve in Ryde. Biodiversity assessment included vertebrate and invertebrate animal species, endemic plants and introduced species, either exotic to Australia or non-endemic Australian native plants. Diversity assessment also included a measure of the number of species within a given area (the species richness) and the relative abundance of the species present (or cover of the species within a given area).

This report includes the results of two major surveys carried out in 2006, in autumn and spring. This study only surveyed four reserves in the Ryde LGA; namely Brush Farm Park, Darvall Park, Lambert Park and Field of Mars Reserve, and sought to provide a comprehensive assessment of the current flora and fauna of each reserve. The results of this study will be a "yardstick" against which the results of subsequent surveys will be compared. Follow-up surveys carried out in subsequent years using the same survey methods will provide comparable information about the status of the animals and plants in each reserve and contribute towards future bushland management decisions.

Ryde LGA contains several bushland reserves that retain representative native flora and fauna. The integrity of each reserve varies greatly as each has been impacted to different degrees by past land management practices. As Sydney's human population continues to increase, there will be more and more pressures placed on bushland reserves such as weed invasion, feral and domestic animals and greater public usage of the sites. Ryde City Council is being pro-active in identifying these threats so that appropriate management strategies can be employed to protect and enhance these reserves.

1.2 General Findings

The Ryde LGA contains important areas of native or restored bushland. Bushland reserves vary greatly in size and condition. Some reserves, such as Lambert Park and Brush Farm Park have been highly impacted by clearing, land filling and have been substantially replanted. Other reserves, such as Field of Mars are larger and less modified. No reserves were free of urban impacts.

1.2.1 Ryde Flora

Complete plant lists were prepared for each reserve, including weed species. In addition, rigorous tests were applied to determine the correct identification of the vegetation communities in each reserve. In some cases, vegetation communities not previously recognized were supported, and previously proposed vegetation communities failed the tests. Turpentine-Ironbark Forest was recognised in Darvall

Park, Lambert Park, Brush Farm Park and Field of Mars (Wellington Road). Blue Gum High Forest was not recognized in Brush Farm Park or Darvall Park. Western Sydney Gully Forest was found to be present in Field of Mars as was a Mangrove-Saltmarsh complex.

Many of the reserves had large numbers of exotic or non-native plants in them and several recommendations are proposed to help retain the vegetative features of each reserve.

Several rare plants were found and two threatened species: *Epacris purpurescens* var *purpurescens* and *Pimelea curviflora* ssp *curviflora* was found in Field of Mars Reserve.

1.2.2 Ryde Fauna

Some animal groups that originally inhabited parts of the Ryde LGA have fared badly in the wake of urbanisation, others have survived relatively unscathed. The groups most seriously affected by urban development in the Ryde Local Government Area are:

* terrestrial mammals
* large reptiles
* frogs

Terrestrial mammals (such as native rodents, bandicoots and wombats) have almost completely disappeared from the area. The only remaining native terrestrial mammals are:

* Echidnas (Field of Mars)
* Eastern Bush Rat (Field of Mars)
* Brown Antechinus (Field of Mars).

The main reason for the widespread loss of terrestrial mammals appears to be through predation by exotic animals, such as foxes, cats and dogs. Land clearing, particularly of native undergrowth has left the ground-dwelling mammals highly vulnerable to attack by introduced predators.

Large reptiles have been extensively eliminated. This includes goannas, large snakes, dragons (such as Bearded Dragons) and large skinks (such as Blue-tongue lizards). Many of these reptiles appear to have either been deliberately killed (mainly snakes), accidentally killed or killed by domestic animals.

The only large reptiles still remaining in the Ryde area are:

* Red-bellied Black Snakes (Field of Mars, Brush Farm Park)
* Eastern Water Dragons (Field of Mars, Brush Farm Park)
* Eastern Blue-tongue Lizard (Field of Mars)

Frogs have suffered a precipitous decline in Ryde. Most reserves have just one or two species. There appears to be several reasons for the decline of frogs:

* loss of ephemeral or still-water flooded sites

* loss of creek catchment habitat
* poor water quality
* introduced predatory fish (notable the Plague Minnow, *Gambusia holbrooki*).

Pond-breeding species are now confined to back-yard habitats and have been lost from creek areas. Most tree frogs have disappeared despite the amount of woodland and forest that has been retained. This is a direct consequence of the loss of breeding habitat.

Most other animal groups have shown declines in diversity.

The fauna groups that are still well represented in the area are forest and woodland birds. In many bushland reserves the tall canopy has been retained and reserves are close together so that birds can move freely between bushland areas. The birds that have declined markedly are the small passerines that require mid-canopy cover for protection and wading birds.

Invertebrates were well represented in most reserves while Field of Mars also supported several species of fish.

1.2.3. Impacts

The types of impacts on the bushland areas varied but included:

* weed invasion
* dumping of garden wastes and household rubbish
* planting of non-native or non-endemic plants
* uncontrolled fires that alter plant communities
* contamination of creeks and ground water
* changes in flow patterns of creeks through storm water control
* increased erosion of creek banks
* loss of ephemeral freshwater habitat
* ground compaction through foot traffic
* penetration of bushland by walking tracks, roads and easements
* feral animals, such as foxes, cats, dogs, rats and mice
* high density of native, predatory birds
* night-light pollution from street lights and house lights
* noise and movement disturbance
* edge effects

Some of these impacts are being addressed by Ryde City Council and an active bush rehabilitation program is currently under way. These programs are required to ameliorate the impacts experienced by the reserves, but are confined to the rehabilitation of flora. The rehabilitation of fauna is much more difficult and more contentious but is not possible without the conservation and management of bushland habitat areas. Fox-baiting programs have been operating in Field of Mars and Brush Farm Park for a number of years.

1.3 Nature of Recommendations

The Fauna and Flora Study assessed the animal and plant life in the bushland reserves in terms of the species and communities that have coped well with urban impacts and will survive with minimal assistance, to those species that are poorly represented and need considerable assistance. The report also considered those species or groups of species that are absent.

Recommendations concerned issues such as the protection and creation of specific habitat areas and vegetation communities, the establishment of buffer strips around reserves, the enhancement of fauna corridors between bushland areas through the use of suitable street trees and encouraging residents to plant appropriate vegetation around their houses, the need for continued control of weed and feral animals (particularly foxes) and the protection of critical habitat areas for endangered or threatened species.

Most importantly a Sustainability Management Plan is required that will include the systematic rehabilitation of all bushland reserves in the Ryde LGA. For the plan to be comprehensive, all of the bushland reserves need to be surveyed and the inventory of the plants and animals in each park determined.

Finally, it is recommended that the flora and fauna study is repeated in five years time so that changes in the biodiversity can be assessed and planning decisions made accordingly.

2.0 Introduction

2.1 Background

Ryde Local Government Area (LGA) contains highly valued bushland. The retention of these bushland areas came about as the result of complicated patterns of land settlement, difficulties with site access and the establishment of public utility easements, and not because of long-term conservation planning by the early city founders. However, regardless of the mechanism for the establishment of the reserves, the bushland areas have become an important component of the Ryde landscape.

Urbanisation

Urban development did not occur at uniform rates around Sydney Harbour. Areas south of Port Jackson were inhabited first because the land on the south side of the harbour was flatter and appeared to be more fertile (Watkin Tench 1789).

With the construction of the Sydney Harbour Bridge in 1933, the North Shore area became the focus of rapid urban development. Few farms had been established as fertile land was confined to a few narrow valleys. A road link to the Hawkesbury River was established along the ridge top that ran between Middle Harbour and the Lane Cove River valley. This ridge eventually became the route for the Pacific Highway.

Access to the Ryde area was difficult as it was bounded by the Lane Cove River to the east and the Parramatta River to the south. The Hornsby Plateau slopes steeply southwest into the Ryde area again making passage uncomfortable. The easiest means of entry was by boat along the Parramatta River or by land from Parramatta. Eventually punts were established to provide crossing points across the Parramatta River and it was only then that road networks were established throughout the area.

Initially only river flat areas were opened up for agriculture but orchards and other small scale farms were established in the valley areas. Agriculture was not to remain as the dominant land use for long. The demand for land for housing soon outstripped acreages required for farming and Ryde quickly adopted the heavily-urbanised features that it still retains. The surge of residential dwellings put great pressure on the supply of land and all land that was not in very rugged or inaccessible locations was converted to residential sites or roads.

Remnant Bushland

For Ryde, urbanisation has meant that all of the higher ridge areas were cleared and settled. Major roads were located at the peak of ridges and smaller, lateral roads branched from the main thoroughfares to lower levels. Very little of the original ridge-top vegetation survived land clearing (Howell and Benson 2000). Fortunately, several areas of gully vegetation were not overtaken by the urban sprawl and these remain as green oases in a sea of bricks, tar and cement.

The bushland reserves of Ryde have become an integral part of the nature of this Local Government Area (LGA). Green spaces soften the harshness of buildings and roads and create a much more attractive setting, increasing the value of residential properties nearby and providing a retreat for those wishing to escape suburbia.

In recent years, Councils in Sydney have found that bushland reserves have changed focus in the community. Originally, they were spaces that escaped development and were pleasant places to visit. With the increasing urgency for urban consolidation, a movement towards greater protection of remnant areas has resulted (e.g. Green Web Project for Sydney). Bushland reserves are no longer areas that can be left to their own devices, they need to be managed and maintained. In short, bushland reserves are areas of conservation for both native plants and animals.

For Sydney city councils, a role in fauna and flora conservation has not existed until recently. Councils are seeking to become managers of bushland and the animals and plants that occur within. Ryde City Council has accepted this role and the current flora and fauna study is an integral part of the development of long-term management strategies for these reserves.

2.2 Aims of the Flora and Fauna Study

Although some historic records exist for the flora and fauna of the four bushland areas in this study, the data does not provide a quantitative basis for useful comparison of impacts and changes in the bushland areas. Ryde City Council commissioned Biosphere Environmental Consultants to undertake a systematic flora and fauna survey of the bushland reserves. These surveys had three primary aims:

1. to establish a series of reference quadrats in each bushland area,
2. to develop and carry out standardized and repeatable methods of flora and fauna survey in each of these quadrats,
3. to conduct a generalised survey of the rest of the bushland areas with the aim of cataloguing the species of plants and animals present therein, and
4. to provide recommendations that may assist Ryde City Council in the conservation and management of these bushland reserves.

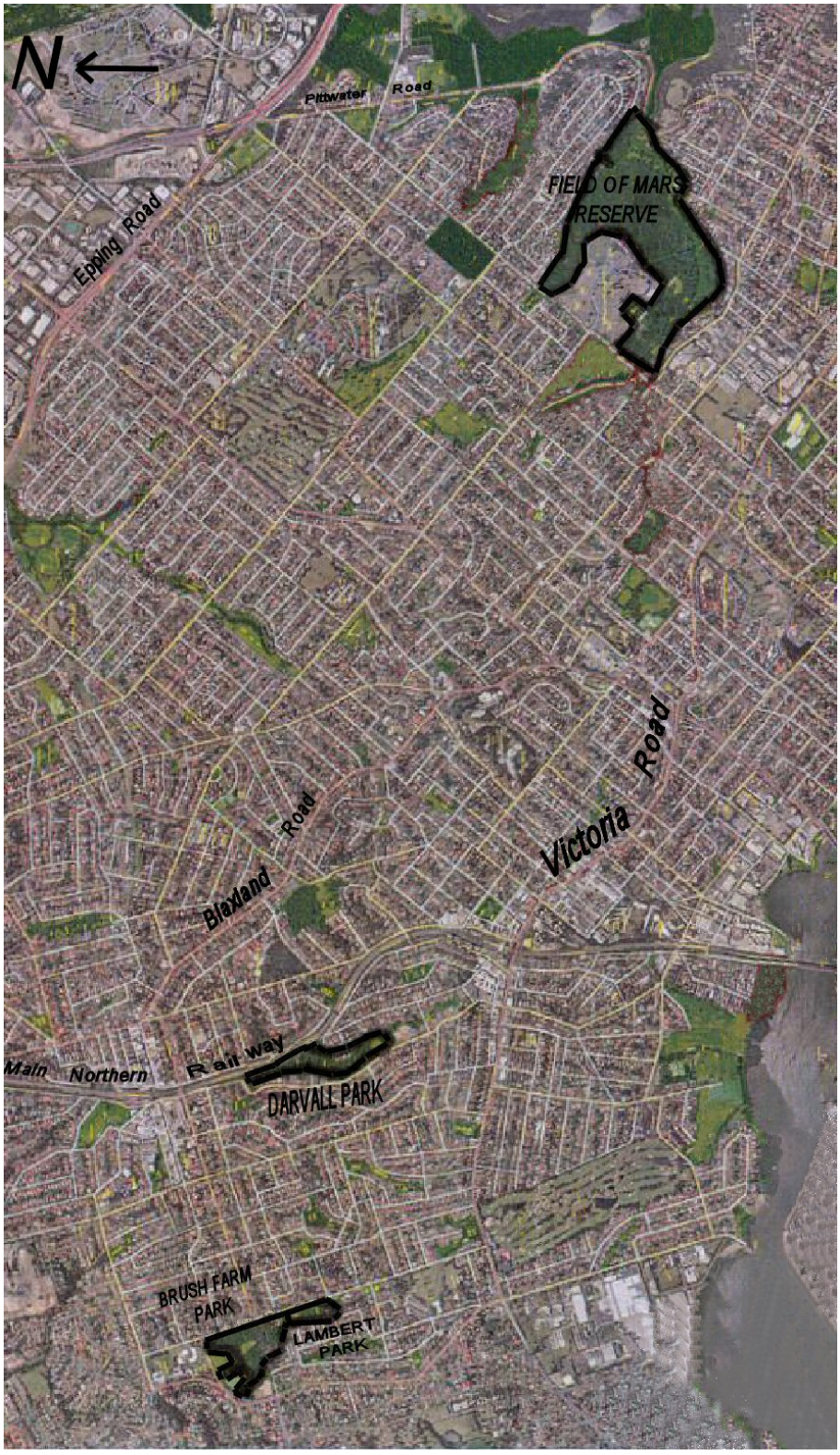
2.3 Description of the Study Area

Ryde LGA is endowed with a number of parks and reserves ranging from bushland reserves with a conservation role to more altered areas that have a totally recreational focus. The management of bushland areas is a relatively new role for urban Councils and Ryde City Council is seeking to manage these areas from a position of knowledge and awareness of the many issues impacting upon these land areas.

Three parks and one reserve were included in the flora and fauna survey. Brush Farm Park, Lambert Park and Darvall Park are all located in the western section of the Ryde LGA whereas Field of Mars Reserve is situated in the eastern section of the LGA, abutting the Lane Cove River valley.

Figure 1

Location of the Bushland Reserves Surveyed in the Flora and Fauna Study



2.3.1 Brush Farm Park

Brush Farm Park is a large park with a total area of about 8 ha (Figure 2). The park occupies ridge-top areas and steep gullies. The park is divided into various land uses including heritage estate (associated with Brush Farm House), playing fields and bushland. The bushland area comprises about 6 ha of the park and occupies the steep slopes and lower southern gully areas of the park that comprises the headwaters of Archer Creek. The bushland area has been greatly altered through past land uses including clearing and land filling. As a result, very little original vegetation remains and exotic plants have overrun the clearings in the past.

Over the last ten or more years, Ryde City Council has sponsored bush restoration works at Brush Farm. This has been a mammoth task and has involved extensive weed removal and slope restabilisation, track creation and stormwater control. Natural regeneration of bush has not been possible in most of the park because of the extensive and prolonged site disturbances so replanting of native vegetation has taken place in many areas. This work has resulted in the establishment of a closed gully forest with open forest on the higher slopes. Regionally important areas of remnant wet forest and gully vegetation plants are now well established.

The southern end of Brush Farm Park abuts a council road reserve and a Roads and Traffic Authority (RTA) road reserve. The boundary between Brush Farm Park and these reserves is not readily apparent and for the purposes of this report, the council reserve is included in Brush Farm Park.

2.3.2 Darvall Park

Darvall Park is a long, thin strip of bushland (Figure 3) that runs parallel with Chatham Road (and the railway). The park is about 8 ha in area and the southern section of the park has been cleared for playing fields, a bowling club and open recreation. The middle and northern section consists of tall Turpentine-Ironbark Forest with a severely disturbed understorey. The park is crossed by two formal walkways: Withington Walk and Burnett Walk, but has two informal tracks that pass from north to south alongside the creek.

2.3.3 Lambert Park

Lambert Park is continuous with Brush Farm Park (Figure 2) and is about 3 ha in area. The boundary between the two reserves is confused by the presence of an RTA road reserve and council road reserve in this area. The northern end of Lambert Park abuts the RTA road reserve (Rutledge Street) and the southern end of the park was an easement for the sewer as well as containing underground culverts that carry water from Archer Creek. This easement runs on either side of two dish drains that collect surface stormwater and connects up with an old quarry site. Lambert Park is roughly rectangular in shape and is about 250 metres long and varied between 40 and 70 metres wide. It previously was a steep gully but has been filled in to become a relatively flat area. There is a service track running through the center of the park.

Figure 2

Brush Farm Park and Lambert Park

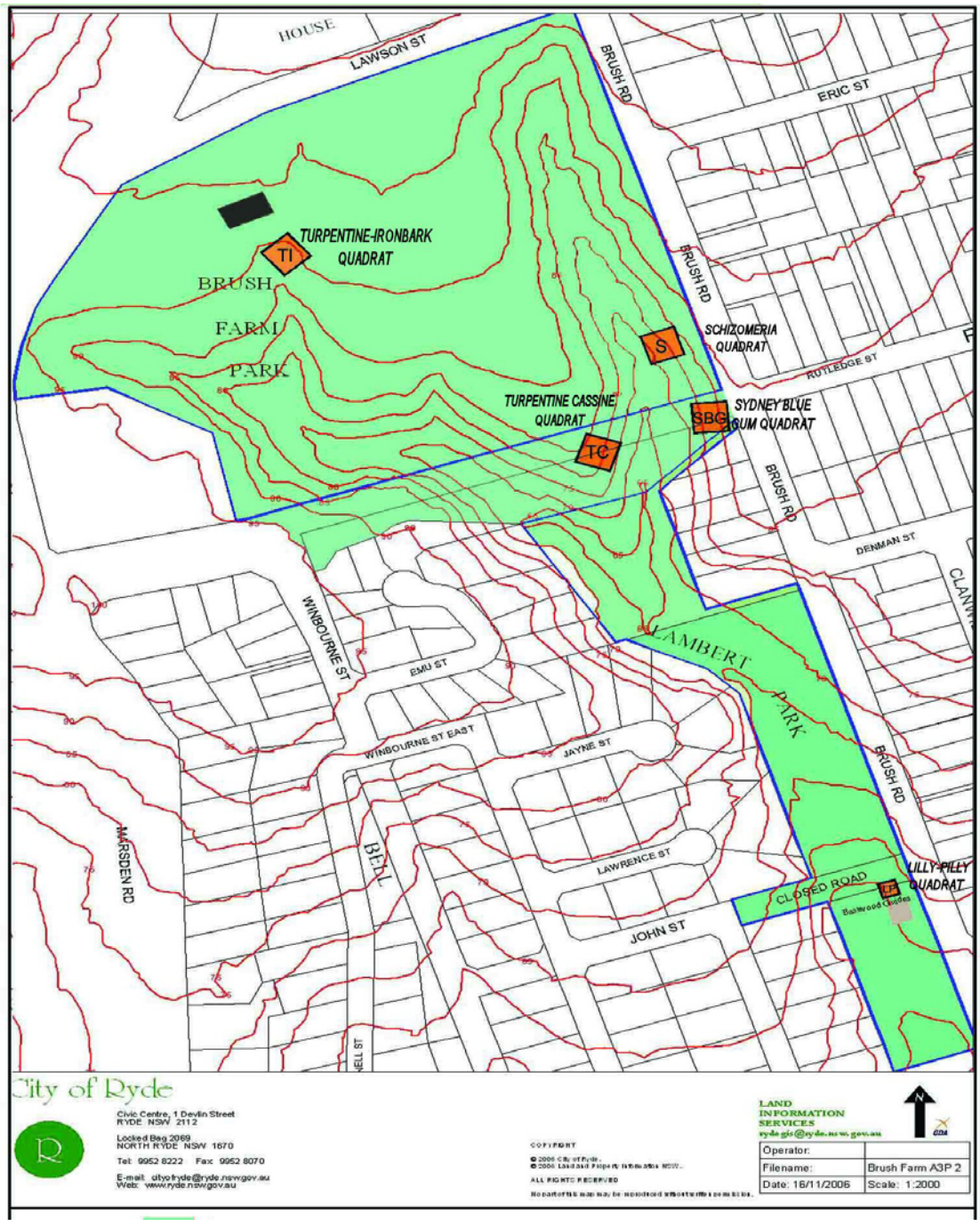
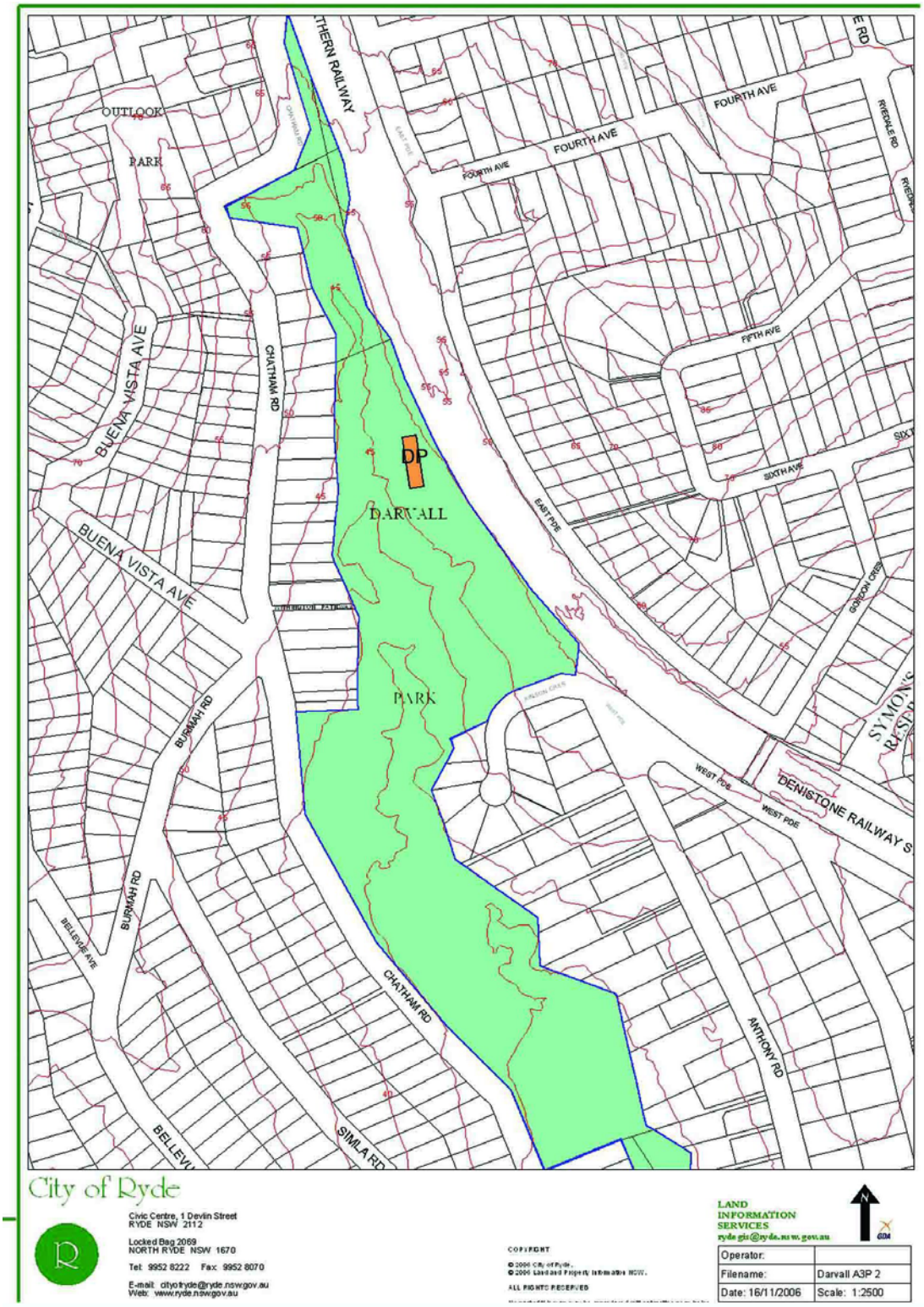


Figure 3

Darvall Park



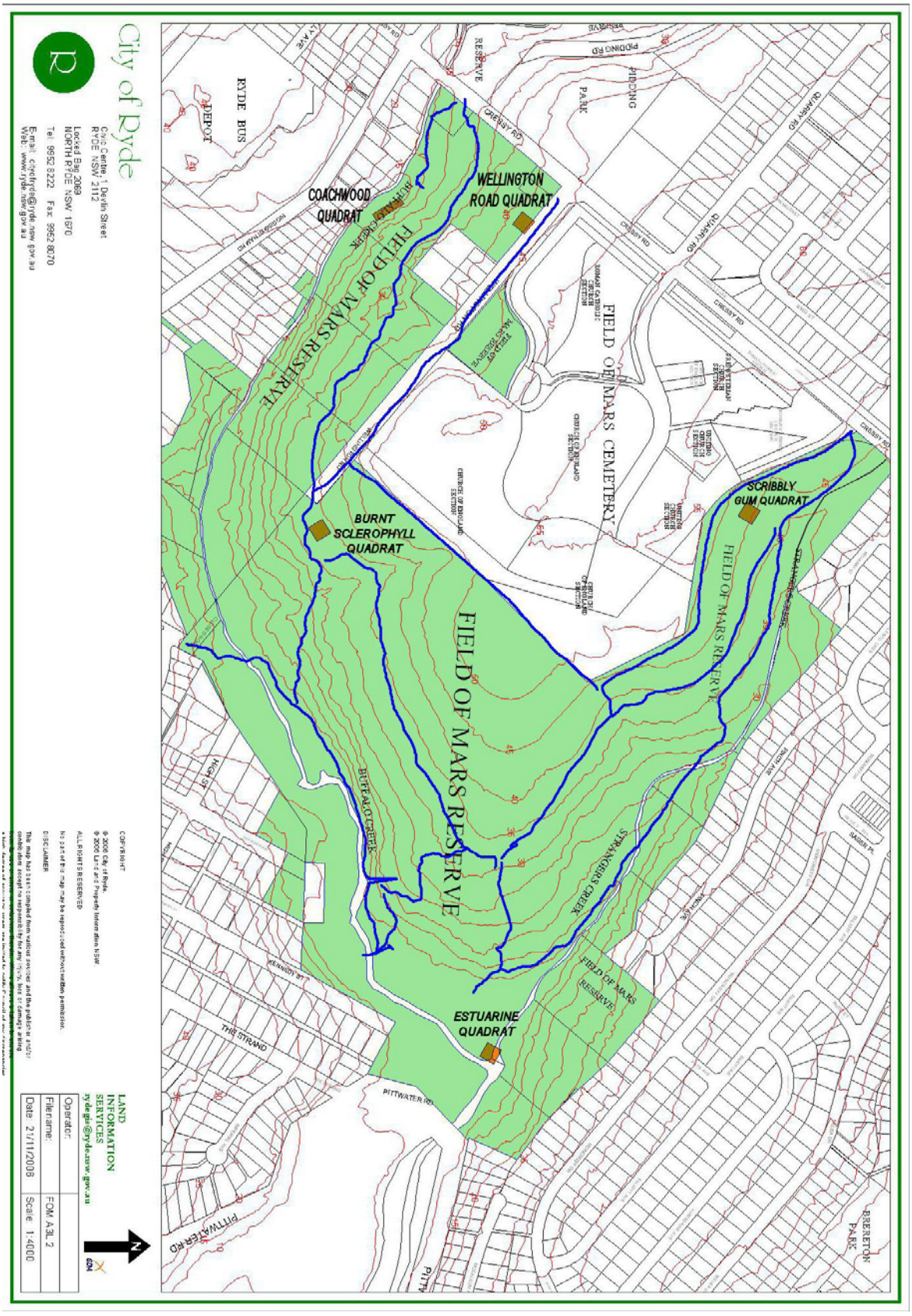
2.3.4 Field of Mars Reserve

The Field of Mars Reserve is the largest bushland reserve in Ryde LGA being 51 ha in area. The reserve occupies two valleys and an intervening ridge; the valleys bear the watercourses of Strangers Creek and Buffalo Creek which converge and exit the reserve at Pittwater Road (Figure 4). The reserve is predominately bushland but areas have been cleared for passive recreation in the south-eastern end of the park. A field study center owned by the NSW Department of Education and amenities blocks have been constructed in this area.

The north-western portion of the reserve is incised by the Field of Mars Cemetery and there is a council compound area off Wellington Road that has recently been incorporated into the reserve. There are several well-formed but unsealed walking tracks throughout the reserve and these are used regularly.

Various woodland types occur across the reserve including Scribbly Gum woodland, Turpentine-Ironbark Forest and mixed woodland; the gullies contain mesic plants such as Coachwood (*Ceratopetalum apetalum*), Callicoma (*Callicoma serratifolia*) and ferns. The lower section of Buffalo Creek is brackish and it is here that saltmarsh and mangrove areas are present.

Figure 4
Field of Mars Reserve



3.0 Methods

3.1 Selection of Survey Sites

Survey sites were selected in areas of representative vegetation communities in each reserve. For example, Brush Farm Park had four identifiable vegetation communities present; one survey site was established in each of these communities in areas where there were minimal external impacts. This meant that the final location in each community was away from paths and roads where possible, contained a relatively high proportion of representative canopy, shrub and ground cover species (and correspondingly fewer invasive or non-representative species) and was unlikely to be significantly disturbed in the foreseeable future.

Each survey site consisted of a 400 square metre quadrat; where possible, this was a 20 m by 20 m square but in narrow or linear vegetation communities the quadrat may have been 40m by 10 m. One quadrat, in Lambert Park was only 10 m by 10 (i.e. 100 m^2 in area) as the Lilli Pilli habitat there in was so limited that a larger quadrat would no longer contain vegetation that was typical of this type of plant community.

Survey pegs and string lines were used to mark the boundaries of each quadrat and the location of each corner peg was plotted by GPS (in case they were interfered with or removed).

3.2 Location of Survey Quadrats

Table 1 describes the location and vegetation community represented within each quadrat while Figures 2, 3 and 4 depict the location of each quadrat in each reserve.

Table 1
Location and features of the Survey Quadrats

Quadrat Number	Park Or Reserve	Quadrat Name	Vegetation Community Represented	Area (m^2)
1.	Road Reserve	Sydney Blue Gum	Sydney Turpentine-Ironbark Forest	400
2.	Brush Farm	Schizomeria	Wet Gully Forest	400
3.	Brush Farm	Turpentine	Sydney Turpentine-Ironbark Forest	400
4.	Road Reserve	Turpentine-Cassine	Sydney Turpentine-Ironbark Forest	400
5.	Lambert	Lilli Pilly	Lilli Pilly Regeneration Area	100
6.	Darvall	Darvall	Sydney Turpentine-Ironbark Forest	400
7.	Field of Mars	Estuarine	Brackish Riparian	400
8.	Field of Mars	Scribbly Gum	Western Sandstone Gully Forest	400
9.	Field of Mars	Wellington Road	Sydney Turpentine-Ironbark Forest	400
10.	Field of Mars	Coachwood	Sydney Sandstone Gully Forest	400
11.	Field of Mars	Burnt Sclerophyll	Sydney Sandstone Ridgetop Woodland	400

Survey quadrats 1 and 4 are geographically located in the Rutledge Street Road reserve despite quadrat 1 being continuous with vegetation areas in Brush Farm Park and quadrat 4 being continuous with vegetation in Lambert Park.

3.3 Vegetation Survey Methods

The flora study entailed:

1. a general survey of the plant species in each reserve
2. quadrat based survey of particular bushland areas in each reserve (using 7 stage Braun-Blanquet technique).

Initially, the reserves were explored to compile lists of local native plants and non-local native/exotic plant species and to assess the vegetation communities. A Species Checklist of Native Plants Local to Ryde Municipality, contained in Appendix 1, was compiled from a draft report *Native Plants of the Ryde District The Conservation Significance of Ryde's Bushland Plants* (Kubiak 2005). This list has been added to as new observations have been made during the survey. A Checklist Of Exotic And Non-Local Native Plants In Ryde Municipality was also compiled (See Appendix 2). Species nomenclature follows *the Flora of NSW* (Harden 1990-1993).

Vegetation communities were determined by assessing colour aerial photographs supplied by Council and then ground-truthed. Geology and soil types were also determined. It was stipulated by Council that the methods used for this biodiversity survey were to be the same as used by the National Parks and Wildlife Service (NSW). The model for this survey was taken from Tozer (2003). Quadrats were to be 400^2m (0.04ha) in area. In most cases this was achievable with 20m x 20m quadrats except in two sites where 40m x 10m quadrats were necessary, either due to the narrowness of the vegetation community or the reserve. One extra 10 X 10m quadrat was set up in a small native remnant in Lambert Park. Quadrats were placed in areas of highest diversity of local native plants with consideration of the required size of the quadrat and the narrowness of the reserves. In order to assess abundance a Braun-Blanquet scale was used. While this method involves a subjective or qualitative description, it also provides for a quantitative, or measurable documentation for comparison of plant community characteristics, especially species richness. Therefore, an inventory of plant species and approximate species numbers was completed for each quadrat then each species was assigned a Braun-Blanquet Cover Class. In order to adequately assess the foliage projective cover of tree species, which may have a dominant effect on other plants within the quadrat, the diameter at breast height (dbh) of the dominant tree species as well as an assessment of the Specht Vegetation Structure (Table 6.1 in Recher, Lunney & Dunn, 1986) is also provided.

Finally, species contained in the quadrats were compared to species listed in the map units described by Tozer (2003) for classification purposes. Tozer lists the number of native plants and the number of positive diagnostic native species required to reach a 95% confidence interval in order to fulfill the map unit classification. This information is provided in the individual quadrat descriptions (See Appendix 3). Tozer defines a species as being positively diagnostic if the frequency of the target species was higher than across the whole data set. In contrast, species with a community frequency less than or equal to 0.4 and not identified as positive diagnostic is regarded as a constant species. If, on the other hand, the occurrence of

the target species is less than 0.2 and the class frequency coefficient of variation is greater than 0.5, the species were classed as uninformative.

The seven point Braun Blanquet Cover Class score (from Tozer, 2003) was assigned as follows (Table 2):

Table 2

Braun Blanquet Cover Class scores

Braun Blanquet Cover Class	Cover Abundance
1	Rare, few individuals (three or less) and cover <5%
2	Uncommon, (more than three but not consistently throughout the plot) and cover <5%
3	Common (consistent throughout the plot) and cover <5%
4	Very abundant and cover <5% or cover >5% but <20%
5	Cover >20% but <50%
6	Cover >50% but <75%
7	Cover >75% but< 100%

3.4 Fauna Survey

a) Historical Data:

Although the purpose of the study was to create a snap-shot understanding of the fauna of the Ryde LGA, efforts were made to locate historic data for the area. Ryde City Council had a partial fauna data base. These records were not the results of systematic surveys but rather they constituted opportunistic sightings by residents or council staff, bush care volunteers and local conservation groups.

In addition, once the surveys commenced contact was made with a number of local residents and council staff working in the LGA. People were asked specific fauna questions and details were noted and later cross-checked.

b) Field Surveys:

The following techniques were used to sample the fauna:

Small Ground Mammals:
Single entrance, baited hair tubes were used in all of the bushland areas. These tubes proved very successful in surveys carried out in other council areas (eg. Kogarah Bushland Reserves: Biosphere 1997; Rockdale LGA: Biosphere 1999). The tubes are used in preference to traps as they are less stressful on fauna, do not cause undue concern with the general public and are usually not interfered with by passers-by. Hair tubes remained at each site for a minimum of five days. They were then collected and the hair samples forwarded to Dr David Read in Bathurst for hair analysis.

The number of hair tubes set out depended on the size of the reserve. Table 3 lists the number of hair tubes that were used.

Table 3

Hair Tube Numbers

RESERVE NAME	NO. of HAIR TUBES	LOCATION OF TUBES
Brush Farm Park	50	Alongside all walking tracks in park
Darvall Park	25	Set in a line running from north to south through the centre of the park.
Lambert Park	15	Around the outer boundaries of the park
Field of Mars Reserve	125	25 traps set around each survey quadrat site

In addition, animal tracks, burrows, diggings, shed fur or feathers and scats were searched for and collected. Scats and fur samples were collected by bush regeneration staff in the field. If these contained bone or hair samples they were forwarded to Dr Read for analysis.

Arboreal Mammals:

Arboreal mammals were detected mainly by spot-lighting at night. In general, all of the walking tracks in each reserve were walked slowly while panning a spotlight either side of the track. If an animal's eye shine was detected, the location of the animal was approached directly, keeping the spotlight on the animal so that it did not move away. In most cases, the animal could be identified visually. In a few instances (e.g. sugar gliders) the animals were identified by call.

Spotlighting was carried out during the first three hours after dusk. Most reserves could be adequately covered in this time; some of the larger reserves (e.g. Field of Mars) required more than one night of spotlighting to cover the length of the reserve.

In addition, an examination of trees for scratch marks and drays took place during daylight hours.

Bats:

Flying foxes were detected by spotlighting at night whereas insectivorous bats were detected using ultra-sonic (ANABAT) bat recorders. The recorders are hand-held and carried through the reserves at night while spotlighting was in progress. Recorded bat calls were later analysed using Anabat 5.0 software.

Day Birds:

Birds were surveyed in the early mornings in two ways, in the survey quadrat areas, two mornings of twenty minutes survey time (in each survey period) was devoted to recordings the birds that were seen or heard there. In addition, opportunistic bird surveys were carried out at other times throughout the reserves.

Owls and Night Birds:

Owl surveys were conducted at night using a small portable amplifier. Owl calls were broadcast at night for Southern Boobook Owls, Powerful Owls, Sooty Owls, Masked Owls and Barn Owls. Calls were played at suitable sites each night and the amplifier was aimed away from nearby residences before the sounds were played. A listening period of 2 minutes followed the playing of each tape. If it was possible to visually identify the responding owl, all attempts were made to do so.

Other night birds, such as Tawny Frogmouths, Owlet Nightjars and Night Herons were also spotlighted during night surveys.

Reptiles:

Reptiles were searched for by hand during the day. On two sunny mornings, the quadrat survey areas were walked and all potential reptile shelter sites examined. Where possible, reptiles were caught, identified and immediately released. Other signs of reptiles were searched for, such as the presence of burrows, shed skins and droppings. Opportunistic reptile surveys were carried out throughout the rest of the reserve.

Frogs:

Frog surveys were carried out at night under suitable (wet) weather conditions. Calling frogs were identified, non-calling frogs were caught, identified and released. Searches of the area were carried out using head lamps.

During daylight hours, hand-netting was carried out to search for tadpoles. Tadpoles were immediately returned to the water once identified. If the tadpoles were too small to be readily identified they were kept and reared in captivity until they could be confidently identified and then released.

As most of the quadrats did not include a creek or watercourse, frog searches in the quadrats was confined to two evenings of twenty minutes duration each.

Fish:

Small hand nets were used to sample for fish in Archer Creek in Brush Farm Park, the drains in Lambert Park, the channel in Darvall Park and Buffalo and Strangers Creek in the Field of Mars.

Invertebrates:

Invertebrates were also surveyed in the quadrats as well as opportunistically. Invertebrate searches were combined with the reptile searches in each quadrat (i.e. two mornings of twenty minutes search effort per season). Opportunistic searches were carried out throughout the rest of the reserve and this comprised dip-netting creeks, searching undergrowth for spiders, insects and other soft-bodied creatures and using small battery operated night lights for two evenings to collect night-flying insects.

Many of the invertebrates were only identified to order or class.

3.5 Fauna Survey Dates

Table 4
Fauna Survey dates

Reserve	Hair Tubes	Spotlighting	Bats	Birds	Reptiles	Frogs
Brush Farm Park	**4-9 May 1-6 November**	**5,8 May 1,2 November**	**5,8 May 1,2 November**	**5,6 May 2,3 November**	**5,6 May 2,3 November**	**11,12 May 2,5 November**
Darvall Park	**12-17 May 23-28 October**	**13, 14 May 23,24 October**	**13, 14 May 23,24 October**	**15, 16 May 26,27 October**	**15, 16 May 26,27 October**	**11,12 May 2,5 November**
Lambert Park	**27 April-1 May 19-24 October**	**27, 28 April 22,24 October**	**27, 28 April 22,24 October**	**29, 30 April 19,20 October**	**29, 30 April 19,20 October**	**26 April,11 May 2,5 November**
Field of Mars Reserve	**11-16 May 9-14 October**	**13,14 May 9,11 October**	**13,14 May 9,11 October**	**11,12 May 12,13 October**	**11,12 May 12,13 October**	**26 April, 12 May 3,6 November**

4.0 Flora of the Bushland Reserves

4.1 Overview of the Vegetation Survey

Descriptions of the reserves, including the number and percentage of native plants and weed species in each quadrat are presented in the following discussion. The quadrats were then subjected to comparison with the procedure for classification developed by Tozer (2003) in order to assess the vegetation classification (Table 5).

Table 5
Vegetation Classifications

Name of Quadrat	Quadrat designation (see veg map)	Location	Soil Type	Results	Vegetation Community
Darvall Park	DP	Darvall Park	Wianamatta Shale	Natives: 46/33 Diagnostic species: 28/18 PASS	Turpentine Ironbark Forest
Lilly-Pilly	LP	Lambert Park	Wianamatta Shale	Natives: 22/33, FAILED (but see *) Diagnostic species: 11/18	Most likely Turpentine Ironbark Forest
Turpentine/Cassine	TC	Road reserve (Lambert Park)	Wianamatta Shale	Natives: 44/33 Diagnostic species: 23/18 PASS	Turpentine Ironbark Forest
Schizomeria	S	Brush Farm Park	Wianamatta Shale	Natives: 42/33 Diagnostic species: 18/18 PASS	Turpentine Ironbark Forest
Sydney Blue Gums	SBG	Road Reserve (Brush farm park)	Wianamatta Shale	Natives: 29/33 FAILED Diagnostic species: 19/18	Most likely Turpentine Ironbark
Turpentine Ironbark	TI	Brush Farm Park	Wianamatta Shale	Natives: 25/33 FAILED Diagnostic species: 17/18	Most likely Turpentine Ironbark
Wellington Road	WR	Field of Mars	Wianamatta Shale	Natives: 47/38 Diagnostic species: 17/11 PASS	Turpentine Ironbark Margin Forest
Coachwood	C	Field of Mars	Hawkesbury Sandstone	Natives: 31/10 PASS Diagnostic species: 5/31 FAILED	Most likely Riparian Scrub or Western Sydney Gully Forest
Scribbly Gums	SG	Field of Mars	Hawkesbury Sandstone	Natives: 43/43 PASS Diagnostic species: 17/28 FAILED	Most likely Sydney Ridgetop Woodland
Burnt Sclerophyll	BS	Field of Mars	Hawkesbury Sandstone	Natives: 57/39 Diagnostic species: 33/27 PASS	Western Sydney Gully Forest
Estuarine	E	Field of Mars	Alluvium	Natives: 12/2 Diagnostic species: 6/2 PASS	Mangrove-Saltmarsh Complex

Natives: the number of species located in the quadrat/the minimum number required for a 95% confidence interval (the minimum number of diagnostic species expected in any sample of the community); Must pass this category to go on with the classification procedure. Positive diagnostic species: the number of species in the quadrat matching those from the Map Unit listing/the minimum number of required positive diagnostic species for a match with that Map Unit. A fail does not exclude the possibility that the test plot is a match, however, the fewer positive diagnostic species recorded, the less likely it is that the Map Unit is a match. (From Tozer, 2003)
* The Lilly-Pilly quadrat only measured 10mX10m so is not representative

The reserves of Darvall Park, Brush Farm Park and Lambert Park all match criteria for Map Unit 15: Sydney Turpentine-Ironbark Forest as per the new classification procedure by Tozer (2003). The Turpentine Ironbark and Sydney Blue Gums quadrats in Brush Farm Park and the Lilly Pilly quadrat in Lambert Park failed the classification procedure, however, the vegetation in these quadrats tends towards those positive diagnostic species listed for Sydney Turpentine-Ironbark Forest (Tozer, 2003).

In the Field of Mars Reserve the soil showed a gradation from stony clay-rich soil in the west to a sandier, and often stonier (laterite), clay soil then to the sandy soils derived from Hawkesbury Sandstone. The Wellington Road quadrat fulfilled the criteria for Map Unit 43: Turpentine-Ironbark Margin Forest while to the east is an unsampled area, possibly shale/sandstone transition vegetation (marked as such by Oculus (1999), which grades into Sandstone Ridgetop Woodland and in lower topographical areas Sandstone Gully Forest vegetation. There are two other quadrats that match the corresponding Map Units developed by Tozer (2003): the Burnt Sclerophyll quadrat corresponds to Map Unit 33: Western Sandstone Gully Forest while the Estuarine quadrat matches Map Unit 34: Mangrove/Saltmarsh Complex. The Scribbly Gums quadrat is most close to Map Unit 31: Sandstone Ridgetop Woodland while the Coachwood quadrat is too narrow to be classified in either the Riparian scrub or Western Sandstone Gully Forest.

Of the Wianamatta Shale communities Darvall Park has the highest percentage of weeds (42% of species present) of all quadrats; the average was close to 1/3 weeds over all quadrats. Quadrats protected in the core of the reserves such as Schizomeria Quadrat and Turpentine/Cassine quadrat had lower percentages (21% and 27% respectively). The Wellington Road quadrat, on Wianamatta Shale, in Field of Mars contained 26% weeds. Two other quadrats, affected by water, also had high weed inundation: the Coachwood quadrat (26%) and the Estuarine quadrat (39%). The two sandstone communities had the fewest weeds of all quadrats: Scribbly Gums (12%) and Burnt Sclerophyll (0%).

One threatened plant species was found in the Field of Mars; namely *Epacris purpurescens* var *purpurescen*s. This plant was found in several locations in the Field of Mars including the Scribbly Gum Quadrat.

4.2 Endangered Ecological Communities on Wianamatta Shale

4.2.1 Darvall Park

The soil is deep well-drained clay derived from Wianamatta Shale and the topography of this narrow linear park slopes from the north at 60m ASL to 20m ASL to the south. The vegetation community is an Open Forest to Tall Open Forest dominated by Grey Ironbark (*Eucalyptus paniculata*) and Sydney Blue Gum (*E. saligna*) with an

understorey of Turpentine (*Syncarpia glomulifera*), *Rapanea variabilis*, *Trema tomentosa* var. *viridis* and *Notelaea longifolia* and a wide variety of ground covers. The vegetation has previously been described as typical BGHF by Benson & Howell (1994) and mapped as such by Oculus (1999). BGHF is listed as an endangered ecological community (Threatened Species Conservation (TSC) Act, 1995.

Due to narrowness of the reserve a 10m x 40m quadrat was erected for this study. The study area is undergoing bush regeneration by professionals/volunteers and is in the early stages of succession after weeding and a pile burn in 2003. The herbs *Sigesbeckia, Centella, Dichondra, Pratia, Glycine tabacina* and the grasses*, Imperata, Microlaena,* and *Oplismenus aemulus* dominate the ground cover. Five species of wattle have regenerated after the pile burn and the vine *Cayratia clematidea* is dominant within the shrub layer. There is a greater diversity of native species here in comparison to other areas in this park that are degraded by understorey exotics, particularly the vines *Passiflora suberosa, P. subpeltata* or *Thunbergia alata*.

One hundred and eighteen native local plant species were found in Darvall Park during this survey and the quadrat contained 46 native plants. Native plants within the reserve listed by Kubiak (2005) as regionally significant are *Eucalyptus acmenoides* and *Acacia stricta*, while *E. paniculata* and *Angophora floribunda* are locally significant because they are uncommon in the Ryde municipality. He also lists *Rubus parvifolius* as very rare in Northern Sydney Bushland. Native species found during this survey within the quadrat match those in Map Unit 15: Turpentine Ironbark Forest (Tozer, 2003).

There were 33 exotic species listed for the quadrat, a very high percentage (almost 42%) of weeds. This listing will most likely change due to weed removal by professional bush regenerators. Weeds bordering the creek are habitat for many small birds. Besides the weeds, and especially the vine inundation, the major threats to Darvall Park are from bicycle and pedestrian traffic, weed propagule introduction from greenwaste dumping, stormwater erosion and nutrients/pollutants in the stormwater.

4.2.2 Lambert Park

A sign near the Girl Guides Hall states that Lambert Park was a Shale and Clay Quarry in the 1900s. Approximately one third of the area of the park was quarry. After mining, the slopes became unstable and residential properties were threatened. Archer Creek was piped and the area filled with a mixed material from 1991 to 1994. A lack of diversity has been caused by shale mining and subsequent landfill; consequently areas with no natural soil profile or native seed bank dominate the park. Much of the park has been extensively planted, but these plantings have not been maintained and the area is excessively weedy. Two areas of remnant bushland were surveyed.

- The small (10m x 10m) Lilly-Pilly Quadrat was set up behind the Girl Guides Hall as this area contains what is possibly a remnant *Acmena smithii* (Lilly-Pilly). Also within the quadrat are the very rare *Cyperus tetraphyllus, Convolvulus erubescens* and the locally significant *Calystegia marginata* plus 18 other native species (Kubiak, 2005). The native understorey contains *Cyperus tetraphyllus*, with generalist species such as *Oplismenus aemulus, Oplismenus imbecilis* and

Dichondra repens competing with the extensive cover of the weedy grass, *Ehrharta erecta*. *Pittosporum undulatum* seedlings are regenerating the shrub layer. Despite the smallness of this quadrat, it most likely fits Map Unit 15: Turpentine Ironbark Forest. Development in this area has promoted weeds (24 weed species or 35 % of all vegetation). The greatest threats come from the Class 3 noxious weed, Green Cestrum (*Cestrum* parqui) and Class 4 noxious weeds Madeira (*Anredera cordifolia*), Moth Vine (*Araujia sericiflora*), Trad (*Tradescantia fluminensis*), Large-leaf Privet (*Ligustrum lucidum*), and the non-listed but dominating Panic Veldt Grass (*Ehrharta erecta*). The wild passionflowers *Passiflora subpeltata* and *P. suberosa* are capable of smothering understorey shrubs.

- The Turpentine/Cassine Quadrat was set up in an area cleared of Privet in 2001 in the upper section of the road reserve near Lambert Park. This quadrat, in the core area of Brush Farm/Lambert Park, shows the greatest native plant diversity (44 species). This is greater even in comparison to the Schizomeria quadrat across the gully in Brush Farm Park. The dominant trees of this Open Forest are the Turpentines but this steep slope also contains a mature *Podocarpus elatus*, which was not listed on Kubiak's list. Other rare plants are *Rubus rosifolius*, *Alectryon subcinereus* and *Cassine australis* (Kubiak, 2005). Colonisers such as *Acacia parramattensis, Senecio hispidulus, Sigesbeckia, Trema, Indigofera, Einadia* and *Pseuderanthemum* are common. This quadrat qualifies for Map Unit 15: Turpentine Ironbark Forest. Threats to native diversity in this quadrat come from the dominating grass *Ehrharta erecta* and African Olive (*Olea europaea ssp africana*) seedlings, which are two of the 16 weeds present (almost 27% weeds). There were many annual weed species (*Bidens pilosa, Conyza, Sonchus, Cirsium vulgare, Senecio madagascariensis*) during the spring survey in October. A cause for concern is the over-clearing of woody weeds, which promotes erosion on the steep slopes in this reserve.

4.2.3 Brush Farm Park

Brush Farm Park, on Wianamatta Shale, has previously been noteworthy for containing species listed in the BGHF ecological community (TSC Act, 1995) and also for the unique and rare gully rainforest that is not found elsewhere in northern Sydney or the Cumberland Plain (Benson & Howell, 1994; Oculus, 1999; Kubiak, 2005). The topography of the park forms a gully with gentle slopes in the north at 95 – 85m ASL then drops steeply from 85 – 65m ASL within the gully itself. 133 native species were found during this survey. While the disturbed Sydney Blue Gums and Turpentine Ironbark quadrats showed a paucity of native plants and did not fulfill all requirements for Map Unit 15: Turpentine Ironbark Forest, the diverse Schizomeria quadrat successfully matched the criteria. Three quadrats were set up to assess native plant diversity.

- The ridge-top Sydney Blue Gums Quadrat (in the road reserve) contains an Open Forest of *E. saligna* in association with *Syncarpia glomulifera* and the regionally significant tree *E. acmenoides* (Kubiak, 2005). The understorey consists of *Alectryon subcinereus*, *Pittosporum undulatum* and the very rare *Citriobatus pauciflorus* as well as the Gum Vine, *Aphanopetalum resinosum* (Kubiak, 2005). The quadrat was chosen because it contained 3 mature Blue Gums. There has been disturbance due to adjacent Rutledge St on one side

and residential development on another. This area has been heavily mulched and planted, so it is difficult to ascertain what is natural. A bush track enters from Rutledge St. There were 29 native species and 14 weed species (32% weeds). During the survey two of the three mature Blue Gums died from Longicorn attack, possibly contributed to by the severe drought, but other causes such as disturbance and closeness to the road, bush track (compaction) and/or mulching at the base of the tree could have contributed to stress. *Acacia buxifolia* ssp. *buxifolia*, planted in this quadrat, is a native plant local to the tablelands of NSW.

- The Turpentine/Ironbark Quadrat is behind the Scout Hall off Lawson St. It is also degraded and has less diversity due to the proximity to the playing fields and past building development of the Scout Hall and associated car park. It is bisected by a stormwater drain and has a bush track on the oval (eastern) side. The weed, *Ehrharta erecta,* is a dominant ground cover here and an infestation of White Passionflower (*P. subpeltata*) poses a threat to the understorey species. Despite this there are trees that may have been present at colonial settlement: two magnificent Grey Ironbarks (*E. paniculata*) and two mature Sydney Turpentines (*Syncarpia glomulifera*) (Britton *et al,* 2004). There are plantings of 12 *E. saligna* and a few *Pittosporum revolutum* on the oval side. There are 25 native species and 16 weed species (almost 39% weeds).
- Schizomeria Quadrat is located on the east gully-slope/creek and contains plants that form the rainforest environment that Brush Farm Park is rightly noted for. Some native species are listed as very rare: *Cassine australis*, *Cryptocarya glaucescens, Cyperus tetraphyllus, Rubus rosifolius, R. parvifolius* and *Melicope micrococca* as well as rare native plants such as *Schizomeria ovata,* and *Eupomatia laurina* (Kubiak, 2005). The ground layer is dominated by *Cyperus tetraphyllus, Morinda jasminoides* and *Adiantum hispidulum* var *hispidum* while there are many *Ficus coronata* in the shrub layer. This quadrat crosses the bush track and extends to the creek where there are several *Livistona australis*. This native is listed as a rare plant by Kubiak (2005) and has been widely planted in the gully from seed sourced by a now-dead plant (W. Klarenaar, pers. comm.). Extensive removal of weedy privet occurred in 1999. The diversity is greatest in this quadrat, contained within the core of the park, with 42 native species and only 11 weedy species (almost 21% weeds). The worst weed threat is *Ehrharta erecta* located upslope adjacent to the disturbed land along Rutledge St. The north coast native plant *Cyathea cooperi* is also naturalised in the gullies.

4.2.4 Field of Mars Reserve

Five quadrats were set up in this large (51 ha) reserve that contains a wide diversity of sclerophyll species growing in the Hawkesbury Sandstone derived soil. The reserve also contains remnants of Wianamatta Shale soil on the southwest and northwest ridges and the area to the southeast just below the cemetery. At lower altitudes alluvium dominates the estuarine and freshwater wetlands closer to Pittwater Road. In all, 293 local native species and 108 weeds were identified during this survey. This reserve shows the lowest percentages of weed species of all the reserves in the study. Low abundances of local native vegetation in each of the quadrats may indicate how commonly widespread the vegetation is throughout the reserve. The low-lying areas

were used as a rubbish tip in the 1950's and much of the area from Pittwater Road to above the Field Studies Centre contains landfill (McLoughlin, 1993) and was subsequently planted; it is not included in this study.

4.3 Endangered Ecological Communities in the Field of Mars Reserve

Sydney Turpentine Ironbark Forest

Oculus (1999) mapped only one area of Sydney Turpentine Ironbark Forest on the northwest ridge that was not examined in this study. There was another area on the southwest ridge that Oculus (1999) had mapped as a combination of "other vegetation" grading to Shale/Sandstone Transition Forest which contained a diverse number of species so a quadrat was set up there.

- The Wellington Road Quadrat is across Wellington Road from the Cemetery between Cressy Road and the old depot site. There are sandstone outcrops about 20m down slope from the quadrat. The site contains four tree species common to transitional soils: Grey Gums (*Eucalyptus punctata*), Turpentines (*S. glomulifera*), Smooth-barked Apple (*Angophora costata*) and Red Mahogany (*E. resinifera*). *E. punctata* is noted as being uncommon in the vegetation of Ryde (Kubiak, 2005). The understorey of this Open Forest contains native species that are common to both sand and shale soils. The most abundant species were: *Allocasuarina littoralis, Pittosporum undulatum, Polyscias, Hibbertia aspera, Aristida vagans, Cayratia, Clematis glycinoides* var *glycinoides, Dichondra, Entolasia stricta, Glycine microphylla, Imperata cylindrica, Microlaena, Pseuderanthemum, Themeda* and *Xanthorrhoea sp*. The diversity of this quadrat is high with 47 native species exhibiting good regeneration of shrub/tree species and a healthy grassy understorey. This quadrat corresponded with Map Unit 43: Turpentine-Ironbark Margin Forest (Tozer, 2003). Closeness of the quadrat to the disturbance of the road/cemetery is responsible for many of the weeds. The most abundant weeds, (*Lantana, Senna pendula, Ochna* and *Ligustrum* sp) are spread by birds. There are 17 weed species or 26% weeds in the quadrat.

Sydney Basin Coastal Saltmarsh

West of Pittwater Road along Strangers Creek is an area that has either eroded through the landfill or been protected from the landfill and has formed a native Saltmarsh vegetation community. It consists of a Closed Sedgeland of Coastal Saltmarsh as described by Benson & Howell (1994) and listed as a Threatened Ecological Community in the TSC Act (1995). It is mapped as such by Oculus (1999).

- The Estuarine Quadrat contains 11 native species including the dominant sedge *Baumea juncea* with *Juncus kraussii, Samolus repens, Sarcocornia quinqueflora* ssp *quinqueflora*, *Tetragonia tetragonoides* and the salt-tolerant grass, *Sporobolus virginicus var virginicus.* Mangroves, important for fisheries and bird habitat (Oculus, 1999), occur along the lower borders of the quadrat and a large patch of *Typha* sp. sits in the permanent water hole nearby. The vegetation in this quadrat qualifies for Map Unit 34: Mangrove/Saltmarsh complex described by Tozer (2003). The fill slope above the quadrat is the vector for the spread of weeds into the quadrat, which already contains 39% weeds. The weed of most concern is *Salpichroa origanifolia*, which spreads

via its vigorous system of rhizomes that are very difficult to remove once it takes hold. Common Couch (*Cynodon dactylon*), Kikuyu (*Pennisetum clandestinum*) and Japanese Honeysuckle (*Lonicera japonica*) are also encroaching. Japanese Honeysuckle is one of the vines listed as a Key Threatening Process to Coastal Saltmarsh in the Sydney Basin (DEC (NSW) 2006). For some reason, Melaleuca species, previously in this quadrat have died.

4.4 Sandstone Vegetation Communities in Field of Mars

Three quadrats were erected within the three sandstone vegetation communities of the reserve.

- The Coachwood Quadrat measures 40m x 10m and is located on the southwest side of the Field of Mars in the sandstone gully just below the Cascades at Cressy Road. This community contains a Closed Forest of *Ceratopetalum apetalum* (Coachwood) and *Tristaniopsis laurina* (Water Gum), *Acmena smithii* (Lilly-Pilly), *Callicoma serratifolia* (Black Wattle) and vines and ferns below the sandstone escarpment. *Austromyrtus tenuifolia,* listed by Kubiak (2005), is locally uncommon. This distinctive riparian vegetation, a component of the Sydney Sandstone Gully Forest, lines sheltered sandstone creeks as described by Benson & Howell (1994). The narrowness of this quadrat precluded a good match with either the Western Sandstone Gully Forest (Map Unit 33) or Riparian Scrub (Map Unit 35) from Tozer (2003). There are 11 exotic species, including the privets, *Ochna* & *Lantana*, which are spread by birds and/or water. Due to the proximity to the nutrient rich waters and floodplain of the creek, this area is subject to flooding, litter and weed inundation.
- The Burnt Sclerophyll Quadrat was set up just west of where the Canon walk intersects with the Sand Track in vegetation consistent with Sydney Sandstone Gully Forest (Benson and Howell, 1994). Oculus (1999) has mapped this area as Sydney Sandstone Gully Complex. This area, burnt by arson in 2002, contains Open Woodland of *Angophora costata, Corymbia gummifera* and *Eucalyptus resinifera* with an understorey of regenerating plants in the sclerophyll families FABACEAE, MYRTACEAE, PROTEACEAE, LOMANDRACEAE and POACEAE. There is a marvelous diversity of native species (57 in total) that is found in healthy sclerophyll communities after fire and no exotic species are present. The vegetation corresponded with the listing for Map Unit 33: Western Sandstone Gully Forest (Tozer, 2003).
- The Scribbly Gums Quadrat contains an Open Forest of sclerophyllous vegetation dominated by *Eucalyptus racemosa, Corymbia gummifera, Angophora costata and Eucalyptus resinifera.* While the Sand Track towards the southeast is bordered by *Eucalyptus haemastoma,* the tree species change towards the northwest corner to *E. racemosa*, which prefers a more clay-rich soil. About 100m to the north, laterite on the path indicates a higher clay influence and the canopy trees change to *Syncarpia glomulifera* (Turpentine). This quadrat is typical of Sydney Sandstone Ridge-top Woodland (Benson & Howell, 1994; Oculus, 1999) and it contains the TSC listed *Epacris purpurascens* var *purpurascens* as well as 42 other native species. Although this quadrat is lacking in positive diagnostic species, it is representative of

Map Unit 33: Western Sandstone Gully Forest. There are 5 exotic species (12% weeds) in the quadrat that are all bird dispersed.

4.5 Exotic and Non-Local Native Species

At the completion of the survey in November 2006 the Exotic and Non-local Native Plant Checklist contained 152 species. Twelve of these species are Australian native plants not local to Ryde municipality. Several of these are native to the Central or North coasts of NSW and have been promoted by the nursery industry/horticultural trade*: Alectryon tomentosus, Cryptocarya obovata, Cyathea cooperi, Melia azedarach var australasica, Brachychiton acerifolius, Grevillea robusta, Solanum aviculare,* and *Toona ciliata*. *Alectryon tomentosus* from the North coast of NSW was planted in Lambert Park but does not exhibit weedy characteristics.

- *Alectryon tomentosus* grows in dry and subtropical rainforest north from the Hunter Valley (Harden, G (Ed), 1991).
- *Cryptocarya obovata* is found in subtropical rainforests north from Ourimbah NSW (Benson & McDougall, 1997). It is not exhibiting weedy characteristics in Darvall Park or Lambert Park.
- *Cyathea cooperi* is a native to north coast and south coastal warm rainforest (Benson & McDougall, 1993). It has increased its range into the Sydney Basin through promotion of the nursery trade in the 1990s and it thrives due to increased water and nutrient availability along stormwater drains and creeks. The large dense fronds cause increased shade along the creek-lines changing the ecological environment to suit its spread. The increased shade and mulch of fronds prevents germination of native species such as *Callicoma serratifolia* and *Ceratopetalum*.
- *Grevillea robusta* is native to the north coast of NSW and not endemic in the Sydney Basin (Harden, G (Ed), 1991). It self-seeds readily in the Sydney Basin.
- *Solanum aviculare* is a native to the margins of the Illawarra and (possibly the Blue Mountains) rainforest communities. It naturally occurs on basalt or slate derived soils in areas with 700-1600mm annual rainfall (Benson & McDougall, 2001). In Sydney the only site where it is natural is on basalt diatremes (eg Brown's Field in Turramurra). It has spread down the Lane Cove River by birds and humans who plant it in their gardens.
- *Melia azedarach* var *australasica* also occurs endemically along the Nepean-Hawkesbury River and in the Illawarra. It has been widely planted as a street tree and it is spread into bushland by birds or deliberately planted. (Benson & McDougall, 1997).
- *Toona ciliata* is native to the Illawarra (Benson & McDougall, 1997) and is most likely planted in Brush Farm Park.
- *Brachychiton acerifolius* is native to rainforest in Gosford and the Illawarra but has been planted widely as a street tree and in gardens; therefore it tends to spread into bushland (Benson & McDougall, 2001).

Other non-local native species include:

- *Casuarina cunninghamiana* ssp *cunninghamiana* is native along the Nepean-Hawkesbury River and has been widely planted for landscaping in parks

around Sydney (Benson & McDougall, 1995). It does not exhibit weedy characteristics.

- *Acacia elata* is native to the Blue Mountains and the Hornsby Plateau (Benson, D & McDougall, L, 1996). It is widely cultivated and has most likely escaped from local gardens.
- *Acacia fimbriata* is native to southwest Sydney and is promoted by the nursery trade (Benson, D & McDougall, L, 1996). It has been used to stabilise the slopes on the southeast side of the Field of Mars Cemetery and has readily spread along the edge of the reserve.
- *Acacia buxifolia ssp buxifolia* occurs naturally in the NSW tablelands (Benson, D & McDougall, L, 1996) and has been planted within the Sydney Blue Gums quadrat near Rutledge Street.

The Noxious Weeds Act 1993 Weed Control Order No. 19 (NSW Government Gazette No 166, 2005) which commenced on 1/3/06 lists many of the weed species found in the survey. Of concern is *Cestrum parqui,* which is listed in Class 3, and is found in three of the four reserves. Under the Control Order this plant "must be fully and continuously suppressed and destroyed". Other weeds are in Class 4 in which "the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority". These weeds are common throughout the reserves: *Anredera cordifolia, Arundo donax, Asparagus aethiopicus, Asparagus asparagoides, Asparagus plumosus, Cardiospermum grandiflorum, Cinnamomum camphor, Delairea odorata, Ipomoea indica, Lantana camara, Ligustrum lucidum and L. sinense, Ochna serrulata, Olea europaea spp. africana, Parietaria judaica, Ricinus communis, Tradescantia fluminensis* and *Senna pendula*. Many are spread by bird vectors or by dumping of garden rubbish by residents. *Oxalis sp.* is a Class 5 notifiable weed. *Solanum rostrum* was found on Wellington Road in the area adjacent to the old Council Depot. This weed is listed as a Class 4 weed in rural areas.

Lantana camara has recently been listed at a Key Threatening Process in Schedule 3 of the TSC Act (1995). This listing is applicable to the Sydney Turpentine Ironbark communities in Darvall Park, Lambert Park and Brush Farm Park (DEC (NSW), 2006).

In 2006 the Department of Environment and Conservation (NSW) made a final determination on "the Invasion and Establishment of Exotic Vines and Scramblers" as a Key Threatening Process in Schedule 3 of the Threatened Species Conservation Act, 1995. Of particular concern is the seriousness of the vine problem in Darvall Park. Biodiversity is severely compromised by rampant growth of *Anredera cordifolia, Asparagus aethiopicus, A. plumosus, Cardiospermum grandiflorum, Ipomoea indica, Lonicera japonica, Passiflora suberosa, P. subpeltata, Thunbergia alata and Tradescantia fluminensis.* All these vines are listed in the new proclamation, however; Turpentine-Ironbark is not listed as one of the affected ecological communities. This proclamation, however, does apply to the Coastal Saltmarsh Ecological Community in the Field of Mars Reserve, which is affected by *Lonicera japonica*.

4.6 Vegetation Communities and their Assessment

The classification procedure developed by Tozer (2003) has been useful for describing most of the vegetation communities in the four reserves and also for assessing the native plant species richness in the study areas. Species richness was lowest in the Estuarine Quadrat and the disturbed Turpentine-Ironbark, Blue Gums and Coachwood Quadrats. It was similar for the Schizomeria, Scribbly Gums, Turpentine/Cassine, Darvall Park and Wellington Road Quadrats and greatest in the Burnt Sclerophyll Quadrat.

Eleven quadrats were sampled in this survey; six of these passed the classification procedure while five failed. All six quadrats that passed showed a healthy diversity and abundance in both the number of native plants that were present, but also the number of positive diagnostic species. Two quadrats were especially interesting: Darvall Park and the Burnt Sclerophyll Quadrat. Darvall Park is a thin linear park that is highly degraded, with the highest number of weed species (33) of all quadrats. This reserve is especially threatened from vines such as *Passiflora* species and *Thunbergia alata* that are vigorous and prolific growers that seed readily to rapidly dominate the ground and shrub layers resulting in a loss of native species. The edge to area ratio is high and the introduction of weeds into the reserve from neighbouring properties and the creek that runs down the western edge is more than likely the source of degradation. The bush regeneration and small pile burn in 2003 have provided the conditions necessary for natural regeneration of the native soil seed bank thereby increasing the native plant diversity. The Burnt Sclerophyll quadrat was burnt in December 2002 by arson. The natural regeneration in this quadrat was typical of the positive response of healthy Hawkesbury Sandstone sclerophyllous vegetation communities to fire. The number of native species in the quadrat and the number of positive diagnostic species was the highest ratio of all quadrats in the study. Also, there are no weed species in the quadrat despite its closeness to the Sand Track and a nearby weedy area.

Darvall Park, Brush Farm Park and Lambert Park are all located on Wianamatta Shale soils and the vegetation in these reserves has previously been classified as Blue Gum High Forest (Benson & Howell, 1994). The topography of the three parks is below 100m ASL and no longer satisfies that listing criteria (DEH, 2006). The study quadrats in these parks fulfill or come close to fulfilling the criteria for Map Unit 15: Turpentine Ironbark Forest (Tozer, 2003).

In the Field of Mars Reserve, the Estuarine Quadrat has previously been classified as Coastal Saltmarsh (TSC Act, 1995) and fulfils the criteria for Map Unit 34: Mangrove/Saltmarsh Complex (Tozer, 2003). The Wellington Road quadrat fulfils the criteria for Map Unit 43: Turpentine Ironbark Margin Forest. The Scribbly Gums Quadrat comes close to fulfilling the criteria for a Sandstone Ridgetop Woodland while the Burnt Sclerophyll Quadrat fulfils the criteria for the Map Unit 33: Western Sandstone Gully Forest. The Coachwood Quadrat, if re-evaluated, is possibly Western Sandstone Gully Forest or Riparian Scrub. One area that was not sampled in this study but that has previously been listed as (endangered) Shale/Sandstone Transition Forest by Oculus (1999) contains numerous rare species including the endangered *Pimelea curviflora* ssp *curviflora*, the regionally significant *Pultenaea paleacea* and locally significant and rare *Telopea speciosissima* (Kubiak, 2005).

Two quadrats most likely failed because the area of the quadrat was too small or the wrong shape to be representative. The Lilly-Pilly Quadrat in Lambert Park was a $100m^2$ quadrat of a small remnant located in a degraded area. It contained, for the small area, 24 weed species. The Coachwood Quadrat was narrow (10m X 40m) and located along a creek-line below a sandstone escarpment. Had the quadrat been 20m X 20m, it is most likely that enough positive diagnostic species would be present to fulfill the criteria for either the Riparian Scrub Map Unit or possibly the Western Sydney Gully Forest Map Unit.

Two other quadrats failed because of a lack of native plant diversity most likely due to disturbance. Both the Sydney Blue Gums and the Turpentine Ironbark Quadrats in Brush Farm Park did not have the required number of native species for a 95% confidence level. Both are located in areas that have been degraded by residential development, bush tracks or stormwater drains. Positive diagnostic species were close to satisfactory. If the effects of the disturbances were addressed and decreased, both areas have the potential to regenerate naturally with some supplementary planting on the external edges.

The Scribbly Gums Quadrat, in the Field of Mars reserve, is deficient only in positive diagnostic species, having 17 of the recommended 28 species. This quadrat contained a 5cm deep leaf litter and many of the colonizing plants in the quadrat showed signs of senescence. This gradual decline in species may possibly be due to lack of fire in this area of the park. The TSC listed vulnerable plant *Epacris purpurascens* ssp *purpurascens* is located within the quadrat and plants can be compromised with a too-frequent fire regime, as the adult plants are killed by fire. Despite this, seed held in the soil will regenerate. The regionally significant plant *Gompholobium pinnatum* (Kubiak, 2005) is also in the area. Species in the family FABACEAE are also killed by fire but will regenerate from the soil seed bank after fire.

The classifications contained in this survey and listed by Tozer (2003) are equivalent to the following Endangered Ecological Communities listed on Schedule 1 of the NSW TSC Act (1995).

Table 6
Endangered Ecological Communities

Tozer classification	**NSW TSC Act (1995)**	**The Natural Vegetation of the Sydney 100000 Map Sheet (Benson & Howell, 1994)**
Turpentine-Ironbark Forest	Sydney Turpentine Ironbark Forest	Turpentine-Ironbark Forest
Turpentine-Ironbark Margin Forest	Sydney Turpentine Ironbark Forest	Turpentine-Ironbark Forest
Mangrove/Saltmarsh Complex*	Coastal Saltmarsh in the NSW Sydney Basin	Coastal Saltmarsh
Shale/Sandstone Transition Forest (High Sandstone Influence)	Shale/Sandstone Transition Forest	
*Mangrove/Saltmarsh was poorly sampled in the Tozer study and further sampling is required. However, vegetation in the Estuarine Complex corresponds to the Endangered Ecological Community listing (DEC (NSW)).		

The results have shown that use of this classification procedure can be utilized by Council managers to ascertain the quality of bushland native plant diversity and also to alert them to a gradual loss of native species richness. Loss of, or change in, the positive diagnostic species may point to a gradual degradation of the area or a change in vegetation community type.

Once diversity is noticed to be decreasing, it is important to look for the source of the disturbance and to take measures to correct it. Oculus (1999) lists the factors that contribute to the loss of native plant diversity in the Ryde municipality: lack of maintenance and weed control (Turpentine/Cassine Quadrat), increased degradation (Lambert Park), continuation of threatening processes (Darvall Park Quadrat, Estuarine Quadrat) increased stormwater runoff into bushland with associated increase in nutrient levels and erosion (or flooding) (Turpentine Ironbark Quadrat, Coachwood Quadrat) and physical damage to tree roots by path construction (Blue Gums Quadrat). This study would also add incorrect bush regeneration practices such as heavy mulching at the base of trees (Blue Gums Quadrat), over-clearing of hill slopes prone to erosion and lack of maintenance in previously cleared sites leading to an increased competition with annual weed species (Turpentine/Cassine Quadrat). Despite the high native plant diversity in the Turpentine/Cassine quadrat in Lambert Park, there were as many weeds as the more degraded Turpentine Ironbark and Sydney Blue Gums quadrats in Brush Farm Park. Weed clearance needs to occur in small mosaics that can be maintained by the small number of bush regenerators available. Wholesale cutting and painting of weed trees such as Privet or African Olives should be avoided, as in the short term these trees have a short-lived seed life and can act as nurse plants that keep the soil cool and provide shade for newly emerging native species. They also provide a roost for birds that may bring other native seeds to the area via their droppings or regurgitated pellets. When the native saplings are established, these species can be removed and follow-up weeding of weed seedlings will be completed after a few years follow-up. Removal of the weedy grass *Ehrharta erecta* is paramount as this species has the potential to seed every four weeds from the first spring rains and throughout the summer. It can become so prolific as to prevent regeneration of native ground covers and indiscriminate spraying can poison any native seedlings.

Widespread planting in areas where natural regeneration occurs is also to be avoided as species may become inadvertently weedy (eg *Acacia fimbriata*). Control of non-local native plants, such as *Cyathea cooperi*, which have spread prolifically down creek-lines since its promotion through the nursery trade, should be undertaken, despite the fact that the plant "looks so nice". If planting is to occur, it should only be done in areas where a natural soil profile is absent and natural regeneration cannot occur. In this case, only plants of local provenance should be used as a seed source. Seed should be collected according to best management practice. Permission must be obtained from NPWS (NSW) as the National Parks and Wildlife Act (1974) governs various activities such as 132C Scientific licenses for seed collection within reserves containing Endangered Ecological Communities. Collection of local provenance seed avoids the introduction of possible native weeds such as *Acacia buxifolia* ssp *buxifolia* in Brush Farm Park and *Acacia fimbriata,* which has spread into the bush in the Field of Mars reserve.

5.0 Ryde Fauna

The following tables of fauna are the combined findings of the quadrat and opportunistic surveys. The quadrat data only is tabulated in Appendix 4.

5.1 Brush Farm Park

Mammals:

There are no native terrestrial mammals in Brush Farm Park. Two species of possum still occur there as well as bats. The ground fauna is dominated by exotic mammals, such as rats, cats, dogs and foxes (Table 7). Possum numbers are quite low despite the thick tree canopy across parts of the reserve.

Table 7
Mammal Fauna of Brush Farm Park

Species	Common Name	Relative Abundance	How Detected	Comments
Brush-tail Possum	*Trichosurus vulpecula*	Low	Spotlighting Hair Tubes	Only 3 possums were sighted over the two survey periods
Ring-tail Possum	*Pseudecheirus peregrinus*	Low	Spotlighting	Only 2 possums were sighted during the survey
Black Rat	*Rattus rattus*	High	Spotlighting Hair Tubes	11 out of 25 hair tubes in the summer survey had rat hairs
House Mouse	*Mus musculus*	Low	Hair Tubes	Only 2 hair tubes had mouse hair in them.
Dog	*Canis lupus familiaris*	Low	Spotlighting	Two dogs were spotted in the reserve during the summer survey
Red Fox	*Vulpes vulpes*	Low	Spotlighting Scat Tracks	Foxes were detected during both spring and summer surveys.
Cat	*Felis catus*	Low	Spotlighting	Cats were observed in the reserve during both survey sessions.
Rabbit	*Oryctolagus cuniculus*	Medium	Spotlighting	Rabbits were observed around the top oval
Grey-headed Flying Fox	*Pteropus poliocephalus*	Common	Spotlighting	Several flying foxes were spotlighted each night survey.

Gould's Wattled Bat	*Chalinolobus gouldii*	Low	Anabat	Bats detected in spring and summer
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	Low	Anabat	Bats detected in spring and summer
White-striped Freetail Bat	*Nyctinomus australis*	Low	Anabat	Only detected in summer survey

Birds:

Seventy six species of day birds and four species of night birds were found in Brush Farm Park (Table 8). Many of the birds found were those commonly found in open woodland; ground-nesting or ground-frequenting birds were conspicuously absent. It is assumed that their absence is due to the high number of exotic predators in the park.

The majority of birds present were insect-eating birds. The high diversity of these birds reflects the stage of development of Brush Farm Park where there are many areas where trees are still immature and actively growing. There is also a mixture of open and closed canopy areas as well as a variety of plant species that support a reasonable variety of insects (Table 12). It is likely that as the trees mature this diversity will decrease and the number of migratory insect-feeding birds will decrease.

Table 8
Bird Fauna of Brush Farm Park

Species	Common Name	Autumn Survey	Spring Survey
Dacelo novaeguinea	Kookaburra	√	√
Halycon sancta	Sacred Kingfisher	√	√
Vanellus miles	Masked Lapwing	√	√
Grallina cyanoleuca	Magpie-lark	√	√
Corvus coronoides	Australian Raven	√	√
Gymnorhina tibicen	Australian Magpie	√	√
Cracticus torquatus	Grey Butcherbird	√	√
Strepera graculina	Pied Currawong	√	√
Rhipidura leucophrys	Willie Wagtail	√	√
Rhipidura fuliginosa	Grey Fantail	√	√
Hirundo neoxena	Welcome Swallow	√	√
Hirundo ariel	Fairy Martin		√
Artamus cyanopterus	Dusky Wood swallow	√	√
Hirundapus caudicutus	White-throated Needletail	√	√
Geophaps lophotes	Crested Pigeon	√	√
Platycercus eximia	Eastern Rosella	√	√
Platycercus elegans	Crimson Rosella	√	√
Falcunculus frontatus	Crested Shrike-tit	√	√
Pardalotus punctata	Spotted Pardalote	√	√
Sphecotheres viridis	Fig Bird	√	
Pachycephala pectoralis	Golden Whistler	√	√
Pachycephala rufiventris	Rufous Whistler		√
Trichoglossus haematodus	Rainbow Lorikeet	√	√
Cacatua rosiecapilla	Galah	√	

Calyptorhynchus funereus	Yellow-tail Black Cockatoo	√	√
Cacatua galerita	Sulphur-crested Cockatoo	√	√
Coracina novaehollandiae	Black-faced Cuckoo Shrike	√	√
Phylidonyris novaehollandiae	New Holland Honeyeater	√	√
Lichenostomus penicillatus	White-plumed Honeyeater	√	√
Meliphaga lewinii	Lewin's Honeyeater		√
Acanthorhynchus tenuirostris	Eastern Spinebill	√	√
Anthochaera carunculata	Red Wattlebird	√	√
Anthochaera lunulata	Little Wattlebird	√	√
Philemon corniculatus	Noisy Friarbird	√	√
Manorina melanocephalus	Noisy Miner	√	√
Neochmia temporalis	Red-browed Firetail	√	√
Malurus cyaneus	Superb Blue Fairy Wren	√	√
Sericornis frontalis	White-browed Scrub-wren	√	√
Acanthiza pusilla	Brown Thornbill	√	√
Acanthiza nana	Yellow Thornbill		√
Acanthiza lineata	Striated Thornbill	√	√
Zosterops lateralis familiaris	Silver-eye	√	√
Zosterops lateralis lateralis	Tasmanian Silver-eye	√	√
Cisticola exilis	Golden-headed Cisticola	√	
Petroica rodinogaster	Rose Robin	√	√
Monarcha melanopsis	Black-faced Monarch		√
Microeca fascinans	Jacky Winter		√
Oriolus sagittatus	Olive-backed oriole		√
Macropygia amboinensis	Brown Cuckoo-Dove	√	√
Anas supercilliosa	Pacific Black Duck	√	√
Ardea novaehollandiae	White-faced Heron	√	√
Threskiornis aethiopica	White Ibis	√	√
Larus novaehollandiae	Silver Gull	√	√
Grallina cyanoleuca	Magpie Lark	√	√
Phalacrocorax sulcirostris	Little Black Cormorant	√	√
Elanus notatus	Black-shouldered Kite	√	
Falco cenchroides	Nankeen Kestrel Brown	√	√
Accripiter fasciatus	Brown Goshawk	√	√
Accripiter novaehollandiae	Grey Goshawk		
Cuculus flabelliformis	Fan-tail Cuckoo	√	√
Chrysococcyx basalis	Horsfield Bronze Cuckoo		√
Cacomantis flabelliformis	Fan-tailed Cuckoo		√
Cuculus pallidus	Pallid Cuckoo		√
Chrysococcyx lucidus	Shining Bronze Cuckoo		√
Eudynamys scolopacea	Koel	√	√
Scythrops novaehollandiae	Channel-billed Cuckoo		√
Podargus strigoides	Tawny Frogmouth	√	√
Aegotheles cristanus	Australian Owlet-Nightjar		√
Ninox novaeseelandiae	Southern Boobook Owl	√	√
Ninox strenua	Powerful owl		√

Powerful Owls were detected in Brush Farm Park but no roosting sites were found for these birds. In view of the low number of possums in the local area, it is probable that Powerful Owls occasionally visit the park but are not permanent residents there.

Brush Farm Park contains a high numbers of exotic birds (Table 9). Many of these birds feed outside of the park but nest inside the park. Some species, especially the Common Mynas, compete with native hollow-nesting birds for nest sites. The numbers of mynas in the park may need to be monitored and bird numbers controlled in the future.

Table 9
Exotic Birds of Brush Farm Park

Species	Common Name	Autumn Survey	Spring Survey
Pycnotus jocosus	Red-whiskered Bulbul	√	√
Sturnus vulgaris	Common Starling	√	√
Acidotheres tristis	Common Myna	√	√
Passer domestica	House Sparrow	√	√
Lonchura castaneothorax	Chestnut-breasted Mannikin		√
Columbra livia	Feral Pigeon	√	√
Streptopelia chinensis	Spotted Turtle-dove	√	√

Reptiles:

Six lizard species and one snake were found in Brush Farm Park (Table 10). The majority of lizards are small, ant-eating species that can hide quickly in short grass or under fallen branches. Larger lizards, such as Water Dragons, have fewer shelter areas and are more prone to predation by exotic predators. The Black-bellied Marsh Snake is a lizard feeding snake and is not common in the park.

Table 10
Reptile Fauna of Brush Farm Park

Species	Common Name	Spring Survey	Summer Survey	Abundance
Lampropholis delicata	Garden Skink		√	Common
Lampropholis guichenoti	Grass Skink	√	√	Common
Saproscincus mustelinus	Weasel Skink		√	Uncommon
Eulamprus quoyii	Eastern Water Skink	√	√	Very Common
Cryptoblepharus virgata	Wall Skink	√	√	Uncommon
Physignathus lesueurii	Eastern Water Dragon	√	√	Uncommon
Hemiaspis signata	Black-bellied Marsh Snake	√		Uncommon

Frogs:

Three species of frogs were found in Brush Farm Park (Table 11). None of the frogs were abundant. The ephemeral nature of Archer Creek means that water is not readily available for frogs but the enclosed gullies provide shelter sites for frogs.

Table 11
Frog Fauna of Brush Farm Park

Species	Common Name	Autumn Survey	Spring Survey	Abundance
Limnodynastes peronii	Striped Marsh frog	√	√	Common
Crinia signifera	Common Eastern Froglet	√	√	Common
Litoria phyllochroa	Leaf-green Tree Frog		√	Uncommon

Fish:

No fish were found in Brush Farm Park.

Invertebrates:

A wide variety of invertebrates were found in Brush Farm Park (Table 12). Insects dominate the invertebrates present with 16 major taxa of insects being found. Most of the insects were leaf-eating or sap-sucking insects exploiting the young tree growth in the park. Spiders, snails, centipedes and slaters were also conspicuous about the park.

Table 12
Invertebrate Fauna of Brush Farm Park

Major Group	Order or Family	Lower Taxon (if possible)	Common Names	Where Found
Insecta	Collembola		Springtails	Leaf Litter
	Ephemeroptera		May Flies	Creek
	Odonata	Zygoptera	Damselflies	Creek
		Anisoptera	Dragonflies	Creek
	Plecoptera		Stone Flies	Creek
	Blattodea		Cockroaches	Leaf Litter
	Isoptera		Termites	Flying
	Mantodea		Prayer Mantis	Foliage
	Dermaptera		Earwigs	Ground
	Orthoptera	Gryllacridae	Tree Crickets	Foliage
		Tettigoniidae	Katydids	Foliage
		Gryllotalpidae	Mole Crickets	Ground
		Gryllidae	Crickets	Ground
		Acrididae	Grasshoppers	Ground
	Hemiptera	Notonectidae	Backswimmers	Creek
		Gerridae	Water Striders	Creek
		Lygaeidae	Ground Bugs	Ground
		Pentatomidae	Stink Bugs	Foliage
		Reduviidae	Assassin Bugs	Foliage
	Homoptera	Cicadidae	Cicadas	Foliage
		Cicadellidae	Leaf Hoppers	Foliage
		Aphididae	Aphids	Stems
		Coccidea	Scale Bugs	Shrubs
	Coleoptera	Cincindelidae	Tiger Beetles	Ground
		Carabidae	Ground Beetles	Ground
		Dytiscidae	Diving Beetles	Creek
		Staphlinidae	Rove Beetles	Ground
		Scarabaeidae	Scarab Beetles	Foliage
		Buprestidae	Jewel Beetles	Foliage
		Elateridae	Click Beetles	Foliage
		Coccinellidae	Labybirds	Foliage

		Cerambycidae	Long-horned Beetles	Dead Trees
		Chrysomelidae	Leaf Blisters	Foliage
	Lepidoptera	Hesperidae	Skippers	Flying
		Papillionidae	Swallowtail Butterflies	Flying
		Danaidae	Milkweed Butterflies	Flying
		Lycaenidae	Ant Blue Butterflies	Flying
		Sphingigae	Hawk Moths	Flying
		Arctidae	Tiger Moths	Flying
		Sesiidae	Clearwing Moths	Flying
		Geometridae	Geometer Moths	Flying
	Diptera	Tipulidae	Crane Flies	Creek
		Culicidae	Mosquitoes	Creek
		Tabanidae	March Flies	Flying
		Assilidae	Robber Flies	Flying
		Syrphidae	Hover Flies	Flying
		Muscidae	House Flies	Flying
		Calliphoridae	Blow Flies	Flying
	Hymenoptera	Icneumonidae	Parasitic Wasps	Flying
		Vespidae	Vespid Wasps	Flying
		Sphecidae	Sphecid Wasps	Flying
		Formicidae	Ants	Ground
		Apoidea	Bees	Flying
	Neuroptera		Lace Wings	Flying
Arachnids	Arcarina		Mites, Ticks	Ground
		Tetragnathidae	Long-jawed Spiders	Foliage
		Lycosidae	Wolf Spiders	Ground
		Nephilidae	Orb-Weavers	Foliage
Chelicerates	Chilopoda		Centipedes	Ground
	Myripoda		Millipedes	Ground
Crustacea	Isopoda		Slaters	Ground
Molluscs	Gastropoda		Snails	Ground
			Slugs	Ground
Annelida	Oligochaeta		Earthworms	Ground
	Hirunidae		Leeches	Foliage

5.2 Darvall Park

Mammals:

Native mammals are uncommon in Darvall Park. Terrestrial native animals are totally absent while only one possum species was present (Table 13). Unfortunately, exotic

animals are more common in Darvall Park. Dogs and cats were commonly found in the park at night; Black Rats appear widespread across the park.

Table 13
Mammal Fauna of Darvall Park

Species	Common Name	Relative Abundance	How Detected	Comments
Trichosurus vulpecula	Brush-tail Possum	Low	Spotlighting Hair Tubes	Only 4 possums were sighted over the two survey periods
Rattus rattus	Black Rat	Medium	Spotlighting Hair Tubes	5 out of 25 hair tubes in the summer survey had rat hairs
Mus musculus	House Mouse	Low	Hair Tubes	4 hair tubes in the summer survey had mouse hair in them.
Canis lupus familiaris	Dog	Low	Spotlighting	Dogs were spotted in the reserve during the spring and summer survey
Felis catus	Cat	Medium	Spotlighting	Cats were observed in the park during both survey sessions.
Pteropus poliocephalus	Grey-headed Flying Fox	Common	Spotlighting	Several flying foxes were spotlighted each night survey.
Chalinolobus gouldii	Gould's Wattled Bat	Low	Anabat	Bats detected in spring and summer
Nyctinomus australis	White-striped Freetail Bat	Low	Anabat	Single individuals detected in both surveys

Birds:

Fifty three day bird species were recorded in Darvall Park and two night birds were detected as well (Table 14). Most of these birds were resident species, particularly the parrots. The high diversity and abundance of parrots is due to the mature stand of eucalypts in the park that provide ample nesting hollows for these birds.

Small shrub-dwelling birds are almost absent from the bird fauna as there original understorey has been almost completely removed for Darvall Park.

Table 14
Native Bird Fauna of Darvall Park

Species	Common Name	Autumn Survey	Spring Survey
Dacelo novaeguinea	Kookaburra	√	√
Vanellus miles	Masked Lapwing	√	√
Grallina cyanoleuca	Magpie-lark	√	√
Corvus coronoides	Australian Raven	√	√
Gymnorhina tibicen	Australian Magpie	√	√
Cracticus torquatus	Grey Butcherbird	√	√
Strepera graculina	Pied Currawong	√	√
Rhipidura leucophrys	Willie Wagtail	√	√
Rhipidura fuliginosa	Grey Fantail	√	√
Hirundo neoxena	Welcome Swallow	√	√
Geophaps lophotes	Crested Pigeon		√
Platycercus eximia	Eastern Rosella	√	√
Platycercus elegans	Crimson Rosella	√	√
Falcunculus frontatus	Crested Shrike-tit	√	√
Pardalotus punctata	Spotted Pardalote	√	√
Sphecotheres viridis	Fig Bird	√	√
Pachycephala pectoralis	Golden Whistler	√	√
Pachycephala rufiventris	Rufous Whistler	√	√
Trichoglossus haematodus	Rainbow Lorikeet	√	
Cacatua rosiecapilla	Galah	√	√
Calyptorhynchus funereus	Yellow-tail Black Cockatoo		√
Cacatua galerita	Sulphur-crested Cockatoo	√	√
Coracina novaehollandiae	Black-faced Cuckoo Shrike	√	√
Phylidonyris novaehollandiae	New Holland Honeyeater	√	√
Lichenostomus penicillatus	White-plumed Honeyeater	√	√
Meliphaga lewinii	Lewin's Honeyeater	√	√
Acanthorhynchus tenuirostris	Eastern Spinebill	√	√
Anthochaera carunculata	Red Wattlebird	√	√
Anthochaera lunulata	Little Wattlebird		√
Philemon corniculatus	Noisy Friarbird	√	√
Manorina melanocephalus	Noisy Miner	√	√
Neochmia temporalis	Red-browed Firetail	√	√
Malurus cyaneus	Superb Blue Fairy Wren	√	√
Sericornis frontalis	White-browed Scrub-wren	√	√
Acanthiza pusilla	Brown Thornbill	√	√
Acanthiza nana	Yellow Thornbill	√	√
Acanthiza lineata	Striated Thornbill	√	√
Zosterops lateralis familiaris	Silver-eye	√	√
Zosterops lateralis	Tasmanian Silver-eye		√
Cisticola exilis	Golden-headed Cisticola	√	√
Petroica rodinogaster	Rose Robin	√	√
Monarcha melanopsis	Black-faced Monarch	√	
Microeca fascinans	Jacky Winter	√	√
Oriolus sagittatus	Olive-backed oriole	√	√
Macropygia amboinensis	Brown Cuckoo-Dove		√
Anas supercilliosa	Pacific Black Duck		√
Ardea novaehollandiae	White-faced Heron		√
Threskiornis aethiopica	White Ibis	√	√
Larus novaehollandiae	Silver Gull	√	√
Grallina cyanoleuca	Magpie Lark	√	√
Phalacrocorax sulcirostris	Little Black Cormorant	√	√
Elanus notatus	Black-shouldered Kite	√	√
Falco cenchroides	Nankeen Kestrel Brown	√	√

Accripiter fasciatus	Brown Goshawk	√	
Accripiter novaehollandiae	Grey Goshawk	√	√
Cuculus flabelliformis	Fan-tail Cuckoo	√	√
Chrysococcyx basalis	Horsfield Bronze Cuckoo	√	
Cacomantis flabelliformis	Fan-tailed Cuckoo		√
Cuculus pallidus	Pallid Cuckoo	√	√
Chrysococcyx lucidus	Shining Bronze Cuckoo		√
Eudynamys scolopacea	Koel		√
Scythrops novaehollandiae	Channel-billed Cuckoo		√
Podargus strigoides	Tawny Frogmouth		√
Ninox novaeseelandiae	Southern Boobook Owl	√	
Ninox strenua	Powerful Owl		

Darvall Park contains a large number of exotic bird species (Table 15). Many of these birds inhabit that the mowed grassland areas of the park and do not utilise the mature trees.

Table 15
Exotic Bird Fauna of Darvall Park

Species	Common Name	Autumn Survey	Spring Survey
Pycnotus jocosus	Red-whiskered Bulbul	√	√
Sturnus vulgaris	Common Starling	√	√
Acidotheres tristis	Common Myna	√	√
Passer domestica	House Sparrow	√	√
Columbra livia	Feral Pigeon	√	√
Streptopelia chinensis	Spotted Turtle-dove	√	√

Reptiles:

Five species of lizard were found in Darvall Park; no snakes or geckoes were found (Table 16). Most of the lizards were small species that require small ground cover. Larger reptiles would not be able to hide from predators in Darvall Park because of the loss of native ground cover vegetation, logs and rocks.

Table 16
Reptile Fauna of Darvall Park

Species	Common Name	Autumn Survey	Spring Survey	Abundance
Lampropholis delicata	Garden Skink		√	Common
Lampropholis guichenoti	Grass Skink	√	√	Common
Saproscincus mustelinus	Weasel Skink		√	Uncommon
Eulamprus quoyii	Eastern Water Skink	√	√	Uncommon
Cryptoblepharus virgata	Wall Skink	√	√	Uncommon

Frogs:

Two species of frogs were present in Darvall Park (Table 17). Frogs are uncommon in the park despite the presence of permanent water. Unfortunately, the water that passes along the channels in Darvall Park is polluted and often has an oil slick on top of it. Frogs will continue to struggle to survive in Darvall Park until the water quality can be improved.

Table 17
Frog Fauna of Darvall Park

Species	Common Name	Spring Survey	Summer Survey	Abundance
Limnodynastes peronii	Striped Marsh frog	√	√	Common
Crinia signifera	Common Eastern Froglet	√	√	Common

Fish:

One species of fish, the Plague Minnow *Gambusia holbrooki*, was found in Darvall Park. This exotic fish has a high tolerance to some contaminants and is able to survive in the eastern channel.

Invertebrates:

Darvall Park contained a reasonably high variety of invertebrate animals (Table 18). Insects were the most prolific with 14 major taxa being found. Most of the insects were leaf-eating or sap-sucking insects that exploit the mature eucalypt trees in the park. Spiders, slugs, snails and earthworms are also relatively common in the park.

Table 18
Invertebrate Fauna of Darvall Park

Major Group	Order or Family	Lower Taxon (if possible)	Common Names	Where Found
Insecta	Collembola		Springtails	Leaf Litter
	Odonata	Anisoptera	Dragonflies	Creek
	Plecoptera		Stone Flies	Creek
	Blattodea		Cockroaches	Leaf Litter
	Isoptera		Termites	Flying
	Mantodea		Prayer Mantis	Foliage
	Dermaptera		Earwigs	Ground
	Orthoptera	Gryllacridae	Tree Crickets	Foliage
		Tettigoniidae	Katydids	Foliage
		Gryllotalpidae	Mole Crickets	Ground
		Gryllidae	Crickets	Ground
		Acrididae	Grasshoppers	Ground
	Hemiptera	Gerridae	Water Striders	Creek

		Lygaeidae	Ground Bugs	Ground
		Pentatomidae	Stink Bugs	Foliage
		Reduviidae	Assassin Bugs	Foliage
		Cicadidae	Cicadas	Foliage
	Homoptera	Cicadellidae	Leaf Hoppers	Foliage
		Aphididae	Aphids	Stems
		Coccidea	Scale Bugs	Shrubs
	Coleoptera	Carabidae	Ground Beetles	Ground
		Dytiscidae	Diving Beetles	Creek
		Staphlinidae	Rove Beetles	Ground
		Scarabaeidae	Scarab Beetles	Foliage
		Elateridae	Click Beetles	Foliage
		Coccinellidae	Labybirds	Foliage
		Cerambycidae	Long-horned Beetles	Dead Trees
	Lepidoptera	Hesperidae	Skippers	Flying
		Papillionidae	Swallowtail Butterflies	Flying
		Danaidae	Milkweed Butterflies	Flying
		Sphingigae	Hawk Moths	Flying
		Sesiidae	Clearwing Moths	Flying
		Geometridae	Geometer Moths	Flying
	Diptera	Culicidae	Mosquitoes	Creek
		Tabanidae	March Flies	Flying
		Assilidae	Robber Flies	Flying
		Syrphidae	Hover Flies	Flying
		Muscidae	House Flies	Flying
		Calliphoridae	Blow Flies	Flying
	Hymenoptera	Icneumonidae	Parasitic Wasps	Flying
		Vespidae	Vespid Wasps	Flying
		Formicidae	Ants	Ground
		Apoidea	Bees	Flying
Arachnids	Arcarina		Mites, Ticks	Ground
		Lycosidae	Wolf Spiders	Ground
		Nephilidae	Orb-Weavers	Foliage
Crustacea	Isopoda		Slaters	Ground
Chelicerates	Chilopoda		Centipedes	Ground
Molluscs	Gastropoda		Snails	Ground
			Slugs	Ground
Annelida	Oligochaeta		Earthworms	Ground

5.3 Field of Mars Reserve

Mammals:

Field of Mars Reserve had the greatest diversity of mammals of the four parks surveyed (Table 19). Field of Mars was the only reserve to contain Sugar Gliders and Echidnas; it also had the greatest diversity of bats. The reasons for this larger number of species is complex but is due to the larger land area of the park, the more intact nature of the native ground cover and shrub layer, and the greater diversity of habitats available in the park. Unfortunately, Field of Mars also contains a high proportion of exotic mammals, including predatory species.

Table 19
Mammal Fauna of Field of Mars Reserve

Species	Common Name	Relative Abundance	How Detected	Comments
Trichosurus vulpecula	Brush-tail Possum	Low	Spotlighting Hair Tubes	Only 3 possums were sighted over the two survey periods
Pseudecheirus peregrinus	Ring-tail Possum	Low	Spotlighting	Only 2 possums were sighted during the survey
Petards crevices	Sugar Glider	Low	Spotlighting	One glider seen in autumn survey, two seen in spring survey.
Ornithorhynchus anatinus	Echidna	Low	Opportunistic	One seen in February 2006.
Rattus rattus	Black Rat	High in some areas	Spotlighting Hair Tubes	Black rats detected in two of the five quadrats
Mus musculus	House Mouse	Low	Hair Tubes	Mice detected in three of the five quadrats.
Canis lupus familiaris	Dog	Low	Spotlighting	Several dogs were spotted in the reserve during the summer survey
Vulpes vulpes	Red Fox	Low	Spotlighting Scat Tracks	Foxes were detected during both spring and summer surveys.
Felis catus	Cat	Low	Spotlighting	Cats were observed in the reserve during both survey sessions.
Rabbit	*Oryctalagus cuniculus*	Low	Spotlighting	Rabbits were observed near the park entrance
Pteropus poliocephalus	Grey-headed Flying Fox	Common	Spotlighting	Several flying foxes were spotlighted each night survey.
Chalinolobus	Gould's Wattled	Low	Anabat	Bats detected in

gouldii	Bat			spring and summer
Nyctophilus geoffroyi	Lesser Long-eared Bat	Low	Anabat	Bats detected in spring and summer
Nyctinomus australis	White-striped Freetail Bat	Low	Anabat	Detected in both surveys
Myotis adversus	Mouse-eared Fishing Bat	Low	Anabat	Fishing Bats were detected near the mouth of Buffalo Creek

Figure 4

Echidna sighted Field of Mars February 2006.

Birds:

Field of Mars Reserve also contained the greatest number of bird species; seventy nine day birds and five night birds were found in the park (Table 20). The birds represented a wide variety of feeding guilds including insect-feeders, nectar feeders and predatory birds. The wide variety of feeding types is only possible when there is a range of habitat available. Field of Mars is dominated by woodland but has diverse woodland types, riparian corridors and a well established shrub layer. Field of Mars is also the most heavily used reserve by migratory birds moving across the state. Field of Mars also has resident Powerful Owls but these birds appear to be second year birds that have just begun foraging for themselves. Powerful Owls feed in Field of Mars but also fly along the Lane Cove River corridor in search of food.

Table 20
Native Bird Fauna of Field of Mars Reserve

Species	Common Name	Autumn Survey	Spring Survey
Dacelo novaeguinea	Kookaburra	√	√
Halycon sancta	Sacred Kingfisher	√	√
Vanellus miles	Masked Lapwing	√	√
Grallina cyanoleuca	Magpie-lark	√	√
Corvus coronoides	Australian Raven	√	√
Gymnorhina tibicen	Australian Magpie	√	√
Cracticus torquatus	Grey Butcherbird	√	√
Strepera graculina	Pied Currawong	√	√
Rhipidura leucophrys	Willie Wagtail	√	√
Rhipidura fuliginosa	Grey Fantail	√	√
Hirundo neoxena	Welcome Swallow	√	√
Hirundo ariel	Fairy Martin		√
Artamus cyanopterus	Dusky Wood swallow	√	√
Hirundapus caudicutus	White-throated Needletail	√	√
Geophaps lophotes	Crested Pigeon	√	√
Platycercus eximia	Eastern Rosella	√	√
Platycercus elegans	Crimson Rosella	√	√
Falcunculus frontatus	Crested Shrike-tit	√	√
Pardalotus punctata	Spotted Pardalote	√	√
Sphecotheres viridis	Fig Bird	√	
Pachycephala pectoralis	Golden Whistler	√	√
Pachycephala rufiventris	Rufous Whistler		√
Trichoglossus haematodus	Rainbow Lorikeet	√	√
Cacatua rosiecapilla	Galah	√	√
Calyptorhynchus funereus	Yellow-tail Black Cockatoo	√	√
Cacatua galerita	Sulphur-crested Cockatoo	√	√
Coracina novaehollandiae	Black-faced Cuckoo Shrike	√	√
Phylidonyris novaehollandiae	New Holland Honeyeater	√	√
Lichenostomus penicillatus	White-plumed Honeyeater	√	√
Meliphaga lewinii	Lewin's Honeyeater		√
Acanthorhynchus tenuirostris	Eastern Spinebill	√	√
Anthochaera carunculata	Red Wattlebird	√	√
Anthochaera lunulata	Little Wattlebird	√	√
Philemon corniculatus	Noisy Friarbird	√	√
Manorina melanocephalus	Noisy Miner	√	√

Neochmia temporalis	Red-browed Firetail	√	√
Malurus cyaneus	Superb Blue Fairy Wren	√	√
Sericornis frontalis	White-browed Scrub-wren	√	√
Acanthiza pusilla	Brown Thornbill	√	√
Acanthiza nana	Yellow Thornbill		√
Acanthiza lineata	Striated Thornbill	√	√
Zosterops lateralis familiaris	Silver-eye	√	√
Zosterops lateralis lateralis	Tasmanian Silver-eye	√	
Cisticola exilis	Golden-headed Cisticola	√	√
Monarcha melanopsis	Black-faced Monarch		√
Microeca fascinans	Jacky Winter		√
Oriolus sagittatus	Olive-backed oriole		√
Macropygia amboinensis	Brown Cuckoo-Dove		√
Anas supercilliosa	Pacific Black Duck	√	√
Ardea novaehollandiae	White-faced Heron	√	√
Threskiornis aethiopica	White Ibis	√	√
Larus novaehollandiae	Silver Gull	√	√
Grallina cyanoleuca	Magpie Lark	√	√
Phalacrocorax sulcirostris	Little Black Cormorant	√	√
Phalacorocorax melanoleucos	Little Pied Cormorant		√
Egretta intermedia	Intermediate Egret		√
Anhinga melanogaster	Darter	√	√
Elanus notatus	Black-shouldered Kite	√	√
Falco cenchroides	Nankeen Kestrel Brown	√	
Accripiter fasciatus	Brown Goshawk		√
Accripiter novaehollandiae	Grey Goshawk	√	√
Cuculus flabelliformis	Fan-tail Cuckoo		√
Chrysococcyx basalis	Horsfield Bronze Cuckoo		√
Cacomantis flabelliformis	Fan-tailed Cuckoo		√
Cuculus pallidus	Pallid Cuckoo		√
Chrysococcyx lucidus	Shining Bronze Cuckoo	√	√
Eudynamys scolopacea	Koel		√
Scythrops novaehollandiae	Channel-billed Cuckoo	√	√
Podargus strigoides	Tawny Frogmouth		√
Aegotheles cristanus	Australian Owlet-Nightjar	√	√
Ninox novaeseelandiae	Southern Boobook Owl		√
Ninox strenua	Powerful owl	√	√
Nycticorax caledonicus	Nankeen Night heron		√

As with the other reserves, exotic birds are also common in the Field of Mars (Table 21). The exotic species tended to be concentrated around the grassed and more open areas of the park.

Table 21
Exotic Bird Fauna of Field of Mars Reserve

Species	Common Name	Autumn Survey	Spring Survey
Pycnotus jocosus	Red-whiskered Bulbul	√	√
Sturnus vulgaris	Common Starling	√	√
Acidotheres tristis	Common Myna	√	√
Passer domestica	House Sparrow	√	√
Columbra livia	Feral Pigeon		√
Streptopelia chinensis	Spotted Turtle-dove	√	√

Reptiles:

Field of Mars had the highest diversity of reptiles with six lizard species and three snake species being found (Table 22). Larger lizards such as Eastern Water Dragons are able to survive in reasonable numbers here because of the adequate shelter sites nearby. Snakes also can survive as there are an adequate number of small mammals and reptiles for them to feed on.

Table 22
Reptile Fauna of Field of Mars Reserve

Species	Common Name	Autumn Survey	Spring Survey	Abundance
Lampropholis delicata	Garden Skink	√	√	Common
Lampropholis guichenoti	Grass Skink	√	√	Common
Saproscincus mustelinus	Weasel Skink		√	Common
Eulamprus quoyii	Eastern Water Skink	√	√	Very Common
Cryptoblepharus virgata	Wall Skink	√	√	Uncommon
Physignathus lesueurii	Eastern Water Dragon	√	√	Uncommon
Pseudechis porphyriacus	Red-bellied Black Snake	√	√	Uncommon
Cacophis squamulosus	Golden-crowned Snake	√	√	Uncommon
Hemiaspsi signata	Black-bellied Marsh Snake		√	Uncommon

Frogs:

Four frog species were found in Field of Mars and these frogs were also reasonably abundant (Table 23). Two tree frog species were present, an indicator of the presence of relatively unpolluted water.

Table 23
Frog Fauna of Field of Mars Reserve

Species	Common Name	Autumn Survey	Spring Survey	Abundance
Limnodynastes peronii	Striped Marsh frog	√	√	Common
Crinia signifera	Common Eastern Froglet	√	√	Common
Litoria phyllochroa	Leaf-green Tree Frog		√	Uncommon
Litoria peronii	Peron's Tree Frog	√	√	Common

Fish:

Six fish species were caught in the Field of Mars (Table 24); five were native species, only the Plague Minnow is exotic.

Table 24
Fish Fauna of Field of Mars Reserve

Species	Common Name	Autumn Survey	Spring Survey	Abundance
Gobiomorphus australis	Striped Gudgeon	√	√	Common

Hypseleotris galii	Firetail Gudgeon	√	√	Common
Philypnodon sp	Dwarf Flathead Gudgeon	√	√	Uncommon
Myxus petardi	Freshwater Mullet	√	√	Common
Gambusia holbrooki	Plague Minnow	√	√	Common
Anguilla australis	Short-finned Eel	√	√	Common

Invertebrates:

Field of Mars had the greatest diversity and abundance of invertebrates in the four reserves surveyed. Insects dominated with 17 major taxa being present and a great diversity occurring within taxa, for example, 14 families of beetles were found (Table 25). The insects represented a range of flying and of fossorial forms and included leaf eating, sap sucking, carcass feeding, aquatic and predatory forms. Also common in the park were slaters, snails, slugs, earthworms, centipedes and spiders.

Table 25
Invertebrate Fauna of Field of Mars Reserve

Major Group	Order or Family	Lower Taxon (if possible)	Common Names	Where Found
Insecta	Collembola		Springtails	Leaf Litter
	Ephemeroptera		May Flies	Creek
	Odonata	Zygoptera	Damselflies	Creek
		Anisoptera	Dragonflies	Creek
	Plecoptera		Stone Flies	Creek
	Blattodea		Cockroaches	Leaf Litter
	Isoptera		Termites	Flying
	Mantodea		Prayer Mantis	Foliage
	Dermaptera		Earwigs	Ground
	Orthoptera	Gryllacridae	Tree Crickets	Foliage
		Tettigoniidae	Katydids	Foliage
		Gryllotalpidae	Mole Crickets	Ground
		Gryllidae	Crickets	Ground
		Acrididae	Grasshoppers	Ground
	Hemiptera	Notonectidae	Backswimmers	Creek
		Gerridae	Water Striders	Creek
		Lygaeidae	Ground Bugs	Ground
		Pentatomidae	Stink Bugs	Foliage
		Reduviidae	Assassin Bugs	Foliage
	Homoptera	Cicadidae	Cicadas	Foliage
		Cicadellidae	Leaf Hoppers	Foliage
		Aphididae	Aphids	Stems
		Coccidea	Scale Bugs	Shrubs
	Coleoptera	Cerambycidae	Weevils	Shrubs
		Cincindelidae	Tiger Beetles	Ground
		Carabidae	Ground Beetles	Ground
		Dytiscidae	Diving Beetles	Creek

		Gyrrinidae	Whirligig Beetles	Creek
		Staphlinidae	Rove Beetles	Ground
		Scarabaeidae	Scarab Beetles	Foliage
		Buprestidae	Jewel Beetles	Foliage
		Elateridae	Click Beetles	Foliage
		Coccinellidae	Labybirds	Foliage
		Cerambycidae	Long-horned Beetles	Dead Trees
		Chrysomelidae	Leaf Blisters	Foliage
		Silphidae	Carrion Beetles	Ground
		Zophoridae	Ironbark Beetles	Trees
	Lepidoptera	Hesperidae	Skippers	Flying
		Papillionidae	Swallowtail Butterflies	Flying
		Danaidae	Milkweed Butterflies	Flying
		Lycaenidae	Ant Blue Butterflies	Flying
		Sphingigae	Hawk Moths	Flying
		Arctidae	Tiger Moths	Flying
		Sesiidae	Clearwing Moths	Flying
		Geometridae	Geometer Moths	Flying
			Crane Flies	Creek
	Diptera	Chironomidae	Midges	Creek
		Tipulidae	Mosquitoes	Creek
		Culicidae	March Flies	Flying
		Tabanidae	Robber Flies	Flying
		Assilidae	Hover Flies	Flying
		Syrphidae	House Flies	Flying
		Muscidae	Blow Flies	Flying
	Hymenoptera	Calliphoridae	Parasitic Wasps	Flying
		Icneumonidae	Vespid Wasps	Flying
		Vespidae	Sphecid Wasps	Flying
		Sphecidae	Ants	Ground
		Formicidae	Bees	Flying
	Neuroptera	Apoidea	Lace Wings	Flying
Arachnids	Arcarina		Mites, Ticks	Ground
		Tetragnathidae	Long-jawed Spiders	Foliage
		Lycosidae	Wolf Spiders	Ground
		Nephilidae	Orb-Weavers	Foliage
Chelicerates	Chilopoda		Centipedes	Ground
	Myripoda		Millipedes	Ground
Molluscs	Gastropoda		Snails	Ground
			Slugs	Ground
Annelida	Oligochaeta		Earthworms	Ground
	Hirunidae		Leeches	Foliage

5.4 Lambert Park (including the RTA Road Reserve)

Mammals:

Lambert Park had the lowest diversity of native animals of any of the reserves surveyed. No native terrestrial animals were found and only one possum species was present (Table 26). The park was dominated by exotic mammals.

Table 26
Mammal Fauna of Field of Lambert Park

Species	Common Name	Relative Abundance	How Detected	Comments
Trichosurus vulpecula	Brush-tail Possum	Low	Spotlighting Hair Tubes	Only 2 possums were sighted over the two survey periods
Rattus rattus	Black Rat	Low	Spotlighting Hair Tubes	Only few hair tubes contained rat hairs.
Canis lupus familiaris	Dog	Low	Spotlighting	Dogs were spotted in the reserve during the summer survey
Felis catus	Cat	Low	Spotlighting	Cats were observed in the reserve during both survey sessions.
Pteropus poliocephalus	Grey-headed Flying Fox	Common	Spotlighting	Several flying foxes were spotlighted each night survey.
Chalinolobus gouldii	Gould's Wattled Bat	Low	Anabat	Bats detected in summer

Birds:

Forty five day bird species were found at Lambert Park; no night birds were detected (Table 27). The relatively low number of species is due to the small size of the park and the relatively undeveloped vegetation cover in the park. Few migratory species were detected in Lambert Park.

Table 27
Native Bird Fauna of Field of Lambert Park

Species	Common Name	Autumn Survey	Spring Survey
Dacelo novaeguinea	Kookaburra	√	√
Halycon sancta	Sacred Kingfisher	√	√
Vanellus miles	Masked Lapwing	√	√
Grallina cyanoleuca	Magpie-lark	√	√
Corvus coronoides	Australian Raven	√	√
Gymnorhina tibicen	Australian Magpie	√	√
Cracticus torquatus	Grey Butcherbird	√	√
Strepera graculina	Pied Currawong	√	√
Rhipidura leucophrys	Willie Wagtail	√	√
Rhipidura fuliginosa	Grey Fantail	√	√
Hirundo neoxena	Welcome Swallow	√	√
Geophaps lophotes	Crested Pigeon	√	√
Platycercus eximia	Eastern Rosella		√
Platycercus elegans	Crimson Rosella	√	√
Pachycephala rufiventris	Rufous Whistler	√	√
Trichoglossus haematodus	Rainbow Lorikeet	√	√
Cacatua rosiecapilla	Galah	√	√
Cacatua galerita	Sulphur-crested Cockatoo	√	√
Coracina novaehollandiae	Black-faced Cuckoo Shrike	√	√
Phylidonyris novaehollandiae	New Holland Honeyeater	√	
Lichenostomus penicillatus	Eastern Spinebill	√	√
Anthochaera carunculata	Red Wattlebird		√
Manorina melanocephalus	Noisy Miner	√	√
Neochmia temporalis	Red-browed Firetail	√	√
Malurus cyaneus	Superb Blue Fairy Wren	√	√
Sericornis frontalis	White-browed Scrub-wren	√	√
Acanthiza pusilla	Brown Thornbill	√	√
Acanthiza lineata	Striated Thornbill	√	√
Zosterops lateralis familiaris	Silver-eye	√	√
Anas supercilliosa	Pacific Black Duck		√
Grallina cyanoleuca	Magpie Lark		√
Elanus notatus	Black-shouldered Kite	√	√
Cuculus flabelliformis	Fan-tail Cuckoo	√	√
Chrysococcyx basalis	Horsfield Bronze Cuckoo	√	√
Cacomantis flabelliformis	Fan-tailed Cuckoo	√	√
Cuculus pallidus	Pallid Cuckoo	√	√
Chrysococcyx lucidus	Shining Bronze Cuckoo	√	√
Eudynamys scolopacea	Koel	√	√
Scythrops novaehollandiae	Channel-billed Cuckoo	√	√

Exotic birds were the most obvious species in Lambert Park (Table 28). The relatively open nature of the park provides little protection for the smaller native birds; aggressive species like the Common Mynas and Starlings are able to expel some native species from the area.

Table 28
Exotic Bird Fauna of Field of Lambert Park

Species	Common Name	Autumn Survey	Spring Survey
Pycnotus jocosus	Red-whiskered Bulbul	√	√
Sturnus vulgaris	Common Starling	√	√
Acidotheres tristis	Common Myna	√	√
Passer domestica	House Sparrow	√	√
Lonchura castaneothorax	Chestnut-breasted Mannikin		√
Columbra livia	Feral Pigeon	√	√
Streptopelia chinensis	Spotted Turtle-dove	√	√

Reptiles:

Lambert Park had a restricted variety of reptiles; only four species of skinks were found (Table 29). Most of these small lizards are primarily ant-eating and were capable of hiding in areas with limited shelter available.

Table 29
Reptile Fauna of Field of Lambert Park

Species	Common Name	Spring Survey	Summer Survey	Abundance
Lampropholis delicata	Garden Skink	√	√	Common
Lampropholis guichenoti	Grass Skink	√	√	Common
Eulamprus quoyii	Eastern Water Skink		√	Common
Cryptoblepharus virgata	Wall Skink	√	√	Uncommon

Frogs:

The surface drains that cross Lambert Park support two species of frogs (Table 30). These frogs are both capable of surviving in turbid water. The lack of clean water and the lack of fringing vegetation means that others frogs are unlikely to be come established here in the near future.

Table 30
Frog Fauna of Field of Lambert Park

Species	Common Name	Spring Survey	Summer Survey	Abundance
Limnodynastes peronii	Striped Marsh Frog	√	√	Common
Crinia signifera	Common Eastern Froglet	√	√	Common

Fish:

No fish were detected in Lambert Park.

Invertebrates:

The invertebrate fauna of Lambert Park was relatively high despite the relatively poor diversity of vegetation in the park. Many of the invertebrates were flying insects that have probably dispersed from Brush Farm Park. Fourteen major taxa of insects were recorded (Table 31). Snails and slugs were the other most common invertebrates found.

Table 31
Invertebrate Fauna of Lambert Park

Major Group	Order or Family	Lower Taxon (if possible)	Common Names	Where Found
Insecta	Collembola		Springtails	Leaf Litter
	Odonata	Anisoptera	Dragonflies	Creek
	Blattodea		Cockroaches	Leaf Litter
	Isoptera		Termites	Flying
	Mantodea		Prayer Mantis	Foliage
	Orthoptera	Gryllacridae	Tree Crickets	Foliage
		Tettigoniidae	Mole Crickets	Ground
		Gryllotalpidae	Crickets	Ground
		Gryllidae	Grasshoppers	Ground
	Hemiptera	Gerridae	Water Bugs	Creek
		Pentatomidae	Stink Bugs	Creek
		Reduviidae	Assassin Bugs	Ground
	Homoptera	Cicadidae	Cicadas	Foliage
		Cicadellidae	Leaf Hoppers	Foliage
		Aphididae	Aphids	Foliage
		Coccidea	Scale Bugs	Foliage
	Coleoptera	Carabidae	Ground Beetles	Ground
		Dytiscidae	Diving Beetles	Creek
		Scarabaeidae	Scarab Beetles	Ground
		Elateridae	Click Beetles	Foliage
		Coccinellidae	Labybirds	Foliage
		Cerambycidae	Long-horned Beetles	Dead Trees
	Lepidoptera	Hesperidae	Skippers	Flying
		Danaidae	Milkweed Butterflies	Flying
		Lycaenidae	Ant Blue Butterflies	Flying
		Sphingigae	Hawk Moths	Flying
	Diptera	Tipulidae	Crane Flies	Creek
		Culicidae	Mosquitoes	Creek
		Syrphidae	Hover Flies	Flying
		Muscidae	House Flies	Flying
		Calliphoridae	Blow Flies	Flying
	Hymenoptera	Vespidae	Vespid Wasps	Flying

		Formicidae Apoidea	Ants Bees	Ground Flying
Arachnids	Arcarina	 Lycosidae Nephilidae	Mites, Ticks Wolf Spiders Orb-Weavers	Ground Ground Foliage
Chelicerates	Chilopoda		Centipedes	Ground
Molluscs	Gastropoda		Snails Slugs	Ground Ground
Annelida	Oligochaeta		Earthworms	Ground

5.5 Comparison of the Autumn and Spring Survey Results

The detection rate of species increased in the spring survey period, particularly for birds. All reserves showed an increase in species detected in the spring (Table 32). Bats and some reptiles were conspicuously absent in the autumn survey.

Table 32
Comparison of Species Numbers in Autumn and Spring Surveys

Group	Field of Mars		Brush Farm		Lambert		Darvall	
	Autumn	Spring	Autumn	Spring	Autumn	Spring	Autumn	Spring
Arboreal Mammals	3	3	2	2	1	1	1	1
Terrestrial Mammals*	3	6	2	6	1	3	1	4
Bats	4	5	3	4	1	2	3	3
Day Birds	66	77	71	75	34	44	47	52
Night Birds	3	5	2	4	0	0	1	2
Skinks	6	6	4	6	3	4	3	5
Geckoes	1	1	0	0	0	0	0	0
Dragons	1	1	1	1	0	0	0	0
Turtles	1	1	0	0	0	0	0	0
Snakes	2	3	1	0	0	0	0	0
Frogs	3	4	2	3	2	2	2	2
Fish	6	6	0	0	0	0	1	1

* Note: the echidna sighting in the Field of Mars has not been included in this table of results.

5.6 Threatened Animal Species

Two animal species listed under the Threatened Species Conservation Act 1995 were detected during the study; they were:

Powerful Owl	*Ninox strenua*
Mouse-eared Fishing Bat	*Myotis adversus*

Powerful Owls were found in Brush Farm Park and in Field of Mars. A dead Powerful Owl was found in Brush Farm Park and the cause of death could not be determined. The presence of these owls in Brush Farm Park was not entirely expected as there are few possums in the park that can be harvested as a food resource by the owl. There was no indication of a permanent roosting site in Brush Farm Park.

Powerful Owls were detected in the Field of Mars in several areas and a permanent roosting site was found. The abundance of possums is also low in the Field of Mars and it appears that the owls are roosting here and flying along the Lane Cove River corridor in search of food.

The Mouse-eared Fishing Bat was detected near the Estuarine Quadrat on Buffalo Creek. It appears that these bats are flying along the Lane Cove River valley and foraging into the smaller feeder creeks in shallow water areas. No roosting sites were found for these bats.

6.0 Conservation Issues

6.1. Conserving biodiversity through conserving habitats.

The bushland reserves of the Ryde LGA serve a dual role; they provide green enclaves that break up an otherwise continuous urban landscape, and they provide a conservation area for remnant flora and fauna. If conservation is a prime aim of these reserves, what should they be conserving?

There are two main arguments to consider, are the bushland reserves conserving the original flora and fauna (i.e. are they historical reminders of how the area was before European settlement), or are they an attempt to conserve as many native species as possible? Conserving existing habitats is easier to do but is often unsatisfying because so few habitats are represented. For example, in Ryde, most reserves are based around sandstone slopes that were unsuitable for residential development. Thus, Turpentine-Ironbark Woodland is the major habitat present in many reserves. Many habitats are not present as sandstone gullies, plains or headlands were not conserved by this approach.

Trying to conserve the maximum number of species is a fine ideal but it is also fraught with hazards. The amount of land available for conservation purposes is limited. If a reserve is to be altered to create a new habitat, the existing habitat will be lost (and not replaced elsewhere). The decision about which species to conserve is also a difficult decision as the conservation of one is often done at the expense of another.

Often these decisions are made on purely pragmatic grounds. It is often easier and cheaper to conserve existing habitat. The creation of specific habitats does not guarantee that the target species will survive as often we are not aware of all of the habitat requirements for each species.

The vegetation communities that are contained within the four Ryde reserves are listed in Table 5.

Usually, if new habitats are created, they are created in areas of bushland that have become so badly degraded that they no longer represent the original habitat. If habitats are to be recreated in Ryde, the habitats that could be recreated are:

* mid-canopy shrublands
* native grasslands
* ephemeral freshwater habitats
* wet and dry heath

None of these habitats are alien to the Ryde area, some would require the procurement of seed stock from nearby bushland areas as parent plants no longer exist in the Ryde LGA.

6.2. Improving the Habitat Value of Existing Reserves:

The existing bushland reserves suffer from a loss of terrestrial fauna. In many cases this is due to predation by foxes, cats, dogs, black rats or native birds. Predation has taken a heavy toll because there is a lack of shelter sites in the reserves. Dead trees, fallen logs and branches and rocks usually provide the best shelter habitat along with understorey plants. In many reserves the understorey is still present (albeit not completely in tact) but the logs and fallen timber have gone. In some cases they have been removed as part of a program of reducing fuel for bush fires. In other instances they have been removed because they look messy or block tracks. Dead trees are often felled because they are considered a danger to walkers.

The lack of ground shelter is a major impediment for the survival of many native terrestrial species. Given the conflicting demands on reserves, it appears that fallen timber and branches will not be permitted to accumulate. This situation does not prevent the use of artificial shelters for terrestrial animals. Although this is not a widely accepted practice, animal shelters in trees have been used for parrots and possums. These tree shelters replace the dead tree hollows that are lost from reserve habitats.

6.3 Connectivity of Bushland Areas

As the residential areas in Ryde were developed, bushland pockets became smaller and more isolated. The isolation of bushland area makes them even more susceptible to urban impacts and biota loss. An aim in the conservation of remnant bushland area should be to try to increase the connectivity of these sites.

Some of the bushland reserves e.g. Darvall Park, Brush Farm/Lambert Park, are totally isolated from other bushland areas. This isolation diminishes the survival prospects of various animals and limits the capacity of migratory species to use the reserves while moving across Sydney. To create corridors between reserves will require the creation of suitable habitat outside of the reserves. There appears to be two ways that this can be done:

1. Sympathetic street planting. Instead of using ornamental or totally decorative street trees, trees that provide habitat value (either as dense canopy, food or nesting sites) should be utilised. As most of the reserves contain woodland, the types of tree that would serve this purpose include Turpentine *Syncarpia glomulifera*, Sydney Red Apple *Angophora costata*, Grey Gum *Eucalyptus punctata* and Scribbly Gum *E. haemastoma.*

2. Sympathetic backyard planting. Residents who live in areas between reserves could be encouraged by Council to plant suitable trees and shrubs to assist with the creation of green corridors between reserves. Council could provide the seedlings for these residents or offer some other incentive for residents who actively convert their backyard flora into sympathetic habitat.

In each of these examples, the seedlings should come from seeds collected from local trees.

6.4 Bush Regeneration

Ryde Council has undertaken an active bush regeneration program in the LGA and the positive impact of this work is obvious in a number of reserves. Bush regeneration is preferred to replanting in areas where there is sufficient seed bank to allow the endemic plants to grow and develop under the prevailing conditions. Plant communities that establish by themselves, after the removal of weeds and introduced plants, are more capable of surviving in the long term than deliberately planted species.

The disadvantage of bush regeneration practices is that it is a slow and time-consuming process. The gradual replacement of unwanted plants by native species is a sequential process and the results of this change are not immediately obvious. For this reason, it is very easy for bush care officers (and nearby residents) to become impatient with the process and seek to speed up the rate of change in the plant community. Such actions are not in the best interest of the native fauna.

With all bush regeneration work, the impact of weed removal on the existing flora cannot be understated. Weed removal (and the associated disturbance to soil, leaf litter and plant roots) causes some stress in the bushland. For this reason, and to allow for the development and strengthening of native plants in areas previously touched by bush regeneration, bush regeneration should be staggered and only affect relatively small areas at a time.

These principles require that bush regeneration teams have a plan of what areas are to be regenerated, how long they should be left to recover and what follow-up works are likely to be required. Bush regeneration teams therefore need to be constantly moving between and within reserves to be most effective.

The only time that clearing of a site should occur is when the weed density is so great that native plants have no opportunity to recover. In these instances, site clearing should be partial and not absolute. Many native animals are forced to use weeds as alternate shelter areas when the native equivalent is absent. The removal of large areas of weeds can easily dislocate the fauna within.

6.5 Controlled Re-planting

As indicated above replanting is not the preferred option in bush regeneration but there are times when it is necessary. This approach has been adopted by necessity at Brush Farm Park and the results of the replanting have been spectacular. In general, however, replanting should be considered only when native plants cannot naturally re-establish themselves. Replanting is most often used:

i) to quickly cover an area that is bare or has been cleared
ii) to create a buffer zone around bushland areas
iii) to create habitats that have been lost from an area
iv) to replace non-breeding or diseased endemic plants (through seed collection and propagation)

The use of controlled planting to create buffer zones will be discussed below (in 6.5) while their use in creating habitats will be discussed in 6.6.

6.6. Buffers Planting to combat Edge Effects

One of the problems that all bushland reserves suffer from is "edge effect". This term describes a variety of impacts that are experienced by bushland that is in contact with non-bushland areas. In Ryde, this usually means contact with residential areas, streets and recreational parkland.

The plants along the boundary of reserves are subject to much more physical damage and changes than the plants deeper in the reserve. Damage is caused by greater exposure to strong winds, sun and rain, and by regular contact with walkers who accidentally knock leaves and small branches or deliberately break off projecting shoots or stems. In addition, the fringes of reserves are constantly bombarded with exotic seeds (borne by wind or storm water) and are further assaulted by mowing and slashing of regrowth. Garden wastes and rubbish is also deposited along the edges of the reserves. The combined effects of these pressures is to eliminate the more sensitive native plants and create gaps in the vegetation (that are later exploited by fast-growing weeds).

Disturbance to the plants along the edges of reserves is a problem that will not end. Ideally, bushland reserves need to be shielded from these impacts by a wall of more resilient, native plants that can tolerate greater physical damage and exposure. Such plants can create a buffer between the natural bushland and the urban interface. Buffer plants must be hardy, native, non-invasive and easy to maintain. In short, they must not have the potential to become a pest in themselves.

Many of the bushland reserves in Ryde contain woodland with an open understorey. The wide spacing of the ground plants makes it easy for weeds to become established and to eventually become the dominant ground cover. A buffer comprising tall, dense shrubs (such as *Kunzea, Hakea, Monotoca, Melelauca* and *Grevillea*) would greatly reduce the seed load entering the reserves and block off areas containing sensitive plants.

6.7 Creating Habitats

Open and semi-closed woodlands were a feature of the Ryde landscape (Howell and Benson 2000). While these woodlands were widespread in the area in pre-European time, they were not the only habitats present. A number of habitats are missing and their absence is reflected by the absence of particular groups of native birds. The two prime habitats that are not represented in bushland reserves are:

- tall heath (21 g; Benson and Howell 1994)
- native grasslands (21 a; Benson and Howell 1994)

These two habitats could be restored in Ryde. A large area of disturbed land is available in Lambert Park that could be converted to both heath and grassland. Similarly, space is available at Field of Mars for the extension and creation of areas of native grassland.

Another space that appears to be available for this purpose is the lower cleared area in Brush Farm Park. At present this site is covered by exotic grasses and is not used for

either playing areas or for recreation. Its sunny aspects would make it suitable for as an area for heath and native grassland.

In general, low scale planting of insect-attracting plants in the buffer area of each reserve would help boost the biomass of insects in the reserves.

6.8 Feral species control

A conspicuous component of the fauna of Ryde that is missing are the native terrestrial mammals. Bandicoots appear to be completely absent while native rodents are reduced to a small area of Field of Mars. With their absence, the introduced Black Rat and House Mouse has expanded to become the dominant terrestrial mammals. The main reason for the demise of native ground-dwelling mammals appears to be past heavy predation by foxes, cats and dogs. More recent fox-baiting work has reduced the number of predators in the Brush Farm Park and the Field of Mars but the native ground mammals have not recovered.

Foxes will never be eradicated from the bushland reserves but their numbers can be culled. In other council areas of Sydney, efforts to control foxes have been most successful when fox dens are targeted. Dens are located and, during the day when the foxes are inside, are sealed and cyanide pellets released inside the den. Cyanide works quickly and death is very rapid. The dens are left sealed for several days during which residual cyanide is broken down and rendered inactive. The den is then filled in.

By making dens the focus of the fox control program foxes are not being replaced by the next generation. Vagrant foxes will still be present and these could be culled through a baiting program.

Present restrictions on the use of fox-baiting means that only two reserves can be targeted at a time in each LGA. It may be necessary to monitor fox activity in all reserves and to vary the reserves that are included in the fox control program accordingly.

6.9 Control of domestic animals in reserves

Cats and dogs are a problem in bushland reserves. Cats are a particular problem at night as they are able to hunt birds and mammals under cover of darkness. Many of the cats seen in the reserves at night appear to be domestic cats. Residents who live close to bushland reserves must be encouraged to keep cats inside at night.

Dogs are also a problem. Dogs roaming throughout bushland areas disturb a lot of wildlife and their constant presence in the reserves is sufficient to cause native animals to abandon the reserves. Dogs also kill some animals; more dead Blue-tongue lizards were seen than live Blue-tongue lizards during this survey. Almost all of the Blue-tongue lizards had been mauled by dogs and left to die. Possums were also found that had been savaged.

Some bushland reserves should be no-domestic animal reserves (like the Field of Mars). People do take their dogs for walks through bushland reserves, and this generally does little damage if the dogs stay to the tracks. Unfortunately, some dog

owners do not control their dogs and the dogs are allowed to venture into the bush, out of their owner's sight.

A scheme whereby dog–owners can take dogs into reserves needs to be prepared and advertised to residents. Some bushland reserves and parts of reserves should be excluded. These areas include places where dogs (controlled or uncontrolled) will cause fauna dislocation. The areas where dogs should be excluded include:

i) All of Brush Farm Park
ii) All but the lower sections of Field of Mars
iii)All of the bushland areas in Darvall Park
iv) Some control of dogs and cats will also be required in Lambert Park because of its continuity with Brush Farm Park

6.10 Compost heaps as habitats

Human-made habitats sometimes prove to be successful for animal use. While doing this survey, it became clear that one human-made habitat that was used regularly by reptiles were the compost heaps (covered by black plastic sheeting) that were left by bush regeneration teams. The green waste in the mounds would normally be taken away and disposed of. However, the mounds were serving a very useful purpose of their own.

Instead of removing the green wastes, it may be more beneficial to ensure that there are always a few compost mounds in each reserve, particularly over winter. The mounds produce their own internal heat and are easily accessed by ground animals.

6.11 Street Lighting

As many of the bushland animals are nocturnal species, street lighting can be a problem. For creatures such as Ring-tail Possums and owls, light pollution can force these animals out of reserves. Indeed, most nocturnal animals avoid street lit areas, the only exception being Tawny Frogmouths which have learned to sit above street lights and be concealed in the shadow while waiting for moths to be drawn towards the light.

Street lighting does not need to be aimed into reserves. Shielding on the back of street lights greatly reduces the amount of light entering bushland area. Where pathways cross reserves (e.g. Withington Walk in Darvall Park) lighting should be directed downwards to minimise the light penetration into the rest of the reserve. Lights may also be brought lower to the ground, rather than being high above the ground. At present Brush Farm Park does not have any lighting of its bush tracks and this should remain the case.

Residences that back onto bushland areas do not need to have back yard spot lights pointing into the reserves. A single back yard spotlight can dislocate fauna for 50 metres either side of the light source. If spotlights are required the need to be directed into the target area and not across a large area nearby. Council may need to inform residents of this requirement.

6.12. Stormwater overflow areas.

Many stormwater systems overflow into bushland reserves, especially Darvall Park and Brush Farm Park. Often the discharge from these systems is short-lived but dynamic. To reduce the erosional effects of these rapid discharges of stormwater, concrete troughs and basins have been created to disrupt the energy of the water. These structures could easily be modified to also provide frog habitat.

A concrete basin, off-centre to the main flow, would cater for the more generalist frog species. After heavy rain, the basin would fill and retain water for many weeks. Fringing plants need to be established around the ponds to help frogs avoid predators. The ponds would also serve as drinking stations for other native species.

The channel in Darvall Park often contains surface oil. The oil film is lethal to many aquatic insects and tadpoles. It is recommended that an oil trap be installed at the headwall of the channel to prevent oil and other surface films from being dispersed throughout the water channel in the park.

6.13. Fallen timber, dead trees.

A concern in urban bushland is that of fire. For this reason, fallen timber and dead tress are often removed from bushland areas. This practice deprives many animal species of a place to live and may explain the lack of some hollow-nesting species in the Ryde LGA.

Fallen timber could still be removed from around the edges of reserves but not taken out of the reserve. Instead, they could be use to create timber stacks or wood rows in areas where they do not constitute a fire hazard.

6.14. Community care of bushland areas – public education campaign

The health and longevity of bushland reserves is often dependent on community interest. Without it, Council money will be redirected to other purposes. Accordingly, low-level education campaigns need to be maintained to make residents aware of the conservation value of the bushland (and how it increases the retail value of their own land). Local conservation groups need to be encouraged to work with Council in protecting bushland areas. Community awareness programs need to be developed.

6.15. Monitoring the use of reserves

It is difficult to get information about the level of use of each reserve. This information would be useful as it will provide a quantitative measure for assessing the resilience of bushland areas. Such information will become increasingly important as the population density of Ryde increases in the future. A census of the public use of reserves would consist of monitoring pedestrian traffic across bushland tracks, and the use of rest and picnic areas. Knowledge of the level of visitation of reserves will help planners rationalise the use of these public lands.

The Ryde Flora and Fauna Study has provided a snap-shot look at the state of the fauna in the LGA. It is likely that the fauna will change as years go by, and the

changes may not be predictable. However, this study has provided a set of base figures against which subsequent fauna studies may be based. As the methods used in this study are repeatable, any changes in the fauna detected by future studies should reflect real changes in the biota and not merely sampling bias in the survey.

The flora and fauna survey should be repeated in five years time. The follow-up survey may need to be brought forward if there are believed to be significant changes to the fauna (e.g. as a result of bush fires or other impacts).

7.0 Specific Recommendations

7.1 Reclassification of Vegetation Communities

It is recommended to reclassify the following vegetation communities:

- Darvall Park, Brush Farm Park and Lambert Park reclassified as Turpentine Ironbark Forest Ecological Communities.
- The Field of Mars contains vegetation communities as per the map in Appendix 5: Sandstone Ridgetop Woodland, Western Sandstone Gully Forest, Coastal Saltmarsh and Turpentine-Ironbark Margin Forest
    i. Further study is required to assess 3 areas:
        1. The Coachwood area (a 20m X 20m quadrat)
        2. The shale/sandstone area east of the Field of Mars Cemetery
        3. The Turpentine area on the north-west ridge.

All reserves contain Endangered Ecological Communities (TSC Act, 1995):

- Darvall Park: Turpentine-Ironbark Forest
- Brush Farm Park/Lambert Park: Turpentine-Ironbark Forest
- Field of Mars Reserve: Coastal Saltmarsh, Turpentine-Ironbark Margin Forest, and possibly Shale Sandstone Transition Forest (High Sandstone Influence).

7.2 Inclusion of Shale/Sandstone Transition Forest

One area that was not sampled in this study but that has previously been listed as (endangered) Shale/Sandstone Transition Forest. This ecological community is present in the Field of Mars ands should be include din future surveys.

7.3 Protection of bushland health

- Develop a management plan, which includes fire management, in consultation with NPWS (NSW) for areas with Endangered or Threatened Ecological plants and Ecological Communities:
    - Particularly the Field of Mars Reserve, which contains *Epacris purpurascens var purpurascens* and *Pimelia curviflora var curviflora*. If an environmental burn is conducted in the Scribbly Gums quadrat area it would be worthwhile to confirm the vegetation community classification 2 years post fire.
    - The results from the quadrat at Darvall Park show that fire is useful in regenerating from the soil seed bank in areas where there is an

undisturbed, natural soil profile. Therefore, fire in combination with long-term bush regeneration, will be a useful tool in regenerating the Turpentine Ironbark Forest communities.

- Areas with natural soil profiles in Brush Farm Park and Lambert Park, should be regenerated using best practice bush regeneration principles, especially weeding small, manageable areas that will receive the frequent follow-up weeding required to avoid annual weeds from seeding.
- Natural regeneration principles should be followed in areas with an undisturbed soil seed bank. Planting or seed sowing is to be avoided.
- Field of Mars Reserve: A track has been developed by bike riders through the eastern Shale/Sandstone Transition vegetation community area to connect with the Sand Track. This track needs to be closed off and an alternative provided if possible. Interpretive signage could be used to explain why all the Endangered Ecological Communities need protection.
- Seed collection in Endangered Ecological Communities requires a 132C Scientific license from NPWS (NSW) Endangered Species Division as per National Parks and Wildlife Act (1994). If seed is to be sourced from those areas for propagation and planting in degraded areas, best practice methods should be used. Florabank Seed Collection Code of Practice, Native seed collection methods, and collection techniques are available on the Internet.

7.4 Restoration of degraded areas

- Darvall Park is threatened by weedy vines and needs qualified bush regenerators to target the vine problem and protect the understorey from further degradation. Ryde Council has initiated a program to prevent backyard weeds from encroaching into the reserve. A commitment to long-term follow-up is required to alleviate this threat to this endangered community. Install oil trap on channel leading into Darvall Park.
- Lambert Park: Fabrication of a new environmental community in the degraded areas requires that plantings be protected from competition with weedy species. It may be possible to create small native plant grasslands, protecting them first then gradually connecting them. A long-term commitment is required. Most of the Rutledge Street Road Reserve should be maintained as a Turpentine-Ironbark Forest Ecological Community, however some areas are available to be developed as other habitats (see 7.5). The core areas (Schizomeria Quadrat, Turpentine/Cassine Quadrats) should form the foci of native propagule spread and natural regeneration further downstream. As well, the core areas can act as a reservoir for seed collection for future plantings in areas where there is not a natural soil profile. The Lilly-Pilly Quadrat area can be regenerated naturally with supplementary plantings on the disturbed area upslope.
- Brush Farm Park: Reduce over-clearing on steep slopes by clearing only small mosaics that can be maintained weed free in the short term while the canopy is open, allowing regeneration to occur. At all costs, weeds should be prevented from seeding. Bank stabilisation is paramount on steep slopes and planting or seed sowing should only occur in areas with a disturbed soil profile. Mulch should be prevented from coming into contact with the base of any plant as it promotes fungal attack, which weakens plant resilience. Protect core areas

from invasion by *Ehrharta erecta*. Stormwater should be prevented from entering the Park at the Lawson St end (Turpentine Ironbark Quadrat). Some supplementary planting may be beneficial on the exteriors of the Turpentine Ironbark Quadrat area and the Sydney Blue Gums Quadrat areas along Rutledge St.
The cleared area below the playing fields should be restored as native bushland. The exotic grasses could be killed using plastic sheets and when areas are devoid of living grasses the soil could be prepared for native seed stock. This area is sufficiently large enough to support the creation of a heath-shrubland zone surrounding a central native grassland.

- Field of Mars Reserve: Protect the Endangered Coastal Saltmarsh Ecological Community from *Lonicera japonica* and other listed vines. Attempt to limit the spread of *Salpichroa origanifolia* from the fill slopes into this community.
- Remove *Cyathea cooperi* from all bushland creek lines.
- Council plantings (by other Council departments) in any area near bushland reserves should be done in consultation with the Bushland Manager and seed/plants need to be of local provenance.
- Council is required to control any listed Noxious Weed according to bushland management plans.

7.5 Habitat Creation

- Restore grassed area below playing field in Brush Farm Park as habitat area. Outer areas developed as heath-shrubland while the inner areas developed as native grassland.
- Develop land in the Rutledge Street Road Reserve to include native grassland and shrub area.

7.6 Develop a Ryde LGA Sustainability Management Plan

- The Sustainability Management Plan (SMP) should cover all parks and reserves that contain native bushland.
- The SMP should identify existing vegetation communities and fauna habitats, especially those of threatened species.
- The SMP should develop a strategy for protecting existing habitats and where possible, restore lost habitats (e.g. native grasslands in Field of Mars, Brush Farm Park and Lambert Park; heath-shrubland in Brush Farm Park; restore understorey in Darvall Park).
- Bush regeneration work needs to continue in bushland reserves and the SMP should dictate where and when areas are to be affected by bush regeneration work so that the works do not result in displacing fauna from an area. The co-ordination of these work areas means that regeneration sites do not overlap and do not become a major disturbance impact in the park.
- The SMP should identify areas where buffer plantings are required and recommend suitable species; at present buffer strips are required in Darvall Park and around parts of Field of Mars.
- The SMP should review all walking tracks and issues of public access in the reserves and recommend closure of tracks (if required) or the relocation of

tracks). The existing longitudinal walking tracks Darvall Park need to be relocated.

- The SMP should develop a wider program of feral animal control, especially foxes and cats. The control plan should integrate activities between reserves and between adjoining LGAs.
- The SMP should consider the use of low-intensity burns as a means of promoting the regeneration of native plants in particular habitat areas e.g. heath areas in Field of Mars, native grasses in Field of Mars and Lambert Park.
- The SMP should develop a policy for the control of domestic animals in the bushland reserves. This may include dog and cat exclusion zones and the capacity to trap and remove free-roaming animals in the reserves at night. Information signs about the impact on dogs, dog scent and dropping on native fauna may be required to explain to residents why this action has been taken.
- The SMP should review all stormwater sites in bushland reserves and recommend measures to reduce erosion, and improve water quality in the parks.
- The SMP should address issues relating to street and house lighting that affects the reserves. In particular, backyard spotlights or excessive lighting that impacts the bushland areas should be brought to the owners' attention. If necessary, screen planting may be required to reduce light pollution in particular areas.
- The SMP should develop a plan for the promotion and planting of street trees and residential trees to create or develop fauna corridors.
- The SMP should address means to better involve community groups in the maintenance and protection of bushland areas.

7.7 Provision of artificial Shelter Sites

- Nest boxes for parrots, possums and bats are required in Brush Farm Park, Lambert Park and parts of Field of Mars. These boxes are to replace tree hollows lost during fires or through attrition of mature trees.
- Ground cover items such as logs and timber stacks could be created in areas in Field of Mars and Brush Farm Park where they are not likely to become a target for arsonists or become an undesirable feature in the park.
- Covered compost heaps are recommended to be retained in all reserves in areas away from regular public use.
- Sandstone rock piles could also be created in Lambert Park and Darvall Park where ground cover is scarce.

7.8 Repeat the Flora and Fauna Study

- The Flora and Fauna Study should be repeated in five years time (or earlier if changes or impacts have occurred to bushland areas).

7.9 Expand the reserves subject to the Flora and Fauna Study

- The Flora and Fauna Study should be expanded to include all bushland areas in the Ryde LGA. This information will then allow the BMP to develop local conservation strategies.

7.10 Establish a flora and fauna data base

- Ryde Council needs to develop a flora and fauna data base that will allow the Council to make informed decisions for future management issues in the bushland reserves.
- The data base should have two components:
    - a general data base that records all opportunistic sightings made by resident and Council staff
    - a quadrat-based data base that is designed to specifically compare data derived from quadrat surveys of communities with each reserve. The quadrat data should be entered so that statistically-valid comparisons can be made between sites and between years.

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APPENDIX ONE:

SPECIES CHECKLIST OF NATIVE PLANTS LOCAL TO RYDE MUNICIPALITY

SPECIES CHECKLIST OF NATIVE PLANTS LOCAL TO RYDE MUNICIPALITY

This species list is compiled from a draft report *Native Plants of the Ryde District - The Conservation Significance of Ryde's Bushland Plants* (PJ Kubiak, 2005) for Ryde City Council. Kubiak's list comprises observations from 1979-2005. The species contained in this list are given a conservation status (CS) by Kubiak and are those that are common (C) and scattered (S) generally in Ryde's bushland. Others are apparently uncommon in bushland of the Ryde district (U), rare in Ryde's bushland (R), or apparently uncommon to rare (U-R). The reserves encompassed by this study are Darvall Park (DP), Lambert Park (LP), Brush Farm Park (BFP) and Field of Mars Reserve (FMR).

The tables below have been developed as a checklist so that future observations can be entered as required. This study only involved observations over several days in the autumn (March-May) and spring (September-November) 2006 so it is likely that some species are missed due to lack of observation time. A total of 339 species have been observed.

Species observed during this study and that are not on Kubiak's list are marked with a #. Plants listed on the Threatened Species Act 1995 are marked with a + sign. Several orchids have been observed in previous years by Bev Debrincat and are marked with a BD. Several Australian native plants not endemic to the Ryde area are included on the Non-Indigenous plant list because they are not indigenous to the Ryde municipality or the Sydney Basin. These plants include *Cyathea cooperi, Acacia fimbriata, Acacia buxifolia ssp buxifolia, A. elata, A. fimbriata, Brachychiton acerifolius, Casuarina cunninghamiana ssp cunninghamiana, Grevillea robusta, Melia azedarach var australasica, Toona ciliata* and *Solanum aviculare*. The rationale for not including them is discussed in the final report.

FAMILY	SPECIES NAME	CS	DP	LP	BFP	FMR
Pteridiophytes						
ADIANTACEAE	*Adiantum aethiopicum*	C	√		√	√
	Adiantum hispidulum	S	√		√	
ASPLENIACEAE	*Asplenium australasicum*	U				√
	Asplenium flabellifolium	S			√	√
ATHYRIACEAE	*Diplazium australe*	R	√			
BLECHNACEAE	*Blechnum ambiguum*	S				
	Blechnum cartilagineum	C				√
	Doodia aspera	S	√	√	√	
	Doodia australis	R				
	Doodia caudata var *caudata*	S			√	√
CYATHEACEAE	*Cyathea australis*	C			√	√
DENNSTAEDTIACEAE	*Histiopteris incisa*	S				√
	Hypolepis muelleri	S		√	√	√
	Pteridium esculentum	C	√	√	√	√
DICKSONIACEAE	*Calochlaena dubia*	C	√	√		√
DRYOPTERIDACEAE	*#Lastreopsis decomposita*	C				√
GLEICHENIACEAE	*Gleichenia dicarpa*	C				√
	Gleichenia microphylla	S				√

	Sticherus flabellatus	S				√
HYMENOPHYLLACEAE	*Hymenophyllum cupressiforme*	R				
LINDSAEACEAE	*Lindsaea linearis*	C				
	Lindsaea microphylla	C				√
OSMUNDCEAE	*Todea barbata*	S				
POLYPODIACEAE	*Platycerium bifurcatum* ssp *bifurcatum*	S				√
	Pyrrosia rupestris	U				√
PSILOTACEAE	*Psilotum nudum*	R				
PTERIDIACEAE	*Pteris tremula*	U	√		√	
	#Pteris umbrosa					√
SHIZAEACEAE	*Schizaea asperula*					
	Schizaea bifida (s.str.)	S				
SINIPTERIDACEAE	*Cheilanthes distans*	R				√
	Cheilanthes sieberi	C				√
	Pellaea falcata var *falcata*	S		√	√	√
THELYPTERIDACEAE	*Christella dentata*	S	√		√	√
Gymnosperms						
PODOCARPACEAE	*#Podocarpus elatus*				√	
	Podocarpus spinulosus	S				√

Angiosperms-Dicotyledons			**DP**	**LP**	**BFP**	**FMR**
ACANTHACEAE	*Brunoniella australis*	R				
	Brunoniella pumilio	S				
	Pseuderanthemum variabile	C	√	√	√	√
AIZOACEAE	*Tetragonia tetragonoides*	S			√	√
AMARANTHACEAE	*Alternanthera denticulata*	C		√		√
APIACEAE	*Actinotus helianthi*	C				√
	Actinotus minor	C				√
	Centella asiatica	S	√	√		√
	Hydrocotyle peduncularis	C				√
	Hydrocotyle tripartita	R				√
	Platysace lanceolata	C				√
	Platysace linearifolia	C				√
	Trachymene incisa ssp *incisa*	R				
	Xanthosia pilosa	C				√
	Xanthosia tridentata	C				√
APOCYNACEAE	*Parsonsia straminea*	U				
ARACEAE	*#Alocasia brisbanensis*		√			√
ARALIACEAE	*Astrotricha longifolia*	S				
	Polyscias sambucifolia	C	√		√	√
ASCLEPIADACEAE	*Marsdenia suaveolens*	S				√
	Tylophora barbata	S	√			√
ASTERACEAE	*Cassinia aculeata*	U				√
	Epaltes australis	R				√

	Euchiton gymnocephalus	R				
	Helichrysum scorpioides	U-R				
	Olearia microphylla	S				√
	Olearia viscidula	R				
	Ozothamnus adnatus	R				
	Ozothamnus diosmifolius	C	√	√	√	√
	Senecio hispidulus var *hispidulus*		√	√	√	√
	Sigesbeckia orientalis ssp *orientalis*	S	√	√	√	√
AVICENNIACEAE	*Avicennia marina* var *australasica*	C				√
BAUERACEAE	*Bauera rubioides*	S				√
BIGNONIACEAE	*Pandorea pandorana*	C	√	√	√	√
CAMPANULACEAE	*Wahlenbergia communis* (s. lat.)					
	Wahlenbergia gracilis	C		√	√	√
	Wahlenbergia stricta	R				
CASSYTHACEAE	*Cassytha glabella*					√
	Cassytha pubescens					√
CASUARINACEAE	*Allocasuarina littoralis*	C				√
	Allocasuarina torulosa	C	√	√		√
	Casuarina glauca	C		√		√
CELASTRACEAE	*Cassine australis* var *australis*	R	√		√	
	Celastrus subspicata	R	√			
	Maytenis silvestris	U	√	√	√	
CHENOPODIACEAE	*Einadia hastata*	S	√	√	√	√
	Sarcocornia quinqueflora ssp *quinqueflora*	S				√
CLUSIACEAE	*Hypericum gramineum*	S				√
CONVOLVULACEAE	*Calystegia marginata*	R	√	√		
	Calystegia sepium	R?				
	Convolvulus erubescens	R	√	√		
	Dichondra repens (s.lat.)	S	√	√	√	√
	Polymeria calycina					
CUNONIACEAE	*Aphanopetalum resinosum*	R		√	√	
	Callicoma serratifolia	C	√			√
	Ceratopetalum apetalum	S				√
	Ceratopetalum gummiferum	C				√
	Schizomeria ovata	R			√	
DILLENIACEAE	*Hibbertia aspera*	C				√
	Hibbertia dentata	S				√
	Hibbertia fasciculata	S				√
	Hibbertia linearis	C				√
	Hibbertia riparia (s.lat.)	U				√
	Hibbertia scandens	R				
DROSERACEAE	*Drosera auriculata*	C				√

	Drosera peltata	C				
ELAEOCARPACEAE	*Elaeocarpus reticulatus*	C	√		√	√
EPACRIDACEAE	*Brachyloma daphnoides*	S				
	Dracophyllum secundum	U				
	Epacris microphylla	S				√
	Epacris pulchella	C				√
	+ Epacris purpurascens var *purpurascens*	S				√
	Leucopogon ericoides	S				√
	Leucopogon juniperinus	S	√		√	√
	Leucopogon lanceolatus	S				
	Leucopogon microphyllus	C				
	Melichrus procumbens	U				
	Monotoca elliptica	S				
	Monotoca scoparia	C				
	Styphelia longifolia	U-R				√
	Styphelia triflora	U				√
	Styphelia tubiflora	U				
	Trococarpa laurina	R	√		√	
	Woolsia pungens	C				√
EUPHORBIACEAE	*Amperea xiphoclada* var *papillata*	C				√
	Breynia oblongifolia	C	√	√	√	√
	Glochidion ferdinandi	C	√	√	√	√
	Micrantheum ericoides	C				√
	Omalanthus nutans	S	√	√	√	√
	#Phyllanthus gasstroemii		√			
	Phyllanthus hirtellus (ex *P thymoides)*	C				√
	Poranthera ericifolia	U				
	Poranthera microphylla	S				
	Ricinocarpos pinifolius	S				√
EUPOMATIACEAE	*Eupomatia laurina*	R			√	
FABACEAE	*Acacia brownii*	U				√
	Acacia decurrens		√	√	√	
	Acacia falcata	S	√			√
	Acacia floribunda		√	√ p	√ p?	√
	Acacia linifolia	C				√
	Acacia longifolia	C	√	√ p	√p?	√
	Acacia myrtifolia	C				√
	Acacia parramattensis	C	√	√	√	√
	Acacia stricta	U	√			√
	Acacia suaveolens	C				√
	Acacia terminalis	C				√
	Acacia ulicifolia	C				√
	Bossiaea heterophylla	C				√
	Bossiaea obcordata	C				√
	Bossiaea scolopendria	S				√

	Daviesia ulicifolia	S				√
	#Desmodium varians		√			
	Dillwynia retorta	C				√
	Glycine clandestina	C				√
	Glycine microphylla		√	√	√	√
	Glycine tabacina species complex	S	√		√	
	Gompholobium glabratum	S				√
	Gompholobium latifolium	S				√
	Gompholobium pinnatum	R				√
	Hardenbergia violacea	C				√
	Hovea linearis (s.str.)	S				√
	Indigofera australis	R	√ p?	√ p	√ p	
	Kennedia rubicunda	C	√		√	√
	Mirbelia rubiifolia	S				√
	Phyllota phylicoides	C				√
	Platylobium formosum ssp *formosum*	C				√
	Pultenaea daphnoides	C				√
	Pultenaea flexilis	C				√
	Pultenaea mollis	R				
	Pultenaea paleacea	R				√
	Pultenaea retusa					√
	Pultenaea stipularis	C				
	Pultenaea villosa	U				√
	#Sphaerolobium vimineum					√
	Viminaria juncea	S				√
GERANIACEAE	*Geranium homeanum*	S	√	√		√
	Pelargonium inodorum	U				
GOODENIACEAE	*Dampiera stricta*	C				√
	Goodenia bellidifolia	S				
	Goodenia hederacea ssp *hederacea*	C				√
	Goodenia heterophylla ssp *heterophylla*	S				√
	Goodenia ovata	U				
	Scaevola ramosissima	S				
HALORAGACEAE	*Gonocarpus micranthus* ssp *micranthus*					
	Gonocarpus tetragynus					
	Gonocarpus teucrioides	C				√
LAMIACEAE	*Plectranthus parviflorus*	U	√	√	√	√
LAURACEAE	*Cryptocarya glaucescens*	R			√	
	#Cryptocarya microneura				√	
LOBELIACEAE	*Lobelia alata*	S				√
	Lobelia dentata	C				√
	Lobelia gracilis	C				√
	Pratia purpurascens	C	√			√

LOGANIACEAE	*Logania albiflora*	S				√
	Mitrasacme polymorpha	C				√
LORANTHACEAE	*Amyema congener* ssp *congener*					
	Dendrophthoe vitellina					
MELIACEAE	*Synoum glandulosum*	R				
MENISPERMACEAE	*Sarcopetalum harveyanum*	U	√	√	√	
	Stephania japonica var *discolor*	S	√		√	
MORACEAE	*Ficus coronata*	R	√ p	√	√	
	Ficus rubiginosa	S	√ p	√		√
MYRSINACEAE	*Aegiceras corniculatum*					√
	Rapanea variabilis	S	√	√	√	
MYRTACEAE	*Acmena smithii*	U	√	√	√	√
	Angophora bakeri	S				√
	Angophora costata	C			√	√
	Angophora floribunda	S	√			
	Austromyrtus tenuifolia	U				√
	Backhousia myrtifolia	S	√	√	√	
	Baeckea diosmifolia	S				
	Baeckea linifolia	S				√
	Callistemon citrinus	U				√
	Callistemon linearis	S				√
	Callistemon pinifolius	R				
	Callistemon salignus	U	√	√	√	√ p?
	Calytrix tetragona	S				
	Corymbia gummifera	C				√
	Eucalyptus acmenoides	R	√		√	√ p
	Eucalyptus haemastoma					√
	Eucalyptus oblonga					√
	Eucalyptus paniculata	S	√	√p?	√	
	Eucalyptus pilularis	S	√	√	√	√
	Eucalyptus piperita	C				√
	Eucalyptus punctata	U		√p		√
	Eucalyptus racemosa	S				√
	Eucalyptus resinifera	S		√	√	√
	Eucalyptus saligna	S	√	√	√	√
	Kunzea ambigua	C	√	√ p		√
	Leptospermum arachnoides	S				√
	Leptospermum parvifolium	U				√
	Leptospermum polygalifolium ssp *polygalifolium*	C				√
	Leptospermum squarrosum	S				
	Leptospermum trinervium	C				√
	Melaleuca decora	R				√
	Melaleuca ericifolia	R				√
	Melaleuca linariifolia	S				√
	Melaleuca nodosa					√

	Melaleuca stypheloides	U	√	√	√	√ p
	Melaleuca thymifolia	U-R				
	Rhodamnia rubescens	R	√	√	√	
	Syncarpia glomulifera	S	√	√	√	√
	#Syzygium australe			√		
	Tristaniopsis collina	U	√ p			
	Tristaniopsis laurina	C	√			√
OLEACEAE	*Notelaea longifolia*	C	√		√	√
PASSIFLORACEAE	*Passiflora herbertiana* ssp *herbertiana*	R	√	√	√	
PITTOSPORACEAE	*Billardiera scandens*	C			√	√
	Bursaria spinosa	C	√	√	√	√
	Citriobatus pauciflorus	R	√	√	√	
	Pittosporum revolutum	S	√	√	√	
	Pittosporum undulatum	C	√	√	√	√
PLANTAGINACEAE	*Plantago debilis*	R		√		
POLYGALACEAE	*Comesperma sphaerocarpum*	U-R				
	Comesperma volubile	R				
POLYGONACEAE	*Muehlenbeckia gracillima*	R	√		√	
	Persicaria decipiens		√			√
	#Persicaria hydropiper		√	√		√
	#Persicaria lapathifolia					√
	#Persicaria strigosa					√
	Persicaria subsessilis					
	Rumex brownii	S	√	√	√	√
PRIMULACEAE	*Samolus repens*	C				√
PROTEACEAE	*Banksia ericifolia* var *ericifolia*	C				√
	Banksia marginata					√
	Banksia oblongifolia	C				√
	Banksia serrata	C				√
	Banksia spinulosa var *spinulosa*	C				√
	Grevillea buxifolia	C				√
	#Grevillea mucronulata					√
	Grevillea sericea	C				√
	Hakea dactyloides (s.str.)	S				√
	Hakea salicifolia ssp *salicifolia*	S		√ p		√
	Hakea sericea	C				√
	Isopogon anemonifolius	S				√
	Lambertia formosa	C				√
	Lomatia silaifolia	C				√
	Persoonia lanceolata	C				√
	Persoonia laurina	S				
	Persoonia levis	C				√
	Persoonia linearis	C				√
	Persoonia pinifolia	S				√

	Petrophile pulchella	S				
	Telopea speciosissima	R				√
	Xylomelum pyriforme	S				√
RANUNCULACEAE	*Clematis aristata*	C			√	√
	Clematis glycinoides	C	√		√	√
	Ranunculus plebeius	R				
RHAMNACEAE	*Pomaderris discolor*					√
	Pomaderris elliptica					√
	Pomaderris lanigera	U				√
ROSACEAE	*Rubus parvifolius*	R	√		√	
	Rubus rosifolius	R	√	√	√	
RUBIACEAE	*Morinda jasminoides*	S	√	√	√	
	Opercularia aspera	C				√
	Opercularia varia	S				√
	Pomax umbellata	C				√
	Psychotria ioniceroides	R				
RUTACEAE	*Boronia ledifolia*	S				√
	Boronia polygalifolia (FMR 1993)	R				
	Correa reflexa var *reflexa* (pale yellow flowered)	S				√
	Leionema dentatum	U				
	Melicope micrococca	R			√	
	Zieria laevigata	R				√
	Zieria pilosa	C				√
	Zieria smithii	C	√	√	√	√
SANTALACEAE	*Exocarpos cupressiformis*	S	√			√
	Leptomeria acida	S				
SAPINDACEAE	*Alectryon subcinereus*	R		√	√	
	Dodonaea triquetra	C	√			√
	Guioa semiglauca	R		√	√	
SCROPHULARIACEAE	*Veronica plebeia*	C	√		√	√
SOLANACEAE	*Solanum prinophyllum*	R	√	√	√	
	Solanum vescum		√			
STERCULIACEAE	*Lasiopetalum ferrugineum* var *ferrugineum*	C				√
STYLIDIACEAE	*Stylidium graminifolium*	S				√
	Stylidium productum	S				
THYMELAEACEAE	*+Pimelea curviflora* var *curviflora*					√
	Pimelea linifolia	C				√
ULMACEAE	*Trema tomentosa* var *viridis*		√	√	√	
VERBENACEAE	*Cleodendrum tomentosum*	U	√		√	
VIOLACEAE	*Viola hederacea*	C	√			
VITACEAE	*Cayratia clematidea*		√	√	√	√
	Cissus antarctica		√	√	√	
	Cissus hypoglauca		√	√	√	

Angiosperms-Monocotyledons		**CS**	**DP**	**LP**	**BFP**	**FMR**
ARACEAE	*Gymnostachys anceps*	R	√			
ARECACEAE	*Livistona australis*	R			√ +p	√
CENTROLEPIDACEAE	*Centrolepis strigosa* var *strigosa*					
COMMELINACEAE	*#Aneilema acuminatum*			√	√	
	Commelina cyanea	S	√	√	√	√
CYPERACEAE	*Baumea juncea*	S				√
	Carex inversa	S				√
	Caustis flexuosa	C				√
	Cyathochaeta diandra	C				
	#Cyperus gracilis				√	√
	#Cyperus exaltatus		√			
	#Cyperus imbecillis			√	√	√
	#Cyperus polystachyos					?
	#Cyperus sphaeroides					√
	Cyperus tetraphyllus	R	√	√	√	
	Fimbristylis dichotoma	R				
	Gahnia clarkei	S				√
	Gahnia erythrocarpa	C				√
	Gahnia melanocarpa	U	√			
	#Gahnia sieberiana					√
	Isolepis cernua	R				√
	#Isolepis inundata	R	√		√	√
	Lepidosperma filiforme					
	Lepidosperma gunni	S				√
	Lepidosperma laterale	C				√
	Lepidosperma neesii	S				
	Lepidosperma urophorum	U				
	Ptilothrix deusta	C				
	Schoenus apogon	S				√
	Schoenus ericetorum	S				
	Schoenus imberbis	S				
	Schoenus melanostachys	C				√
	Tetraria capillaris	C				√
HAEMODORACEAE	*Haemodorum corymbosum*	U				
	Haemodorum planifolium	C				√
IRIDACEAE	*Patersonia glabrata*	C				
	Patersonia sericea	C				√
JUNCACEAE	*Juncus continuous*					√
	Juncus kraussii	S				√
	Juncus planifolius					
	#Juncus usitatus		√	√	√	√
JUNCAGINACEAE	*Triglochin striata*	U				
LILIACEAE	*Arthropodium milleflorum*	U-R				

	(s.lat.)					
	Blandfordia nobilis	S				
	Burchardia umbellata	C				√
	Caesia parviflora	S				
	Dianella caerulea	C	√	√	√	√
	Dianella revoluta	S				√
	Laxmannia gracilis (s.str.)	C				√
	Thysanotus tuberosus	C				
	Tricoryne simplex	C				√
LOMANDRACEAE	*Lomandra cylindrica*	S				√
	#Lomandra filiformis ssp *correacea*					√
	Lomandra filiformis ssp *filiformis*	S				√
	Lomandra glauca	S				
	Lomandra gracilis	S				√
	Lomandra longifolia	C	√	√	√	√
	Lomandra micrantha	S				
	Lomandra multiflora ssp *multiflora*	C				√
	Lomandra obliqua	C				√
ORCHIDACEAE	*Acianthus caudatus* var *caudatus*	U				
	Acianthus fornicatus	C				√
	Acianthus pusillus					
	Caladenia caerulea (late 1980 FMR)					
	Caladenia carnea	U				
	Caladenia catenata	C				√
	Caladenia testacea (FMR 1993)	R				
	Caleana major	S				
	Calochilus sp					BD
	Calochilus campestris	U				
	Calochilus gracillimus	U-R				
	Calochilus paludosus	S				√
	Calochilus robertsonii	C				
	Corybas aconitiflorus	U				
	Cryptostylis erecta	C				√
	Cryptostylis subulata	S				√
	Dendrobium linguiforme	U				
	Dipodium variegatum	C				BD
	Diuris aurea (FMR 2003)	R				
	Diuris maculata	R				
	Genoplesium fimbriatum	U-R				
	Genoplesium rufum	U-R				
	Glossodia major	R				
	Glossodia minor					
	Microtis unifolia (s.lat.)					

	Prasophyllum sp					BD
	Prasophyllum brevilabre	R				
	Pterostylis acuminata	S				
	Pterostylis concinna	S				√
	Pterostylis longifolia	U				
	Pterostylis nutans	C				
	Thelymitra ixioides var *ixioides*	S				
	Thelymitra pauciflora (FMR 1993)	U-R				
PHILESIACEAE	*#Eustrephus latifolius*		√	√	√	√
	#Geitonoplesium cymosum				√	
POACEAE	*Anisopogon avenaceus*	C			√p?	√
	Aristida ramosa var *ramosa*		√		√	√
	Aristida vagans	C			√	√
	Aristida warburgii (FMR)					
	Austrodanthonia fulva (FMR)					
	Austrodanthonia pilosa					√
	Austrodanthonia racemosa		√			
	Austrostipa pubescens	C				√
	Austrostipa ramossissima					√ p?
	Austrostipa rudis ssp *nervosa*	S				
	#Bothriochloa macra					√
	Cymbopogon refractus	S	√			
	Deyeuxia quadriseta	S				√
	Dichelachne crinita	U				
	Dichelachne micrantha		√		√p?	√
	Dichelachne rara					√ ?
	#Digitaria parviflora		√		√	√
	Echinopogon caespitosus	C			√	√
	#Echinopogon ovata				√	√
	Entolasia marginata	S	√	√	√	√
	Entolasia stricta	C	√	√	√	√
	Eragrostis brownii		√			√
	#Eragrostis lephostachya				√ p?	
	Imperata cylindrica var *major*	C	√		√	√
	Lachnagrostis filiformis	S		√	√	√
	Microlaena stipoides var *stipoides*	C	√	√	√	√
	Oplismenus aemulus	S	√	√	√	√
	Oplismenus imbecillis	S	√	√	√	√
	Panicum simile	S				√
	#Paspalidium distans				√	
	Phragmites australis					√
	Poa affinis					√
	# Poa labillardieri		√			√
	Sporobolus virginicus var *virginicus*	S				√

	Tetrarrhena juncea					√
	Themeda australis	C			√	√
RESTIONACEAE	*Lepyrodia scariosa*	C				√
	Leptocarpus tenax					√
SMILACACEAE	*Ripogonum album*	R		√	√	
	Smilax australis		√	√	√	
	Smilax glyciphylla	C	√			√
SPARGANIACEAE	*#Sparganium subglobosum*					√
TYPHACEAE	*Typha orientalis*		√		√	√
XANTHORRHOEACEAE	*Xanthorrhoea arborea*	C				√
	Xanthorrhoea media ssp *media*	C				√
	Xanthorrhoea minor					√
	Xanthorrhoea resinifera	U-R				
XYRIDACEAE	*Xyris gracilis* spp *gracilis*	R				

APPENDIX 2:

CHECKLIST OF EXOTIC AND NON-LOCAL NATIVE PLANTS IN RYDE MUNICIPALITY

CHECKLIST OF EXOTIC AND NON-LOCAL NATIVE PLANTS IN RYDE MUNICIPALITY

FAMILY	SPECIES NAME	DP	LP	BFP	FMR
Pteridiophytes					
CYATHEACEAE	* *Cyathea cooperi*	√	√	√	√
DRYOPTERIDACEAE	*Cyrtomium falcatum*	√			
SINOPTERIDACEAE	*Pellaea viridis*		√	√	
Angiosperms-Dicotyledons					
ACANTHACEAE	*Odontonema strictum*	√			
	Thunbergia alata	√	√		
ACERACEAE	*Acer negundo*	√	√		√
ALSTROEMERIACEAE	*Alstroemeria pulchella*	√			
ANACARDIACEAE	*Pistachia vera*	√			
APIACEAE	*Apium leptophyllum*	√			
	Hydrocotyle bonariensis				√
ARACEAE	*Calocasia esculenta*	√			√
	Monstera deliciosa	√			√
ARALIACEAE	*Schefflera actinophylla*	√			
ARECACEAE	*Phoenix canariensis*	√	√	√	√
ASCLEPIADACEAE	*Araujia sericiflora*	√	√	√	√
ASTERACEAE	*Ageratina adenophora*	√			√
	Ageratina riparia				√
	Aster subulatus	√	√		√
	Bidens pilosa	√	√	√	√
	Cirsium vulgare	√	√	√	√
	Conyza sp	√	√	√	√
	Coreopsis lanceolata				√
	Cosmos bipinnatus	√			
	Crassocephalum crepidioides	√			√
	Delairea odorata				√
	Erigeron karvinskianus				√
	Gnaphalium sp	√	√		
	Hypochaeris radicata	√	√	√	√
	Senecio madagascariensis			√	√
	Taraxacum officiale	√			√
	Sonchus oleraceus	√	√	√	√
BALSAMINACEAE	*Impatiens* sp	√			
BASELLACEAE	*Anredera cordifolia*	√	√		√
BIGNONIACEAE	*Jacaranda mimosifolia*	√		√	
BRASSICACEAE	*Brassica fruticulosa*				√
	Capsella bursapastoris				√
	Rorippa nasturtium-				√

	aquaticum				
CANNACEAE	*Canna indica*	√			√
CAPRIFOLIACEAE	*Lonicera japonica*	√			√
CARYOPHYLLACEAE	*Cerstium glomeratum*	√			√
	Stellaria media	√			
CASUARINACEAE	**Casuarina cunninghamiana* ssp *cunninghamiana*	√	√		
CHENOPODIACEAE	*Atriplex prostrata*				√
	Chenopodium album		√		√
	Chenopodium ambrosioides				√
CONVOLVULACEAE	*Ipomoea indica*	√	√		√
CRASSULACEAE	*Bryophyllum delagoense*				√
EUPHOBIACEAE	*Euphorbia peplus*	√	√		√
	Phyllanthus tenellus	√	√	√	
	Ricinus communis	√	√		√
FABACEAE subfamily CAESALPINOIDEAE	*Senna pendula* var *glabrata*	√	√	√	√
FABACEAE subfamily FABOIDEAE	*Erythrina* X *sykesii*	√			√
	Medicago polymorpha	√	√		√
	Trifolium repens	√	√		√
	Vicia sativa				√
FABACEAE subfamily MIMOSOIDEAE	**Acacia buxifolia* ssp *buxifolia*			√	
	** Acacia elata*	√p			
	**Acacia fimbriata*				√
FUMARIACEAE	*Fumaria* sp			√	
LAMIACEAE	*Dracocephalum nutans*	√			
LAURACEAE	*Cinnamomum camphora*	√	√	√	√
	**Cryptocarya obovata*	√	√		
MALACEAE	*Rhaphiolepis indica*	√			√
MALVACEAE	*Malva parviflora*	√	√		√
	Pavonia hastata	√		√	√
	Sida rhombifolia	√	√	√	√
MELIACEAE	**Melia azedarach* var *australasica*	√	√	√	√
	**Toona ciliata*			√	
MORACEAE	*Morus albus*	√	√		
MUSACEAE	*Musa sp*	√			
MYRTACEAE	**Eucalyptus grandis*	√			√
	**E. microcorys*	√			√
OCHNACEAE	*Ochna serrulata*	√	√	√	√
OLEACEAE	*Ligustrum lucidum*	√	√	√	√
	Ligustrum sinense	√	√	√	√
	Olea europaea ssp	√	√	√	√

	africana				
OXALIDACEAE	*Oxalis corniculata*	√	√	√	
	Oxalis purpurea		√	√	
PASSIFLORACEAE	*Passiflora edulis*	√		√	√
	Passiflora suberosa	√	√	√	
	Passiflora subpeltata	√	√	√	
PHYTOLACCACEAE	*Phytolacca octandra*				√
PLANTAGINACEAE	*Plantago lanceolata*	√	√		√
	Plantago major				√
POLYGONACEAE	*Acetosa sagittata*	√			√
	Persicaria capitata	√			
PROTEACEAE	* *Grevillea robusta*	√	√	√	√
	Macadamia sp	√			
RANUNCULACEAE	*Ranunculus repens*				√
ROSACEAE	*Duchesnea indica*	√	√	√	
	Rubus fruiticosis species aggregate	√	√	√	√
RUBIACEAE	*Galium aparine*				√
SALICEAE	*Salix babylonica*	√	√		
SAPINDACEAE	**Alectryon tomentosus*	√	√		
	Cardiospermum grandiflorum	√			√
	Triadica sebifera	√	√		
SIMAROUBACEAE	*Ailanthus altissima*	√	√		
SOLANACEAE	*Cestrum parqui*	√	√		√
	Datura sp				√
	Salpichroa origanifolia				√
	**Solanum aviculare*	√	√	√	√
	Solanum mauritianum	√	√		√
	Solanum nigrum	√	√		√
	Solanum pseudocapsicum	√		√	√
	Solanum rostratum				√
	Solanum sisymbriifolium				√
STERCULACEAE	**Brachychiton acerifolius*	√	√	√	√
THUNBERGIACEAE	*Thunbergia alata*	√	√		
TROPAEOLACEAE	*Tropaeolum majus*	√			
URTICACEAE	*Parietaria judaica*				√
VERBENACEAE	*Lantana camara*	√	√	√	√
	Verbena sp	√	√	√	√
VIOLACEAE	*Viola odorata*	√			
ZINGIBERACEAE	*Hedychium gardnerianum*				√
Angiosperms-Monocotyledons		DP	LP	BFP	FMR
ALLIACEAE	*Allium triquetrum*				√

	Nothoscordum gracile	√			√
ASPARAGACEAE	*Asparagus aethiopicus*	√	√	√	√
	Asparagus asparagoides				√
	Asparagus plumosus	√	√		
COMMELINACEAE	*Tradescantia fluminensis*	√	√	√	√
CYPERACEAE	*Cyperus brevifolius*	√			√
	Cyperus eragrostis		√		√
	Cyperus sesquiflorus				√
IRIDACEAE	*Crocosmia* x *crocosmiiflora*	√			
	Dietes sp	√			√
	Watsonia bulbillifera				√
LILIACEAE	*Chlorophytum comosum*			√	√
POACEAE	*Andropogon virginicus*				√
	Arundo donax	√			√
	Avena sativa			√	
	Axonopus affinis	√			√
	Briza maxima				√
	Briza minor				
	Briza subaristata			√	√
	Bromus catharticus	√			√
	Chloris virgata				√
	Cortaderia jubata		√		
	Cynodon dactylon	√	√	√	√
	Digitaria didactyla	√	√		√
	Digitaria sanguinalis	√	√		√
	Echinochloa crus-galli	√	√		√
	Ehrharta erecta	√	√	√	√
	Eleusine indica	√	√		√
	Eragrostis curvula	√	√		
	Paspalum dilatatum	√	√		√
	Paspalum urvillei		√		√
	Pennisetum clandestinum	√	√	√	√
	Setaria gracilis	√	√		
	Setaria palmifolia	√			
	Setaria pumila	√	√	√	√
	Sporobolus indicus var *capensis*	√	√	√	√
	Stenotaphrum secundatum	√			√

- Indicates an Australian native plant that is not indigenous to Ryde municipality; see final report for a detailed discussion on each species.

APPENDIX 3:

NATIVE PLANTS IN SURVEY QUADRATS

DARVALL PARK QUADRAT

The quadrat measures 40m x 10m and is located between a bitumen track (adjacent to the railway) and a bush track (adjacent to the creek). There are a total of 46 native species in the quadrat and 22 positive diagnostic species to fulfil the criteria for Map Unit 15: Turpentine Ironbark Forest (Tozer, 2003). The canopy is dominated by three *Eucalyptus saligna* with diameter at breast height (dbh) of 2.7m, 1.7m, and a forked tree of 0.80m/2.6m, *E. paniculata* 1.9m and a forked *Syncarpia glomulifera* of 0.40m/0.52m. A pile burn had been conducted on the bitumen side of the quadrat in 2003 that resulted in regeneration of many *Acacia* species. There are 33 weed species. The quadrat is currently undergoing secondary follow-up bush regeneration so weed species density may change.

Native Plant Species in 400m^2 Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Acacia decurrens	3
Acacia falcata	2
Acacia floribunda	2
Acacia longifolia	2
Acacia stricta	1
Callistemon salignus (planted?)	1
Cayratia clematidea	4
Centella asiatica	3
Cissus antarctica	1
Cissus hypoglauca	1
Clematis aristata	3
Desmodium varians	2
Dianella caerulea	2
Dichelachne micrantha	1
Dichondra repens	4
Elaeocarpus reticulatus	1
Entolasia stricta	1
Eragrostis brownii	1
Eucalyptus paniculata	1
Eucalyptus saligna	2
Geranium homeanum	1
Glycine microphylla	1
Glycine tabacina	5
Imperata cylindrica	5
Isolepis inundatus	1
Kennedia rubicunda	1

Lomandra longifolia (planted?)	2
Microlaena stipoides var *stipoides*	4
Muehlenbeckia gracillima	1
Notelaea longifolia	1
Oplismenus aemulus	3
Pandorea pandorana	2
Pittosporum revolutum	1
Plectranthus parviflorus	2
Polyscias sambucifolia	2
Pratia purpurascens	4
Pseuderanthemum variabile	2
Rapanea variabilis	1
Rubus parvifolius	2
Senecio hispidulus var *hispidulus*	2
Sigesbeckia orientalis	4
Solanum prinophyllum	1
Stephania japonica var *discolor*	2
Syncarpia glomulifera	1
Trema tomentosa var *viridis*	2
Tylophora barbata	1

Weed Species in 400m^2 Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Apium leptophyllum	3
Asparagus aethiopicus	2
Axonopus affinis	1
Bidens pilosa	2
Bromus catharticus	1
Cinnamomum camphora	1
Cirsium vulgare	1
Cynodon dactylon	1
Dietes sp	2
Digitaria didactyla	1
Digitaria sanguinalis	2
Ehrharta erecta	5
Euphorbia peplus	1
Ligustrum lucidum	1
Lonicera japonica	1
Medicago polymorpha	2
Ochna serrulata	2
Oxalis corniculata	4
Paspalum dilatatum	3
Passiflora suberosa	4
Phyllanthus tenellus	2
Pistachia vera	1
Plantago lanceolata	2
Rubus species aggregate	2
Senna pendula	2

Setaria sp	2
Sida rhombifolia	2
Solanum nigrum	1
Solanum pseudocapsicum	2
Sonchus oleraceus	1
Sporobolus indicus var *capensis*	1
Taraxacum officiale	1
Tradescantia fluminensis	2

LILLY-PILLY QUADRAT
LAMBERT PARK

This small quadrat was set up behind the Girl Guides Hall in an area that is either a remnant of the park before disturbance or it is exhibiting natural regeneration of the native species that is seen a few hundred metres further north in Brush Farm Park. The canopy is a Low Closed Forest of *Acmena smithii* and *Ficus rubiginosa* with *Cyperus tetraphyllus* regenerating on the ground. *Pittosporum undulatum* and the weed *Ligustrum lucidum* dominate the understorey canopy while other ground covers are the weed *Ehrharta erecta* and native grasses *Oplismenus* and *Entolasia stricta.* The quadrat is not large enough to use the classification procedure developed by Tozer (2003) but with 22 natives out of the required 33 and 11 positive diagnostic species out of 18 for Map Unit 15, this area should be maintained as a Turpentine-Ironbark Forest vegetation community.

Native Plant Species in 100^2m Quadrat	
Scientific Name	Braun–Blanquet Cover Scale
Acacia parramattensis	2
Acmena smithii	1
Calystegia marginata	1
Carex inversa	1
Cissus antarctica	1
Convolvulus erubescens	1
Cyperus tetraphyllus	4
Dianella caerulea	1
Dichondra repens	4
Doodia aspera	1
Entolasia stricta	2
Ficus coronata	1
Ficus rubiginosa	1
Glycine clandestina	1
Omalanthus nutans	1
Oplismenus aemulus	5
Oplismenus imbecillis	3
Passiflora herbertiana ssp *herbertiana*	2
Pellaea falcata	1
Pittosporum revolutum	1
Pittosporum undulatum (seedling/saplings)	3
Sarcopetalum harveyanum	1

Weed Species in 100^{2}m Quadrat	
Scientific Name	**Braun –Blanquet Cover Scale**
Acer negundo	1
Anredera cordifolia	3
Araujia sericiflora	3
Asparagus plumosus	1
Bidens pilosa	2
Brachychiton acerifolium	1
Cestrum parqui	3
Cinnamomum camphora	2
Conyza sp	2
Ehrharta erecta	7
Euphorbia peplus	2
Lantana camara	2
Ligustrum lucidum	4-5
Ligustrum sinense	1
Ochna serrulata	2
Olea europaea ssp *africana*	1
Oxalis purpurea	1
Passiflora suberosa	2
Passiflora subpeltata	3
Pellaea viridis	1
Senna pendula	1
Solanum mauritianum	1
Solanum nigrum	3
Tradescantia fluminensis	3

TURPENTINE/CASSINE QUADRAT
LAMBERT PARK

The quadrat is found below Brush Farm Park netball courts/ovals, adjacent to and crossing the track. Turpentines (dbh: [all forked individuals] 1.81m/1.41m, 1.9m/1.24m/1.7m/0.37m, 1.66m/1.18m) form an open forest at the top of the slope with *Elaeocarpus reticulatus* (dbh: 0.37m) and a single *Podocarpus elatus* (dbh: 0.57m) dominating on the slope. The understorey consists of *Trema, Pittosporum, Notelaea, Cassine* and *Acacia parramattensis*. There are 44 native species and 23 positive diagnostic species in this quadrat, which fulfils all the requirements to be classified as Map Unit 15: Turpentine-Ironbark Forest (Tozer, 2003). The area was cleared of privet about 2001 and still remains very open but there are indications of early succession occurring. Unfortunately, lack of follow-up weeding (16 weed species) has resulted in inundation by *Ehrharta erecta* and annuals such as fleabane and cobbler's pegs.

Native Plant Species in 400^{2}m Quadrat	
Scientific Name	**Braun–Blanquet Cover Scale**
Acacia decurrens	1
Acacia parramattensis	4
Adiantum hispidulum var *hispidulum*	3
Alectryon subcinereus (seedling)	1
Breynia oblongifolia	2
Cassine australis var *australis*	2
Cayratia clematidea	1
Cissus hypoglauca	1
Citriobatus pauciflorus	2
Clematis glycinoides var *glycinoides*	3
Cleodendrum tomentosum	1
Cyperus imbecillis	2
Cyperus tetraphyllus	1
Dichondra repens	2
Einadia hastata	4
Elaeocarpus reticulatus	1
Entolasia marginata	2
Eucalyptus saligna (seedling)	1
Glochidion ferdinandi	2
Glycine tabacina	1
Glycine microphyllus	1
Indigofera australis (planted?)	4
Maytenis silvestris	2
Microlaena stipoides var *stipoides*	2

Morinda jasminoides	1
Notelaea longifolia	3
Omalanthus nutans	2
Oplismenus aemulus	2
Oplismenus imbecillis	2
Ozothamnus diosmifolius	1
Pandorea pandorana	3
Passiflora herbertiana ssp *herbertiana*	1
Pittosporum undulatum (seedlings)	3
Plectranthus parvifolius	2
Podocarpus elatus	1
Pseuderanthemum variabile	4
Rapanea variabilis	2
Rubus rosifolius	3
Senecio hispidulus var *hispidulus*	5
Sigesbeckia orientalis ssp *orientalis*	4
Solanum prinophyllum	1
Syncarpia glomulifera	2
Trema tomentosa var *viridis*	3
Wahlenbergia gracilis	1

Weed species in 400^{2}m Quadrat	
Scientific Name	**Braun–Blanquet Cover Scale**
Araujia sericiflora	1
Bidens pilosa	3
Brachychiton acerifolius (sapling)	1
Chlorophytum comosum	2
Cinnamomum camphora	1
Cirsium vulgare	2
Conyza sp	4
Duchesnea indica	1
Ehrharta erecta	7
Fumaria sp	1
Olea europaea ssp *africana* (seedlings)	3
Ochna serrulata	2
Oxalis corniculata	3
Senecio madagascariensis	2
Sonchus oleraceus	3
Passiflora subpeltata	2

TURPENTINE-IRONBARK QUADRAT
BRUSH FARM PARK

The land slopes gently to the south and the 20m X 20m quadrat is located at approximately 95m ASL behind the scout Hall and adjacent to the oval at Brush Farm Park. A stormwater drain empties into the quadrat and a bush track goes down one side. Disturbance has caused a decrease in diversity and weed inundation (16 weed species). There are only 25 native species out of 33 and 17 of the required 18 positive diagnostic species required to fulfill Map Unit 15: Turpentine Ironbark Forest (Tozer, 2003). Even so, this area is indicative of Turpentine Ironbark Forest. Structurally, the quadrat contains a forest dominated by mature *Eucalyptus paniculata* (dbh: 3.85m, 2.2m/0.60m) in association with an understorey of *Syncarpia glomulifera (dbh: 2.44m/1.68m/1.18m, 1.44m)* and a single *Angophora costata* (dbh: 2.28m). There are 12 young planted *Eucalyptus saligna (*dbh: 0.70m, 0.58mm, 0.54m, 0.50m plus others) on the side closest to the oval. The middle story consists of *Pittosporum undulatum, Trema tomentosa var. viridis,* and many vines. The weed *Ehrharta erecta* dominates the ground.

Native Plant species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Angophora costata	1
Cayratia clematidea	2
Cissus antarctica	3
Commelina cyanea	1
Entolasia marginata	1
Eucalyptus paniculata	1
Eucalyptus saligna (planted)	3
Ficus coronata	2
Glochidion ferdinandi	1
Livistona australis (planted)	1
Notelaea longifolia	1
Omalanthus nutans	1
Oplismenus aemulus	2
Oplismenus imbecillis	2
Pandorea pandorana	1
Passiflora herbertiana ssp *herbertiana*	1
Pittosporum revolutum (planted)	1
Pittosporum undulatum (juveniles)	6
Pseuderanthemum variabile	3
Rumex brownii	1
Sarcopetalum harveyanum	2
Smilax australis	1
Stephania japonica var *discolor*	3
Syncarpia glomulifera	1
Trema tomentosa var *viridis*	3

Weed Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Asparagus aethiopicus	1
Araujia sericiflora	1
Bidens pilosa	1
Cinnamomum camphora	1
Ehrharta erecta	4
Grevillea robusta	1
Lantana camara	1
Ligustrum lucidum	1
Melia azedarach	1
Oxalis purpurea	2
Passiflora subpeltata	3
Phyllanthus tenellus	2
Sida rhombifolium	2
Senna pendula	1
Solanum aviculare	1
Solanum nigrum	1

SYDNEY BLUE GUMS QUADRAT
BRUSH FARM PARK

This quadrat is located below the junction of Rutledge St and Brush Park Rd on the eastern side of the reserve. The more recent vegetation classification by Tozer (2003) would list this community as a Sydney Turpentine-Ironbark community despite the fact that there are only 29 native species of the required 33 present but there are 19 of the required 18 positive diagnostic species present. At the beginning of the survey there were 3 remnant and dominant *Eucalyptus saligna* within the quadrat forming an open forest but during the survey two of the trees (2.9m and 2.3m dbh) died and showed signs of attack by Longicorn beetle. The diameter at breast height of the remaining tree is 2.83m in association with *Syncarpia glomulifera* (dbh: 2.6m, 2.26m/1.19m, 1.27m, 0.81m, 1.15m and 1.16m). The area has been heavily mulched and revegetated. There are 14 weed species present.

Native Plant Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Acacia parramattensis	2
Acmena smithii	1
Alectryon subcinereus	2
Aphanopetalum resinosum	1
Breynia oblongifolia	2
Cayratia clematidea	4
Citriobatus pauciflorus	2
Clematis aristata	1
Clematis glycinoides var *glycinoides*	3
Cleodendrum tomentosum	1
Commelina cyanea	1
Dichondra repens	1
Einadia hastata	2
Eucalyptus acmenoides	1
Eucalyptus saligna	1
Eustrephus latifolius	2
Ficus coronata (planted?)	1
Lomandra longifolia (planted?)	1
Melaleuca stypheloides (planted?)	1
Notelaea longifolia	1
Oplismenus aemulus	1
Pittosporum undulatum	3
Paspalidium distans (?)	2
Plectranthus parviflorus	2
Pseuderanthemum variabile	4
Sigesbeckia orientalis ssp *orientalis*	2
Sarcopetalum harveyanum	1
Syncarpia glomulifera	2
Trema tomentosa var *viridis*	3

Weed Plant Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Acacia buxifolia (planted)	1
Bidens pilosa	2
Brachychiton acerifolium	1
Ehrharta erecta	4
Jacaranda mimosifolia	1
Ligustrum lucidum	1
Ochna serrulata	1
Olea europaea ssp *africana*	2
Passiflora subpeltata	1
Pavonia hastata	1
Sida rhombifolia	1
Solanum pseudocapsicum	1
Sonchus oleraceus	3
Tradescantia fluminensis	2

SCHIZOMERIA QUADRAT
BRUSH FARM PARK

This quadrat is on a steep west-facing slope that descends into the creek. The vegetation in this quadrat fits Tozer's (2003) classification for Map Unit 15: Turpentine/Ironbark Forest with 42 native species and 18 positive diagnostic species present in the quadrat. Species are dominated on the upper slope by two multiple branched *Acmena smithii* (dbh: 0.63m/0.74m, 0.32m and 0.23m/0.33m/0.30m/0.50m/ 0.40m) associated with *Schizomeria ovata* (dbh: 1.4m/1.28m/0.32m) and *Cryptocarya glaucescens* forming a Forest to Closed Forest. The understorey consists of *Melicope micrococca, Alectryon subcinereus, Ficus coronata* and *Pittosporum undulatum* (dbh: 1.17m) with *Morinda jasminoides, Cyperus tetraphyllus* and a ferny ground-layer. There are only 11 weed species present.

Native Plant Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Acmena smithii	2
Adiantum aethiopicum	1
Adiantum hispidulum var *hispidulum*	6
Alectryon subcinereus	1
Aneilema acuminatum	1
Breynia oblongifolia	2
Cassine australis var *australis*	1
Christella dentata	1
Clematis aristata	3
Cryptocarya glaucescens	1
Cyperus imbecillis	1
Cyperus tetraphyllus	7
Doodia aspera	2
Doodia caudata	2
Entolasia stricta	1
Eupomatia laurina	1
Eustrephus latifolius	2
Ficus coronata	5
Glochidion ferdinandi	1
Livistona australis	1
Melicope micrococca	2
Microlaena stipoides var *stipoides*	2
Morinda jasminoides	5
Muehlenbeckia gracillima	1
Omalanthus nutans	1
Oplismenus aemulus	3
Oplismenus imbecillis	3
Passiflora herbertiana var *herbertiana*	1
Pellaea falcata	1

Pittosporum undulatum	2
Plectranthus parviflorus	2
Pseuderanthemum variabile	2
Pteris tremula	1
Rapanea variabile	2
Rubus rosifolius	4
Sarcopetalum harveyanum	2
Schizomeria ovata	2
Sigesbeckia orientalis ssp *orientalis*	2
Smilax australis	3
Solanum prinophyllum	1
Syncarpia glomulifera	1
Trema tomentosum var *viridis*	2

Weed Species in 400^2m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Bidens pilosa	3
Brachychiton acerifolium	1
Cinnamomum camphora	1
Conyza sp	2
Duchesnea indica	3
Ehrharta erecta	2
Ligustrum lucidum	2
Ochna serrulata	3
Oxalis purpurea	3
Phoenix canariensis	2
Solanum aviculare	1

WELLINGTON ROAD QADRAT
FIELD OF MARS

This quadrat is on the western ridge (40-45m ASL) of the reserve in an open forest of *Eucalyptus resinifera* with an understorey of *Syncarpia glomulifera, Angophora costata* and *E. punctata*. The soil has high clay content but sandstone outcrops occur approximately 10m - 20m downhill from the quadrat. This quadrat fits Tozer's (2003) requirements for Map Unit: 43 Turpentine - Ironbark Margin Forest. 17 of the required 11 positive diagnostic species are present and overall the quadrat contains 47 native plants. 17 weed species are present due to the close proximity to Wellington Rd and the Field of Mars Cemetery.

Native Plant Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Acacia falcata	1
Acacia longifolia	1
Allocasuarina littoralis	3
Angophora costata	3
Aristida vagans	3
Bothriochloa macra	1
Cayratia clematidea	3
Cheilanthes sieberi ssp *sieberi*	1
Clematis aristata	1
Clematis glycinoides var *glycinoides*	3
Dianella caerulea	2
Dianella revoluta var *revoluta*	1
Dichondra repens	3
Dodonaea triquetra	2
Einadia hastata	1
Entolasia stricta	3
Eucalyptus punctata	1
Eucalyptus resinifera	3
Eustrephus latifolius	1
Geranium homeanum	1
Glochidion ferdinandi	1
Glycine microphylla	3
Grevillea sericea	1
Hardenbergia violacea	1
Hibbertia aspera	3

Imperata cylindrica var *major*	4
Lepidosperma gunnii?	1
Lepidosperma laterale	1
Leucopogon juniperinus	2
Lomandra cylindrica	1
Lomandra filiformis ssp *filiformis*	1
Lomandra gracilis	1
Lomandra longifolia	2
Lomatia silaifolia	1
Microlaena stipoides var *stipoides*	3
Omalanthus nutans	1
Oplismenus aemulus	2
Pandorea pandorana	2
Pittosporum undulatum	3
Platylobium formosum	2
Polyscias sambucifolia	3
Pratia purpurascens	2
Pseuderanthemum variabile	3
Syncarpia glomulifera	3
Themeda australis	5
Tricoryne simplex	1
Xanthorrhoea sp	4

Weed Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Araujia sericiflora	1
Asparagus aethiopicus	1
Bryophyllum delagoense	2
Cersium vulgare	1
Cynodon dactylon	2
Digitaria didactyla	2
Melia azedarach var *australasica*	1
Lantana camara	3
Ligustrum lucidum	1
Ligustrum sinense	3
Ochna serrulata	3
Paspalum dilatatum	1
Pavonia hastata	1
Senna pendula var *glabrata*	3
Setaria gracilis	1
Sporobolus indicus var *capensis*	1
Vicia sativa	2

SCRIBBLY GUMS QUADRAT
FIELD OF MARS

This quadrat is located along the Sand Track on the northeast ridge of the reserve north of the Field of Mars Cemetery. The quadrat does not exactly fit Map Unit 31: Sandstone Ridgetop Woodland described by Tozer (2003) due to only 17 out of 28 positive diagnostic species being present. Amongst the 43 native species in this Open Woodland are the canopy trees *Eucalyptus racemosa* (0.55m, 0.96m) in association with *Angophora costata* (dbh: 0.60m, 0.50m, 0.43m), *Eucalyptus resinifera* (dbh: 0.91m) *Corymbia gummifera* (dbh: 1.0m, 0.9m, 1.25m, 1.5/1.12m) with *Allocasuarina littoralis* in the understorey. There are many young regenerating Eucalypts and She-Oaks. The colonizing shrubs are typical sandstone sclerophyll species in later stages of succession: *Dodonaea triquetra* (1.75m) and *Pimelea linifolia* ssp *linifolia* and *Ozothamnus*. The quadrat contains a single specimen of the endangered *Epacris purpurascens var purpurascens* along with *Themeda australis, Lomandra longifolia* and *Entolasia stricta* that dominate the ground covers. The soil is shallow and sandy and Hawkesbury Sandstone outcrops are located within the quadrat. The leaf litter is up to 5 cm deep.

Native Plant Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Acacia linifolia	1
Acacia ulicifolia	1
Allocasuarina littoralis	3
Angophora costata	3
Anisopogon avenaceus	1
Banksia serrata	1
Banksia spinulosa var *spinulosa*	1
Billardiera scandens	1
Cassytha pubescens	1
Cheilanthes sieberi ssp *sieberi*	3
Corymbia gummifera	3
Cryptostylis sp	2
Dianella caerulea var *producta*	1
Dillwynia retorta	1
Dodonaea triquetra	3
Entolasia stricta	5
Entolasia marginata	1
Epacris microphylla	1
Epacris purpurascens var *purpurascens*	1
Eucalyptus racemosa	3
Eucalyptus resinifera	1
Goodenia hederacea spp *hederacea*	2
Imperata cylindrica	2

Lepidosperma laterale	1
Leptospermum trinervium	1
Lomandra cylindrica	1
Lomandra filiformis ssp *filiformis*	1
Lomandra longifolia	3
Lomandra multiflora ssp *multiflora*	1
Lomandra obliqua	1
Lomatia silaifolia	3
Micrantheum ericoides	3
Ozothamnus diosmifolius	1
Persoonia lanceolata	1
Persoonia levis	1
Pimelea linifolia ssp *linifolia*	2
Pittosporum undulatum	1
Polyscias sambucifolia	2
Pomax umbellata	1
Pteridium esculentum	2
Stylidium graminifolium	1
Themeda australis	4
Xanthorrhoea sp. *(media?)*	3

Weed Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Asparagus aethiopicus (seedlings)	1
Cinnamomum camphora	1
Coreopsis lanceolata	1
Lantana camara	1
Ligustrum sinense	1
Ochna serrulata	1

ESTUARINE QUADRAT
FIELD OF MARS

This quadrat is located on Strangers Creek just north of Pittwater Road. The vegetation community is a closed sedgeland of Coastal Saltmarsh, which is listed as an Endangered Ecological Community (TSC Act, 1995) and is representative of the Estuarine Complex described by Benson & Howell (1994) and of the Map Unit 34: Mangrove/Saltmarsh complex described by Tozer (2003). Species within the quadrat consist of *Baumea juncea* with *Samolus repens* bordered by mangroves dominated by *Avicennia marina var. australasica* on the eastern side and a single 3m *Casuarina glauca*. There is a fire trail on the northern edge with a border of weeds on the fill slope above the quadrat.

Native Plant Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Alternanthera denticulata	2
Avicennia marina var *australasica*	2
Baumea juncea	6
Casuarina glauca	1
Juncus kraussii	2
Lobelia alata	1
Samolus repens	2
Sarcocornia quinqueflora ssp *quinqueflora*	2
Sporobolus virginicus var *virginicus*	2
Tetragonia tetragonoides	2
Typha orientalis	5

Weed Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Acetosa sagittatus	1
Atriplex prostrata	1
Cynodon dactylon	2
Lonicera japonica	2
Pennisetum clandestinum	1
Salpichroa origanifolia	2
Stenotaphrum secundatum	1

COACHWOOD QUADRAT
FIELD OF MARS

This quadrat measures 40m x 10m and is located at the top of Buffalo Creek just below Cressy Road and the Cascades. The northern edge consists of open woodland of *Angophora costata* (dbh: 2.20m) on the escarpment grading into a forest to closed-forest of *Ceratopetalum apetalum* and *Tristaniopsis laurina* along the creek. The understorey consists of *Callicoma serratifolia*, *Acmena smithii*, ferns and young Coachwoods. This is the distinctive riparian vegetation of Hawkesbury Sandstone vegetation communities as described by Benson and Howell (1994). The quadrat was too narrow to be classified.

Native Plant Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Acacia suaveolens	1
Angophora costata (adult + saplings)	1
Austromyrtus tenuifolia	2
Bauera rubioides	1
Callicoma serratifolia	2
Calochlaena dubia	2
Ceratopetalum apetalum	4
Ceratopetalum gummiferum	2
Cryptostylis erecta	2
Dianella caerulea var *producta*	2
Doodia caudata	2
Elaeocarpus reticulatus	1
Entolasia stricta	3
Epacris microphylla	1
Eustrephus latifolium	3
Gahnia sieberiana	2
Hibbertia dentata	1
Lambertia formosa	1
Lomandra longifolia	2
Lomatia silaifolia	2
Notelaea longifolia	1
Omalanthus nutans	1
Pandorea pandorana	2
Pittosporum undulatum	3
Platylobium formosum ssp *formosum*	1
Poa affinis	3
Pteridium esculentum	1
Pultenaea flexilis	1
Smilax glyciphylla	3
Tristaniopsis laurina	3
Zieria smithii	1

Weeds in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Ageratina riparia	1
Asparagus aethiopicus	1
Cinnamomum camphora	1
Dietes sp	2
Lantana camara	1
Ligustrum lucidum	3
Ligustrum sinense	3
Ochna serrulata	2
Olea europaea ssp *africana*	2
Senna pendula	1
Tradescantia fluminensis	2

BURNT SCLEROPHYLL QUADRAT
FIELD OF MARS

This quadrat is located along the Sand Track in an area that was burnt in 2002. It occurs in vegetation described by Benson & Howell (1994) as Sydney Sandstone Gully Forest and mapped by Oculus (1999) as Sydney Sandstone Gully Forest Complex. The vegetation on this southeast-facing slope is of open woodland sclerophyllous species typical of Hawkesbury Sandstone geology. The dominant trees are *Eucalyptus resinifera*, *Corymbia gummifera* and *Angophora costata* with an understorey of regenerating *Acacia terminalis*, *A. linifolia*, *Dodonaea triquetra*, *Kunzea ambigua, Lomandra,* and native grasses and herbs are well represented. This quadrat has a large number of native plants (57) and 33 positive diagnostic species that correspond to Map Unit 33: Western Sydney Gully Forest described by Tozer (2003). Besides the wonderful diversity of native species, there are no weed species in this quadrat.

Native Plant Species in 400^{2}m Quadrat	
Scientific Name	**Braun-Blanquet Cover Scale**
Acacia linifolia	3
Acacia longifolia	2
Acacia suaveolens	2
Acacia terminalis	4
Acacia ulicifolia	1
Acianthus fornicatus	2
Allocasuarina littoralis	1
Angophora costata	1
Anisopogon avenaceus	1
Banksia spinulosa var *spinulosa*	1
Billardiera scandens	1
Bossiaea obcordata	1
Corymbia gummifera	1
Cryptostylis erecta	2
Dianella caerulea var *producta*	3
Digitaria parviflora	1
Dillwynia retorta	3
Dodonaea triquetra	2
Elaeocarpus reticulatus	3
Entolasia stricta	4
Eucalyptus resinifera	2
Drosera peltata ssp *peltata*	1
Goodenia hederacea ssp *hederacea*	1
Gonocarpus teucrioides	2
Grevillea buxifolia	1
Grevillea sericea	2
Hardenbergia violacea	1
Hibbertia aspera	1
Imperata cylindrica	2

Kennedia rubicunda	1
Kunzea ambigua	3
Laxmannia gracilis	2
Lepidosperma laterale	1
Lepyrodia scariosa	1
Leucopogon ericoides	2
Lobelia dentata	1
Lomandra glauca ssp *glauca*	2
Lomandra longifolia	4
Lomandra obliqua	1
Lomatia silaifolia	2
Microlaena stipoides var *stipoides*	2
Micrantheum ericoides	3
Olearia microphylla	1
Opercularia aspera	1
Ozothamnus diosmifolius	2
Persoonia levis	1
Phyllanthus hirtellus	3
Pimelia linifolia ssp *linifolia*	4
Platylobium formosum	2
Platysace lanceolata	2
Polyscias sambucifolia	2
Pomax umbellata	1
Pratia purpurascens	2
Pteridium esculentum	1
Smilax glyciphylla	1
Themeda australis	2
Xanthorrhoea media ssp *media*	2

APPENDIX 4:

FAUNA RECORDED IN SURVEY QUADRATS

Quadrat	Date	Hair Tube	Spot-light	Bats (Anabat + spotlight	Bird Survey	Reptile Survey	Frog Survey
DARVALL	17 May	R. rattus (1)					
	28 Oct	*R. rattus* (1) *M. musculus* (1)					
	13 May		Nil	Nil			
	14 May		Nil	Nil			
	23 Oct		Cat (1) Dog (2)	*N. australis* (1)			
	24 Oct		Nil	Nil			
	15 May				C Rosella 2 E Rosella 1 N. Miner 2 SC Cock 1 Magpie 2	*E quoy* 1 *L guich* 2	
	16 May				E Rosella 2 N. Miner 5 Magpie 3 E Whipbd 1 E Spinebill 1	*E. quoy* 2 *L. guich* 2 *L delicata* 1	
	2 Nov				Magpie 1 E Rosella 1 N. Miner 3 Magpie 1 E Whipbd 2	*E. quoy* 1 *L. guich* 4 *L. delicata* 2	
	3 Nov				Rain Lorik 3 N. Miner 2 Magpie 2 Currawong 1 Starling 2	*E. quoy* 2 *L. guich* 2	
	11May						Nil
	12 May						Nil
LILLY-PILLY (Lambert)	1 May	Nil					
	24 Oct	*R. rattus* (1)					
	27 April		*T. vulpec* (1)	Fly Fox (2)			
	28 April		Cat (1)	Nil			
	22 Oct		Cat (2)	Fly Fox (4)			
	24 Oct		*T. vulpec* (1) Dog (2)	Fly Fox (3) *C. gouldii* (2)			
	29 April				N. Miner 3 Magpie 1 Ind Myna 4 Sparrow 2	*L. guich* 2	
	30 April				Bulbul 2 N. Miner 7 Magpie 3 Ind Myna 3 Bulbul 3	*L. guich* 3 *L. delicata* 1	
	19 Oct				Kookaburrra 1 Magpie 3 Ind Myna 1 Sparrow 2 Bulbul 2	*L. guich* 4	

	20 Oct 26 April 11 May 2 Nov 5 Nov				Magpie 1 Ind Myna 1 Sparrow 1 Bulbul 5 Aust Raven 1	*L. guich* 2 *L. delicata* 2	 Nil Nil Nil *L. peroni* (1)
TURPENT CASSINE (Lambert)	1 May 24 Oct 27 April 28 April 22 Oct 24 Oct 29 April 30 April 19 Oct 20 Oct 26 April 11 May 2 Nov 5 Nov	Nil *R. rattus* (1)	 Nil *T. vulpec* (1) Tawny Frog (1) *T. vulpec* (1)	 Fly Fox (2) Fly Fox (3) Fly Fox (5) Fly Fox (8)	 Magpie 1 E Rosella 1 N. Miner 3 Crest pigeon 1 Rain Lorik 3 Ind Myna 1 Currawong 1 Starling 2 N. Miner 3 Red Wattlebd 1 Crest pigeon 4 Ind Myna 2 Grey Butcher 1 N. Miner 3 Red Wattlebd 1 Ind Myna 1 Currawong 2 Kookaburra 1 N. Miner 6 Red Wattlebd 3 Ind Myna 2 Currawong 4 Kookaburra 1 White-pl HE 1	 *L. guich* 2 *L. guich* 3 *L. delicata* 1 *L. guich* 4 *L.delicata* 3 *L.guich* 3	 Nil Nil Nil Nil
SCHIZOM (Brush Farm)	9 May 6 Nov 5 May 8 May 1 No 2Nov 5May 6May 2 Nov 3Nov 11 May 12 May 2 Nov 5 Nov	*R. rattus* 1 *R. rattus* 1 Fox 1	 *T. vulpec 1* *P. peregri* 1 Nil *T. vulpec* 1 *T vulpec* 1 *P. peregri* 1	 Fly Fox 3 Fly Fox 7 *C. gouldii* 2 Fly Fox 5 *N. geoffro* 1	 Br own Thorn 2 E Yellow Rob 1 Cr Shrike-Tit 1 Wh-brow SW 3 Wh-brow SW 2 Br Thorn 2 Striat Thorn 2 Brown Thorn4 Olive-back Or 1 Hors Brnze C 1 Cr Shrike-Tit 1 Wh-brow SW 3	 *L. guich* 2 *L. guich* 3 *L. guich* 4 *E. quoyii* 1 *S. mustel* 1 *L. guich* 3	 *C. signif* 2 *C. signif* 3 *C. signif* 1 Nil
SYD BLUE GUMS (Brush Farm)	9 May 6 Nov 5 May	Nil *R. rattus* 1 *M. muscu* 2	 Nil	 Fly Fox 4			

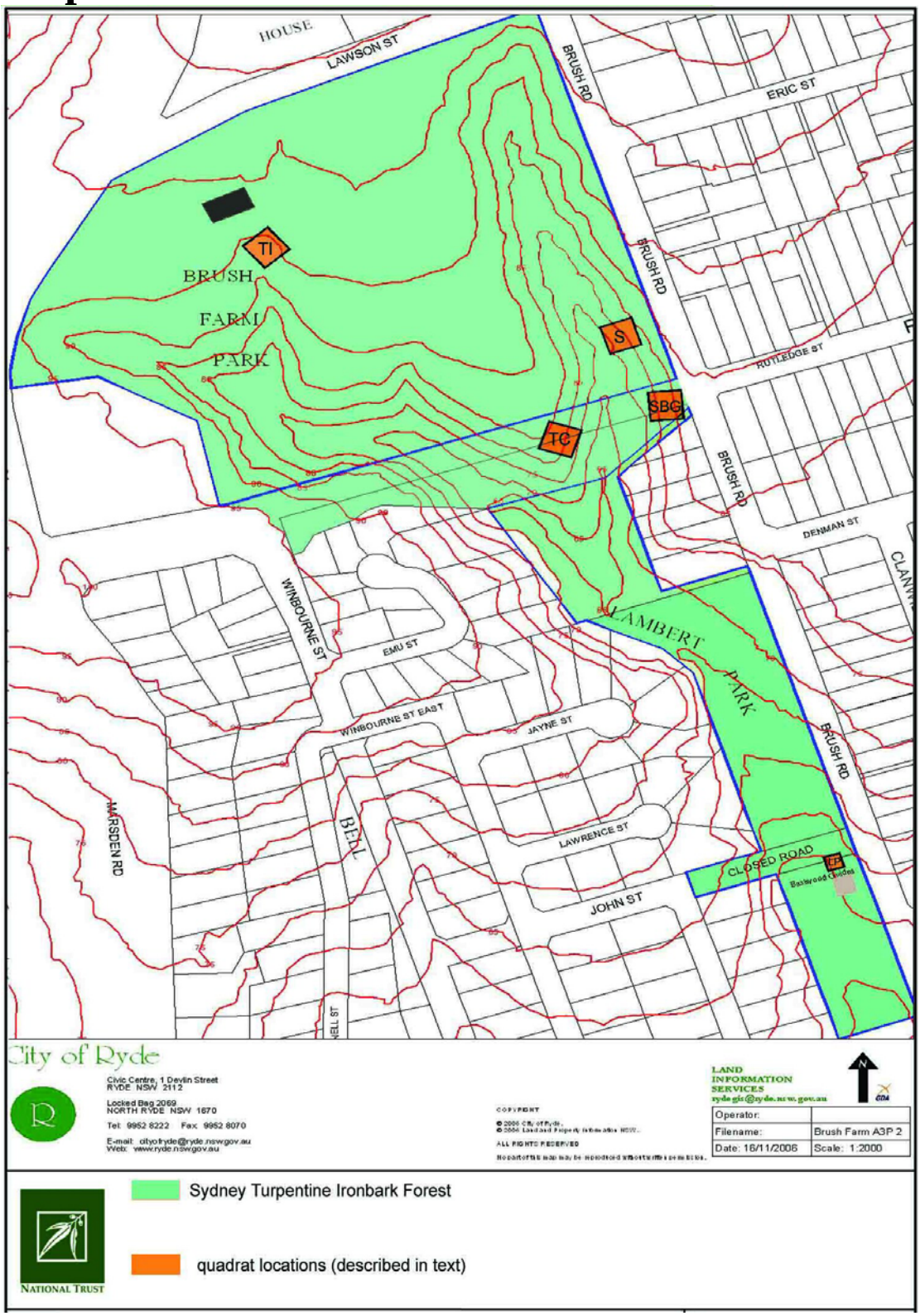
	8 May 1 Nov 2Nov 5May 6May 2 Nov 3Nov 11 May 12 May 2 Nov 5 Nov		Nil Tawny Fr 1 Nil	Fly Fox 4 Fly Fox 1 Fly Fox 2 Cat 1	 N. Miner 3 Magpie 2 Kookaburra 1 New-holl HE 1 Spot Pardal 1 N. Miner 2 Blackface CS 1 Red Wattlebd 1 Spot Pardal 1 Crim Rosella 1 N. Miner 4 Magpie 1 Aust Raven 2 Kookaburra 1 Blackface CS 2 Koel 1 N. Miner 2 Koel 1 Currawong 2 Willy Wagtl 1 Spot Pardal 1	 *L. guich* 3 *L. guich* 5 *L. guich* 3 *C. virgata* 1 *L. guich* 4 *S. mustel* 1	 Nil Nil Nil Nil
TURPENT IRONBAR (Brush Farm)	9 May 6 Nov 5 May 8 May 1 Nov 2Nov 5May 6May 2 Nov 3Nov 11 May 12 May 2 Nov 5 Nov	*M.muscul* 2 *M.muscul* 2 *R. rattus* 1	 Nil *T.vulpec* 1 TawnyFr 1 *T.vulpec* 1	 Fly Fox 3 Fly Fox 2 *C. gouldii* 2 Fly Fox 1 *N. austral* 1 Fly Fox 4 *N. austral* 1	 Blackface CS 1 Currawong 3 N Miner 2 Red Wattlebd 1 Willy Wagtail 1 Magpie 1 Blackface CS 2 E. Yellow Ro 1 Jacky Winter 1 Spot Pard 1 Rufous Whist 1 Blackface CS 1 Currawong 1 Grey Butcher 1 Willy wagtail 1 N. Miner 2	 *L. guich* 4 *L. guich* 3 *E. quoyii* 1 *L.guich* 3 *S. mustel* 1 *L.guich* 3 *L.delicata* 2	 Nil Nil Nil Nil
WELLING TON ROAD (Field of Mars)	16 May 14 Oct 13 May 14 May 9 Oct 11 Oct 11 May 12 May	*M.muscul* 1 Nil	 *T. vulpec* 1 Tawny Fr 1 Owlet-N 1 *T. vulpec* 1 Boobook 1 Dog 2 Dog 1	 Fly Fox 1 Fly Fox 3 *C. gouldii* 2 Fly Fox 3 *C. gouldii* 1 *N. austral* 1 Fly Fox 6 *C. gouldii* 2	 Magpie 2 Currawong 1 Blackface CS 1 Wel Swallow 1 Aust Raven 1	 *L. guich 2* *L.delicata 3* *L. guich 2*	

	12 Oct 13 Oct 26 Apr 12 May 3 Nov 6 Nov				Magpie 2 Red Wattlebd 1 Blackface CS 2 Currawong 1 Noisy Friarbd 4 Red Wattlebd 2 Noisy. miner 4 White-pl HE 2 Noisy Friarbd 8 Red Wattlebd 3 Rainbow Lor 3 White-pl HE 2 Noisy Miner 5	*L. guich* 5 *L.delicata* 1 *L. guich* 5 *L.delicata* 5	 Nil Nil Nil Nil
COACHWOOD (Field of Mars)	16 May 14 Oct 13 May 14 May 9 Oct 11 Oct 11 May 12 May 12 Oct 13 Oct 26 Apr 12 May 3 Nov 6 Nov	*M.muscul* 2 *R. rattus* 1 *M.muscul* 1 *R. rattus* 2	*P.peregri* 1 Nil Nil Nil	Fly Fox 1 Nil Fly Fox 4 Fly Fox 4 *C. gouldii* 1	Willy Wagtail 1 Redbrow Fire 3 Whitebro SW 1 Bulbul 2 E. Spinebill 1 Whitebro SW 2 Redbrow Fire 2 Sup BlueWre 2 Kookaburra 1 Willy Wagtail 1 Rufous Whist 1 Bulbul 2 NewHoll HE 2 Currawong 1 Whitebro SW 1 BulBul 2 E. Spinebill 1 Sup Blue Wre 3 Noisy Miner 2 Fantail Cuck 1	*E. quoyii* 4 *L.guich* 1 *E. quoyii* 2 *L.guich* 3 *L.delicata* 1 *E. quoyii* 4 *L.guich* 2 *E. quoyii* 3 *L.guich* 5 *L.delicata* 2	 *Lim peron* 1 *Lim peron* 2 *Lim peron* 1 *C. signifer* 3 *Lim peron* 1 *C. signifer* 3
SCRIBBLY GUM (Field of Mars)	16 May 14 Oct 13 May 14 May 9 Oct 11 Oct 11 May 12 May 12 Oct 13 Oct	Nil Nil	Fox 1 TawnyFr 1 Nil Dog 2 Dog 1 Fox 1	Fly Fox 2 Fly Fox 2 Fly Fox 4 Fly Fox 2	Magpie 2 Currawong 1 Kookaburra 1 Sulp-Crest C 1 Magpie 2 Aust raven 2 Bulbul 2 Indian Myna 3 Starling 2 Bulbul 3 Magpie 2 MagpieLark 1 Bulbul 3 Sp TurtleDve 1 Magpie 2	 *L.guich* 2 *L.guich* 1 *L.guich* 4 *C.virgata* 2 *L.guich* 3	

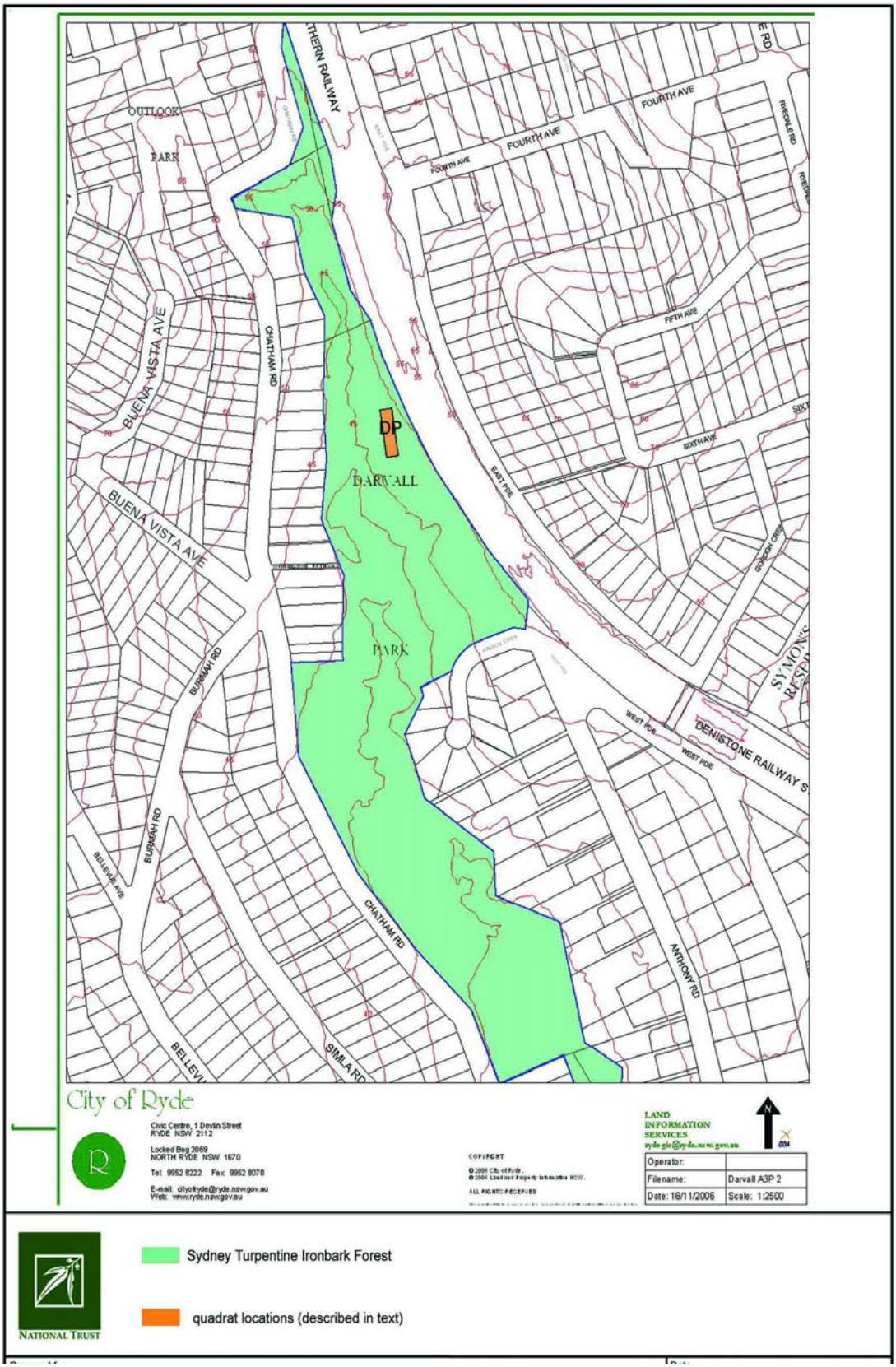
					Grey Fantail 1		
	26 Apr						Nil
	12 May						Nil
	3 Nov						Nil
	6 Nov						Nil
BURNT	16 May	*M.muscul 2*					
SCLEROP	14 Oct	*M.muscul* 3					
HYLL		*R.rattus* 1					
(Field of	13 May		Nil	Fly Fox 5			
Mars)	14 May		Nil	Fly Fox 3			
	9 Oct		Cat 1	Fly Fox 3			
	11 Oct		Nil	Fly Fox 8			
				N. austral 1			
	11 May				Magpie 2	*L.guich* 2	
					Grey Butcher 1		
					Willy Wagtail 1		
					Aust Raven 2		
	12 May				Blackface CS 2	*L.guich* 3	
					Grey Butcher 1	*L.delicata* 1	
					Magpie 1		
					E. Yellow Ro 1		
					Kookaburra 1		
	12 Oct				Crim Rosella 1	*L.guich* 2	
					Kookaburra 1		
					Fantail Cuck 1		
					Currawong 2		
					Noisy Miner 2	*L.guich* 5	
	13 Oct				Aust Raven 2		
					Noisy Miner 3		
					Currawong 3		
					Fantail Cuck 1		
					Channelbill 1		
	26 Apr						Nil
	12 May						Nil
	3 Nov						Nil
	6 Nov						Nil
ESTUARIN	16 May	Nil					
E (Field of	14 Oct	Nil					
Mars)	13 May		*R. rattus* 1	Fly Fox 2			
			Nankeen	*C. gouldii* 2			
			NH 1				
	14 May		Nil	Fly Fox 4			
	9 Oct			Fly Fox 5			
				C. gouldii 2			
			Nil	*M advers* 2			
	11 Oct		Nil	Fly Fox 3			
				C. gouldii 2			
				M. advers 3			
	11 May				L. Black Cor 2	*E. quoyii* 2	
					L. pied Cor 1		
					Whiteface H 1		
					White Ibis 3		
	12 May				L.Black Cor 3	*E. quoyii* 4	
					Darter 1		
					Grey Fantail 2		
	12 Oct				L.Black Cor 1	*E. quoyii* 2	
					Intermed Egr 1	*L.guich* 2	
					Jacky Winter 1		
					White Ibis 2		
					Pac Black Du 2		
					Koel 1		
	13 Oct				L.Black Cor 2	*E. quoyii* 2	
					Darter 1	*P. lesueur* 1	
					Grey Fantail 1	*L.guich* 3	
					Pac Black Du 2		
					Chestnut Teal 2		
					Aust Raven 1		
					Sacred Kingf 1		
	26 Apr						*C. signifera* 2
	12 May						*Lim per* 1
							C.signifera 3
	3 Nov						*C. signifer* 2
	6 Nov						Nil

APPENDIX 5:

VEGETATION MAPS
Map 5A: Brush Farm Park and Lambert Park



MAP 5B: Darvall Park Vegetation Community



MAP 5C: Field of Mars Vegetation Communities