

BUSHLAND FAUNA SURVEYS CITY OF PARRAMATTA OCTOBER 2016 - APRIL 2017

PREPARED FOR THE CITY OF PARRAMATTA MAY 2017





DOCUMENT VERIFICATION

Document Title	FAUNA SURVEYS OCTOBER 2016- APRIL 2017					
Client	CITY OF PARRAMATTA COUNCIL					
Client contact	TROY HOLBROOK					

Revision	Prepared by	Reviewed by	Date
А	AC, MB	MB	MAY 2017
В		СОР	JUNE 2017
0	Final issued by	Anne Carey	23/6/2017

COMMERCIAL IN CONFIDENCE

All intellectual property rights, including copyright, in designs developed and documents created by APPLIED ECOLOGY Pty Limited remain the property of that company. Any use made of any such design or document without the prior written approval APPLIED ECOLOGY Pty Limited will constitute an infringement of the rights of that company which reserves all legal rights and remedies in respect of any such infringement.

The information, including the intellectual property, contained in this document is confidential and proprietary to APPLIED ECOLOGY Pty Limited. It may only be used by the person to whom it is provided for the stated purpose for which it is provided, and must not be imparted to any third person without the prior written approval of APPLIED ECOLOGY Pty Limited. APPLIED ECOLOGY Pty Limited reserves all legal rights and remedies in relation to any infringement of its rights in respect of its confidential information.

DISCLAIMER

This report is prepared by APPLIED ECOLOGY Pty Limited for its clients' purposes only. The contents of this report are provided expressly for the named client for its own use. No responsibility is accepted for the use of or reliance upon this report in whole or in part by any third party. This report is prepared with information supplied by the client and possibly other stakeholders. While care is taken to ensure the veracity of information sources, no responsibility is accepted for information that is withheld, incorrect or that is inaccurate. This report has been compiled at the level of detail specified in the report and no responsibility is accepted for interpretations made at more detailed levels than so indicated.

ACKNOWLEDGMENTS

APPLIED ECOLOGY Pty Limited wishes to thank all representing organisations who contributed to the production, content or commented on the content of this report:

Jenny Stiles Marg Turton Georgeanna Story - Scats About Peter Ridgeway "Friends of Terrys Creek"

IMAGE CONTRIBUTORS Jenny Stiles Steve Paterson Bill de Belin & Wayne de Belin Merryn & Jonathan Horrocks Staff at City of Parramatta including: Troy Holbrook Talia Sawers Sally Williams James Smallson Carrie Jeffers Pino Todarello David Kuhle

Note Nearly all images are from the City of Parramatta LGA, taken during the survey by Applied Ecology staff with additional images supplied by residents. Special thanks to Jenny Stiles whose knowledge of the local Powerful Owl population and local avifauna were invaluable.

1 Executive Summary

This report was commissioned by the City of Prramatta to determine baseline fauna diversity in 14 disjunct bushland areas. Data was collected using a methodology that is repeatable and suitable for quantitative analysis.

148 vertebrate species (excluding fish) were detected during the survey including:

- 12 threatened species
- 4 species listed under the Bonn convention and/or JAMBA/CAMBA/ROKAMBA
- 15 exotic species

97 species of bird, 28 mammals, 7 amphibians, 16 reptiles and 1 species of Gastropoda - the threatened Dural Woodland Land Snail were recorded.

This project illustrates that the City Of Parramatta Local Government Area provides habitat for threatened species and more common sedentary species and is important temporary habitat for seasonal migrants and locally nomadic species.



Figure 1 A White-faced Heron & Great Egret hunting in post rain currents on Hunts Creek, April 2017.



Contents

DOCUMENT VERIFICATION	1
DISCLAIMER	1
ACKNOWLEDGMENTS	1
1 Executive Summary	2
2 Background	10
2.1 The Study sites	10
3 METHODOLOGY	11
Camera trapping	11
Call Playback	12
Spotlighting Survey	13
Bat ultrasonic (Anabat) call recording	14
Diurnal Bird Census	16
Herpetofauna Searches	16
Nocturnal Frog Searches	16
Nocturnal Snail Searches	17
Hair tubing	17
Ground Trapping	18
Searches for Evidence	19
Research Licensing	21
3.1 Key dates and equipment locations	21
4 RESULTS	24
4.1.1 SPECIES PROFILES	26
4.2 MEGAPODES	27
Australian Brush-turkey Alectura lathami	27
4.3 BIRDS OF THE EDGE	28
Australian White Ibis Threskiornis molucca	28
Australian Raven Corvus coronoides	29
Crested Pigeon Ocyphaps lophotes	29
Channel-billed Cuckoo Scythrops novaehollandiae	29
Eastern Koel Eudynamys orientalis	30
Grey Butcherbird Cracticus torquatus	30
Magpie-lark Grallina cyanoleuca	30
Masked Lapwing Vanellus miles	30
Pied Currawong Strepera graculina	31
Noisy Miner Manorina melanocephala	32
Welcome Swallow Hirundo neoxena	32
4.4 PARROTS	33

Australian King-Parrot Alisterus scapularis	
Crimson Rosella Platycercus elegans	
Eastern Rosella Platycercus eximius	34
Galah Eolophus roseicapillus	34
Little Corella Cacatua sanguinea	34
Long-billed Corella Cacatua tenuirostris	35
4.5 LARGER BUSH BIRDS	37
Australasian Figbird Sphecotheres vieilloti	37
Dollarbird Eurystomus orientalis	37
Eastern Whipbird Psophodes olivaceus	
Laughing Kookaburra Dacelo novaeguineae	
Olive-backed Oriole Oriolus sagittatus	
Red Wattlebird Anthochaera carunculata	40
Satin Bowerbird Ptilonorhynchus violaceus	41
Willie Wagtail Rhipidura leucophrys	41
4.6 SMALLER BUSH BIRDS	42
Black-faced Monarch Monarcha melanopsis	42
Brown Gerygone Gerygone mouki	43
Brown Thornbill Acanthiza pusilla	43
Eastern Spinebill Acanthorhynchus tenuirostris	44
Eastern Yellow Robin Eopsaltria australis	44
Golden Whistler Pachycephala pectoralis	44
Grey Fantail Rhipidura albiscapa	45
Leaden Flycatcher Myiagra rubecula	45
Lewins Honeyeater Meliphaga lewinii	45
Mistletoebird Dicaeum hirundinaceum	46
New Holland Honeyeater Phylidonyris novaehollandiae	46
Red-browed Finch Neochmia temporalis	47
Rufous Fantail Rhipidura rufifrons	47
Scarlet Honeyeater Myzomela sanguinolenta	48
Silvereye Zosterops lateralis	48
Striated Thornbill Acanthiza lineata	49
Superb Fairy-wren Malurus cyaneus	49
Variegated Fairy-wren Malurus lamberti	
Varied Sitella Daphoenositta chrysoptera	50
White-browed Scrubwren Sericornis frontalis	51
White-plumed Honeyeater Lichenostomus penicillatus	52
White-throated Treecreeper Cormobates leucophaea	52

appliedecology

Yellow-faced Honeyeater Lichenostomus chrysops chrysops	53
4.7 UP IN THE AIR	53
White-throated Needletail Hirundapus caudacutus	53
4.8 WATER BIRDS	54
Australasian Darter Anhinga novaehollandiae	57
Australasian Grebe Tachybaptus novaehollandiae	57
Australian Wood Duck Chenonetta jubata	57
Dusky Moorhen Gallinula tenebrosa	
(Eastern) Great Egret Ardea alba	
Eurasian Coot Fulica atra	59
Little Black Cormorant Phalacrocorax sulcirostris	59
Little Pied Cormorant Microcarbo melanoleucos	59
Pacific Black Duck Anas superciliosa	60
White-faced Heron Egretta novaehollandiae	60
4.9 BIRDS OF PREY	61
Brown Falcon Falco berigora	61
Brown Goshawk Accipiter fasciatus / Collared Sparrowhawk Accipiter cirrocephalus	61
Pacific Baza Aviceda subcristata	62
White-bellied Sea-eagle Haliaeetus leucogaster	63
4.10 NOCTURNAL BIRDS	64
Owlet Nightjar Aegotheles cristatus	64
Powerful Owl Ninox strenua	65
Southern Boobook Ninox boobook	
Tawny Frogmouth Podargus strigoides	
White-throated Nightjar Eurostopodus mystacalis	69
4.11 INTRODUCED SPECIES	70
Common Myna Sturnus tristis	70
Common Starling Sturnus vulgaris	70
Domestic Duck Anas platyrhynchos domesticus	70
European Blackbird Turdus merula	70
House Sparrow Passer domesticus	70
Nutmeg Mannikin Lonchura punctulata	71
Red-whiskered Bulbul Pycnonotus jocosus	71
Rock Dove Columba livia	71
Spotted Turtle-Dove Streptopelia chinensis	71
4.12 AMPHIBIANS	72
4.12.1 Southern frogs (families Myobatrachidae & Limnodynastidae)	73
Brown-striped Frog Limnodynastes peronii	73

Common Eastern Froglet Crinia signifera	74
Bibron's Toadlet Pseudophryne bibronii	75
Red-crowned Toadlet Pseudophryne australis	76
4.12.2 Tree frogs (Family Hylidae)	80
Eastern Dwarf Tree Frog Litoria fallax	80
Green Stream Frog Litoria phyllochroa	81
Peron's Tree Frog Litoria peronii	82
4.13 REPTILES	83
4.13.1 DRAGONS	83
Eastern Water Dragon Intellagama lesueurii lesueurii,	83
Jacky dragon Amphibolurus muricatus	85
4.14 GECKOES	86
Broad-tailed gecko Phyllurus platurus	86
Stone Gecko Diplodactylus vittatus	87
4.15 SKINKS	88
Dark-flecked Garden Sunskink Lampropholis delicata	88
Pale-flecked Garden Sunskink Lampropholis guichenoti	90
Copper-tailed skink Ctenotus taeniolatus	91
Eastern Blue-tongue Lizard Tiliqua scincoides	92
Eastern Water-skink Eulamprus quoyii	93
Elegant Snake-eyed Skink Cryptoblepharus pulcher pulcher	94
Three-toed Skink Saiphos equalis	95
Weasel Skink Saproscincus mustelinus	96
4.16 MONITORS	97
Lace Monitor Varanus varius	97
4.17 SNAKE-LIZARDS	98
Burton's Legless-lizard Lialis burtonis	98
4.18 SNAKES	99
Red-bellied Black Snake Pseudechis porphyriacus	99
4.19 TURTLES	100
Eastern Long-necked Turtle Chelodina longicollis	100
4.20 MAMMALS	101
Common Brushtail Possum Trichosurus Vulpecula	101
Common Ringtail Possum Pseudocheirus peregrinus	103
Grey-headed Flying-fox Pteropus poliocephalus	104
Long-nosed Bandicoot Perameles nasuta	105
Short-beaked echidna Tachyglossus aculeatus	107
Sugar Glider Petaurus breviceps	108

appliedecology

Swamp Wallaby Wallabia bicolor	110
4.21 MICROBATS	111
White-striped Free-tailed Bat Austronomus australis	111
Gould's Wattled Bat Chalinolobus gouldii	112
Chocolate Wattled Bat Chalinolobus morio	113
Eastern False Pipistrelle Falsistrellus tasmaniensis	114
Eastern Bentwing Bat Miniopterus orianae oceanensis	115
East-coast Free-tailed Bat Mormopterus norfolkensis	116
Ride's Free-tailed Bat Mormopterus ridei	117
Large-footed Myotis Myotis macropus	118
a Long-eared Bat Nyctophilus sp	119
Yellow-bellied Sheath-tailed Bat Saccolaimus flaviventris	120
Greater Broad-nosed Bat Scoteanax rueppellii	121
Eastern Broad-nosed Bat Scotorepens orion	122
Large Forest Bat Vespadelus darlingtoni	
Little Forest Bat Vespadelus vulturnus	124
4.22 Introduced mammals	126
Black Rat Rattus rattus	126
Cat Felis catus	128
Dog Canis lupus familiaris	129
House Mouse Mus musculus	129
Rabbit Oryctolagus cuniculus	129
Red Fox Vulpes vulpes	130
4.23 INVERTEBRATES	131
Dural Land Snail Pommerhelix duralensis	131
5 OTHER SURVEY RESULTS	140
5.1 SCAT COLLECTION	140
5.2 HAIRTUBE ANALYSIS	143
5.3 PELLET ANALYSIS	144
5.4 GROUND TRAPPING	144
6 FURTHER DISCUSSION	145
6.1 SUMMARY DATA FROM SURVEYS	145
6.1.1 Overall species richness	145
6.1.2 Avian fauna species richness	148
6.2 Avian species abundances	148
6.3 WHAT NATIVE BIRDS LIVE WHERE?	150
6.3.1 Darling Mills Creek Corridor	150
6.3.2 Hunts Creek Corridor (including Lake Parramatta)	151

	6.3.3	Devlins Creek Corridor	. 152
	6.3.4	Terrys Creek Corridor	. 153
	6.3.5	Quarry Branch Corridor	.154
	6.3.6	Vineyard Creek Corridor	.155
	6.3.7	Upper Ponds Creek Corridor	.156
	6.3.8	Lower Ponds – Subiaco Creek Corridor	.157
	6.3.9	Upper Toongabbie Creek Corridor	. 158
	6.3.10	Lower Toongabbie Creek Corridor	. 159
	6.3.11	Baludarri Wetland	.160
	6.3.12	Ermington Bay	.161
	6.3.13	Edna Hunt Sanctuary	.162
	6.3.14	Haines Reserve Corridor	.163
	6.4 SC	OME OVERALL TRENDS	.164
	6.4.1	Birds	.164
	6.4.2	How similar are avifauna groups across the reserves?	.165
	6.4.3	All other vertebrates	.167
	6.5 TI	HREATENED AND MIGRATORY SPECIES	.168
	6.6 C	OMPARISON WITH PREVIOUS SURVEYS	.171
	6.7 N	IICROBATS OF PARRAMATTA BUSHLAND	.174
	6.7.1	Identification using echolocation calls	.174
	6.7.2	RESULTS OF SURVEYS	.175
7	DISCUS	SION	.178
	7.1 FI	RE IMPACTS AND MANAGEMENT	.178
	7.1.1	Impacts on vegetation and habitat	.179
	7.1.2	Impacts for animals	.180
	7.1.3	Recommendations for management of reserves	.184
	7.2 N	licrobats in urban areas	. 185
	7.2.1	Habitat partitioning in Parramatta LGA	.186
	7.2.2	Availability of food resources	.190
	7.2.3	Habitat preferences	. 190
	7.2.4	Predatory and competitive birds	. 192
	7.2.5	MAIN URBANISATION IMPACTS FOR MICROBATS	. 192
	7.2.6	Summary of potential impacts for microbats	. 195
	7.3 TI	HREATS FOR SWAMP WALLABIES IN URBAN AREAS	. 195
	7.3.1	Future projects for Swamp Wallaby management	. 197
	7.3.2	Vegetation Management for Swamp Wallabies	. 197
8	SUMMA	ARY OF RECOMMENDED MANAGEMENT ACTIONS	.200
	8.1 N	IANAGEMENT OF FAUNA SPECIES/GROUPS	.200

appliedecology

8.	MANAGEMENT OF RESERVES/CORRIDORS	203
9	REFERENCES & FURTHER READING	207
9.	MICROBAT REFERENCES	209
9.	SWAMP WALLABY REFERENCES	212
9.	FIRE IMPACTS REFERENCES	214
9.	VARIED SITELLA REFERENCES	217
9.	WHITE-BELLIED SEA-EAGLE REFERENCES	217
9.	POWERFUL OWL REFERENCES	218
9.	RED-CROWNED TOADLET REFERENCES	219
9.	DURAL LAND SNAIL REFERENCES	219
10	APPENDIX A PROJECT SPECIES LIST	221
11 Octo	APPENDIX B Combined Records -AE survey, Volunteers, Ebird and NSW Wildlife Atlas for period per 2016- April 2017	226
12	APPENDIX C THE BUSHLAND CORRIDORS	231
1.	DEVLINS CREEK	232
1.	HAINES AVENUE RESERVE	237
1.	DARLING MILLS BUSHLAND CORRIDOR	241
1.	HUNTS CREEK CORRIDOR (INCLUDES LAKE PARRAMATTA RESERVE)	248
1.	THE QUARRY BRANCH BUSHLAND CORRIDOR	254
1.	UPPER TOONGABBIE CREEK CORRIDOR	258
1.	THE LOWER TOONGABBIE BUSHLAND CORRIDOR VEGETATION	264
1.	VINEYARD CREEK BUSHLAND CORRIDOR	268
1.	LOWER PONDS CORRIDOR	272
1.	0 UPPER PONDS BUSHLAND CORRIDOR	276
1.	1 EDNA HUNT SANCTUARY	281
1.	2 TERRYS CREEK BUSHLAND CORRIDOR	284
1.	3 ERMINGTON BAY	289
1.	4 BALUDARRI WETLAND	294
13	APPENDIX D WEATHER CONDITIONS DURING THE STUDY	299
14	APPENDIX E STUDY TEAM	301

2 Background

The 'Life in Our City' Parramatta Biodiversity Strategy 2015-2025 provides the framework for conservation and enhancement of biodiversity in Parramatta LGA. A Key Target of the Strategy is to achieve 'no net loss to biodiversity across the LGA between 2015 and 2025'. Native species data is a key indicator of this target and the Strategy recommends that Council 'review and update flora and fauna survey data and mapping every five years'.

Bushland fauna surveys were previously undertaken for Council in 2011/12. Prior to these surveys, only a small number of bushland sites had comprehensive fauna data. Species richness data from these surveys confirmed the correlation between patch size and species density (Birdlife Australia research found that reserves smaller than 2ha will likely only support common urban birds and at least 4 ha is required for many of the urban generalist species that are less prevalent in urban habitat).

The NSW Government proclaimed the 'City of Parramatta' on 12 May 2016, which has resulted in significant areas of bushland being transferred from Hornsby and The Hills Councils. This proclamation also facilitated the loss of bushland from the southern portion of the LGA to Cumberland Council. An updated fauna survey of key bushland corridors and reserves was required to enable Council to conserve and protect biodiversity within the new LGA boundaries in accordance with the goals of the Strategy.

2.1 The Study sites

The study includes 14 discrete sites of contiguous bushland (some connectivity occurs outside the LGA or is not in public ownership as occurs with Devlin's Creek Corridor & the Hunts Creek Corridor) as illustrated in Figure 2 Study site locations overleaf.

DESCRIPTION/NAME	SUBURB	AREA (HA)	CATCHMENT
1. DARLING MILLS CREEK CORRIDOR	NORTH ROCKS	75.13	DARLING MILLS CREEK
2. HUNTS CREEK CORRIDOR	CARLINGFORD	105.85	HUNTS CREEK
3. DEVLINS CREEK CORRIDOR	BEECROFT	16.42	DEVLINS CREEK
4. TERRYS CREEK CORRIDOR	EPPING	21.51	TERRYS CREEK
5. QUARRY BRANCH CREEK CORRIDOR	WINSTON HILLS	36.09	QUARRY BRANCH CREEK
6. VINEYARD CREEK CORRIDOR	TELOPEA	29.48	VINEYARD CREEK
7. UPPER PONDS CREEK CORRIDOR	CARLINGFORD	35.20	UPPER PONDS CREEK
8. LOWER PONDS-SUBIACO CREEKS CORRIDOR	RYDALMERE	27.84	LOWER PONDS-SUBIACO CREEK
9. UPPER TOONGABBIE CREEK CORRIDOR	CONSTITUTION HILL	63.45	UPPER TOONGABBIE CREEK
10. LOWER TOONGABBIE CREEK CORRIDOR	NORTHMEAD	28.66	LOWER TOONGABBIE CREEK
11. BALUDARRI WETLAND	PARRAMATTA	1.65	PARRAMATTA RIVER
12. ERMINGTON BAY	MELROSE PARK	27.29	PARRAMATTA RIVER
13. EDNA HUNT SANCTUARY	EPPING	7.21	EDNA HUNT SANCTUARY
14. HAINES AVE RESERVE	CARLINGFORD	4.73	HAINES AV RESERVE

Table 1 Corridor overview





Figure 2 Study site locations

3 METHODOLOGY

The following techniques were used in conjunction with ad hoc observations collected while traversing the study site. See section 3.1 for key sampling dates.

Camera trapping

Remote cameras were deployed in each reserve in each major habitat in rotation throughout the sampling period (October- April 2017). The number of nights of sampling reflects the size and habitat complexity within a corridor and extra effort to detect particular species in certain locations.

Table 2 Camera trapping survey effort

CORRIDOR	DARLING MILLS CREEK CORRIDOR	HUNTS CREEK CORRIDOR	DEVLINS CREEK CORRIDOR	TERRYS CREEK CORRIDOR	QUARRY BRANCH CREEK CORRIDOR	VINEYARD CREEK CORRIDOR	UPPER PONDS CREEK CORRIDOR	LOWER PONDS- SUBIACO CREEKS CORRIDOR	UPPER TOONGABBIE CREEK CORRIDOR	LOWER TOONGABBIE CREEK CORRIDOR	BALUDARRI WETLAND	ERMINGTON BAY	EDNA HUNT SANCTUARY	HAINES AVE RESERVE
NIGHTS	72	110	28	52	12	28	34	25	50	16	12	12	24	14

Cameras were not deployed on tracks due to the potential for tampering but were set off track in suitable locations such as along animal pads or, when targeting arboreal mammals, in preferred feed trees such as *Corymbia gummifera*. Baiting stations were set up at each camera site to attract animals into the field of view of the camera. Universal bait (peanut butter, honey & rolled oats) in a pvc canister were used at all sites. Baits were deployed up trees, on the ground, and (where Black Rats *Rattus rattus* were an issue) hung by a wire from an appropriate height.



Figure 3 Bait canister deployed approximately 4 metres AGL (left), Sugar glider at canister (right). Vineyard Creek 2017.



■ (082F 27℃ 01/11/2016 18:40:50

Figure 4 Tree mounted camera (left) with baiting station in the field of view, Lucknow Park. View over camera to wire hung canister (right) deployed at Galaringi targeting Swamp Wallaby.

Call Playback

Call playback is commonly used as a technique for detecting nocturnal birds (Kavanagh et al. 1995, Wintle et al. 2005, DEC (2004) unpublished) who may respond to vocalisations of their own species within their territories by "calling back". Call playback was undertaken after spotlighting on 16 occasions. Calls of each species were broadcast for 5 minutes followed by a ten minute listening period. Calls were broadcast using a 25W megaphone that were effective (clearly audible to the human ear) for approximately 600m.The calls broadcast were of four owl species: the Barking Owl (*Ninox connivens*), the Eastern Barn Owl (*Tyto*)

delicatula), the Masked Owl (Tyto novaehollandiae) and the Sooty Owl (Tyto tenebricosa

tenebricosa). We excluded the Powerful Owl (*Ninox strenua*) and Southern Boobook (*Ninox boobook*) from this process due to its known occurrence in the study area(s) and ongoing research by others – further calling is unlikely to reveal new information and risks disturbing resident individuals and pairs. In addition, the "yipping" call of the Sugar glider was played during spotlighting sessions from a handheld speaker attached to a smartphone in habitats where there was some evidence of occupation.



Spotlighting Survey

Spotlighting was undertaken for all terrestrial and arboreal mammals, amphibians and nocturnal birds within the study area. Spotlighting was undertaken using 50- 100 watt hand held spotlights as appropriate which were used to sweep surrounding vegetation in search of eye-shine or animal movements. Time was spent listening for calls at 10 minute intervals for 1 minute. All fauna heard or observed during spotlighting meanders were recorded. Spotlighting was undertaken in all vegetation communities in the study area.

CORRIDOR	DARLING MILLS CREEK CORRIDOR	HUNTS CREEK CORRIDOR	DEVLINS CREEK CORRIDOR	TERRYS CREEK CORRIDOR	QUARRY BRANCH CREEK CORRIDOR	VINEYARD CREEK CORRIDOR	UPPER PONDS CREEK CORRIDOR	LOWER PONDS- SUBIACO CREEKS CORRIDOR	UPPER TOONGABBIE CREEK CORRIDOR	LOWER TOONGABBIE CREEK CORRIDOR	BALUDARRI WETLAND	ERMINGTON BAY	EDNA HUNT SANCTUARY	HAINES AVE RESERVE
SPOTLIGHTING SESSIONS	5	12	3	6	5	4	3	4	3	3	1	2	3	3
OWLING	2	-	1	-	-	-	1	2	2	2	1	1	1	1

Table 3 Spotlighting survey effort

Bat ultrasonic (Anabat) call recording

The method requires the recording and identification of high frequency, echolocation calls made by bats, which, except for one or two species, are ultrasonic, that is, inaudible to humans.



The recording equipment consisted of an Anabat II[®] SD detector and digital flash card recorder, housed within a Tupperware box for weather protection and an Anabat Express[®] unit positioned in a fixed location for multiple nights. Optimum locations were selected during the day to target areas most likely to have higher levels of microbat activity within the reserve, for example, over waterways, near cliffs, caves, overhangs, old buildings, bridges, etc. Multiple locations were surveyed in larger reserves to ensure adequate sampling for the reserve size. Surveys were conducted between 10th October 2016 and 8th April 2017. Selection of survey nights targeted the most suitable weather conditions – nights around the full moon were avoided, along with wet and windy nights. Microbat call identification is a specialised process. Anabat recordings were transferred onto computer and sent to Margaret Turton (an expert in this field) for analysis. Identifications are designated as either: definite, probable or possible, following the methodology of Parnaby (1992). Recordings are assessed visually and compared to reference libraries of calls taken in the Sydney basin.





Figure 3. Features of a generic call pulse.

Figure 7 Insect noise as it appears in bat call analysis software

Figure 8 Characteristics of a call used to identify species (Pennay et al 2004).

Some sites were dominated by insect noise (see Figure 8). A unit deployed in Haine Avenue Reserve near the M2 for five night, for example, recorded over 9000 calls, 12 of which were bat species.



Figure 9 Reference call (left) and raw calls from this project of the same species

Calls that are considered not clear enough for ID are not identified - this includes very short calls that consist of just a few pulses. For this study, "possible" identifications were eliminated, and the few "probable" identifications were treated as "confident" since, in most cases, the same species was recorded elsewhere in the reserve or in another reserve nearby.

Given the high number of calls recorded at each site, and often on each night, analysis was limited to identification of species present. In reality, the number of calls does not represent the number of bats present as a single bat may make numerous passes in front of the detector. The number of calls may give an indication of the level of microbat activity in the area – more calls can indicate the location is used more frequently by microbats. Call identification to this level can become very expensive, and may not add significantly to the overall project.

CORRIDOR	DARLING MILLS CREEK CORRIDOR	HUNTS CREEK CORRIDOR	DEVLINS CREEK CORRIDOR	TERRYS CREEK CORRIDOR	QUARRY BRANCH CREEK CORRIDOR	VINEYARD CREEK CORRIDOR	UPPER PONDS CREEK CORRIDOR	LOWER PONDS- SUBIACO CREEKS CORRIDOR	UPPER TOONGABBIE CREEK CORRIDOR	LOWER TOONGABBIE CREEK CORRIDOR	BALUDARRI WETLAND	ERMINGTON BAY	EDNA HUNT SANCTUARY	HAINES AVE RESERVE
ANABAT NIGHTS	14	18	5	13	5	5	6	13	13	5	4	7	6	10

Table 4 Anabat sampling effort

Diurnal Bird Census

Bird surveys were both targeted and opportunistic. Systematic surveys designed to capture peak activity (dawn chorus, morning, and late afternoon) were undertaken. A total of 40 minutes were spent at each habitat type or, for large reserves, reserve zone with any birds sighted or heard calling during that period recorded. In reality up to 20 ha contributes to each survey with observers walking towards species sighted or heard to confirm identification and to count the number of individuals present. Individuals were counted exactly or estimated to the nearest "5" to a maximum of 20. For example, a social group of Superb Fairy-wrens can be hard to count exactly so an estimate of numbers to the nearest 5 was made. For abundant species in one location such as Noisy Miners, Bell Miners and Sulphur-crested Cockatoos a maximum of "20" was recorded for any given survey despite the likelihood of higher local abundance. Only species flying within the canopy, roosting or foraging were recorded, with the exception of White-bellied Sea-eagles (hawking over Ermington Bay) and White-throated Needletails. For example Australian Pelicans or Australian Magpies flying at height over a reserve were not included in the records for that location. Evidence of breeding was noted (eg adult birds feeding young, juveniles with parent etc). Any species observed during other survey activities and during general traverses of the site were also recorded.

CORRIDOR	DARLING MILLS CREEK CORRIDOR	HUNTS CREEK CORRIDOR	DEVLINS CREEK CORRIDOR	TERRYS CREEK CORRIDOR	QUARRY BRANCH CREEK CORRIDOR	VINEYARD CREEK CORRIDOR	UPPER PONDS CREEK CORRIDOR	LOWER PONDS- SUBIACO CREEKS CORRIDOR	UPPER TOONGABBIE CREEK CORRIDOR	LOWER TOONGABBIE CREEK CORRIDOR	BALUDARRI WETLAND	ERMINGTON BAY	EDNA HUNT SANCTUARY	HAINES AVE RESERVE
# 40 MINUTE SURVEYS	20	35	12	22	15	15	15	9	20	19	7	7	5	5

Table 5 Diurnal bird census survey effort

Herpetofauna Searches

Reptiles and amphibians were surveyed within the study area by timed diurnal searches in suitable areas. Rocks, logs, debris and other material, which provides suitable cover for herpetofauna, were investigated and any species observed recorded. 40 minute timed searches were undertaken in small reserves-Devlins Creek corridor, Baludarri Wetland, Ermington Bay, Edna Hunt Sanctuary and Haines Avenue Reserve. 120 minute searches were undertaken in the larger corridors.

Table 6 Herpetofauna	timed	searched	survey	effort
----------------------	-------	----------	--------	--------

CORRIDOR	DARLING MILLS CREEK CORRIDOR	HUNTS CREEK CORRIDOR	DEVLINS CREEK CORRIDOR	TERRYS CREEK CORRIDOR	QUARRY BRANCH CREEK CORRIDOR	VINEYARD CREEK CORRIDOR	UPPER PONDS CREEK CORRIDOR	LOWER PONDS- SUBIACO CREEKS CORRIDOR	UPPER TOONGABBIE CREEK CORRIDOR	LOWER TOONGABBIE CREEK CORRIDOR	BALUDARRI WETLAND	ERMINGTON BAY	EDNA HUNT SANCTUARY	HAINES AVE RESERVE
TIMED SURVEYS	5	6	2	5	5	3	3	3	4	3	2	3	2	2

Nocturnal Frog Searches



During the evening calling frogs were identified on the basis of their characteristic calls. Spotlighting traverses included wet areas within the study site with the objective to detect calling or active frogs. See spotlighting section for survey effort across the reserves.

Nocturnal Snail Searches

Searches were undertaken at night in March targeting the Dural Woodland Land Snail. Reserves containing suitable shale-influenced forest types were surveyed during, or immediately after rain. Searches were undertaken using hand held torches along trails where snails had the potential to be feeding. If a snail was located the observer would move to a different area in the reserve to continue searches. For this species the aim was to determine prescence or absence rather than to determine an estimate of abundance.

CORRIDOR	DARLING MILLS CREEK CORRIDOR	HUNTS CREEK CORRIDOR	DEVLINS CREEK CORRIDOR	TERRYS CREEK CORRIDOR	QUARRY BRANCH CREEK CORRIDOR	VINEYARD CREEK CORRIDOR	UPPER PONDS CREEK CORRIDOR	LOWER PONDS- SUBIACO CREEKS CORRIDOR	UPPER TOONGABBIE CREEK CORRIDOR	LOWER TOONGABBIE CREEK CORRIDOR	BALUDARRI WETLAND	ERMINGTON BAY	EDNA HUNT SANCTUARY	HAINES AVE RESERVE
SNAIL SESSIONS	1	3	1	1	2	-	-	-	-	-	-	I	-	-

Table 7 Targeted nocturnal snail searches - survey effort

Hair tubing

Hair-tubes are a remote sampling technique that can detect mammals by attracting them to an open cylinder containing afood bait held within a closed chamber. Fur from mammals that enter a hair-tube adheres to double-sided tape that is fixed to the inside of the device. Hair samples are then analysed in a laboratory to identify the species.



Figure 10 (left) A hairtube, (centre) hair sample on tape, (right) tape is removed and placed between non-stick paper with reserve and location noted and sent to the laboratory for processing.



Figure 11 Cross section of hair samples showing different configuration of cells that are diagnostic for genus / species (Common Brushtail Possum and Bush Rat illustrated)

Hair tubes were deployed in transects of 10 with each tube deployed approximately 40-50 metres apart. 1 tube per transect of 10 was tree-mounted. In Large reserves tubes were deployed in each zone of the reserve and every major habitat type sampled.

HAIRTUBE NIGHTS	CORRIDOR
500	DARLING MILLS CREEK CORRIDOR
1000	HUNTS CREEK CORRIDOR
150	DEVLINS CREEK CORRIDOR
220	TERRYS CREEK CORRIDOR
350	QUARRY BRANCH CREEK CORRIDOR
300	VINEYARD CREEK CORRIDOR
350	UPPER PONDS CREEK CORRIDOR
250	LOWER PONDS- SUBIACO CREEKS CORRIDOR
650	UPPER TOONGABBIE CREEK CORRIDOR
310	LOWER TOONGABBIE CREEK CORRIDOR
100	BALUDARRI WETLAND
250	ERMINGTON BAY
100	EDNA HUNT SANCTUARY
100	HAINES AVE RESERVE

Table 8 Hairtube sampling - survey effort

Ground Trapping

Live trapping was undertaken using Sherman traps Type "A" 30 x 10 x 8 cm. Traps were place in "lines" of five traps approximately 20 metres apart. Four lines were established in locations where small ground mammals (specifically *Antechinus* sp.) might have persisted in the LGA. Natural materials found on site were used to provide bedding material within the traps. A generous handful of the fibrous bark was the preferred bedding material. The trap was placed within a plastic bag to protect captured animals from rainfall events. Traps were baited with a mixture of peanut butter, honey and rolled oats which is a standard bait type for native small mammals in Australia (Menkhorst and Knight 2004; Garden *et al.*2007b; Paull *et al.* 2011). Three cage traps were deployed in Third Settlement Reserve on Toongabbie Creek targeting Rakali (*Hydromys chrysogaster*). A large amount of bedding material was placed in each trap and the trap cover with a plastic bag and hessian. Cage traps were baited with universal bait and fish based cat food.



Figure 12 small ground traps (left and centre), and cage trap (right)

TRAPPING NIGHTS	CORRIDOR
40	DARLING MILLS CREEK CORRIDOR
40	HUNTS CREEK CORRIDOR
ı	DEVLINS CREEK CORRIDOR
I	TERRYS CREEK CORRIDOR
I	QUARRY BRANCH CREEK CORRIDOR
I	VINEYARD CREEK CORRIDOR
ı	UPPER PONDS CREEK CORRIDOR
ı	LOWER PONDS- SUBIACO CREEKS CORRIDOR
12	UPPER TOONGABBIE CREEK CORRIDOR
-	LOWER TOONGABBIE CREEK CORRIDOR
-	BALUDARRI WETLAND
L	ERMINGTON BAY
-	EDNA HUNT SANCTUARY
-	HAINES AVE RESERVE

Searches for Evidence

Scats were collected when encountered during any of the survey activities. Systematic surveys for scats were not undertaken however a mix of vegetation types within a reserve were surveyed for Swamp Wallaby scats if Swamp Wallabies were detected by hair sample alone. Area below powerful Owl roost trees were surveyed for pellets. Fox and wild dog scats were collected when encountered on walking trails. Scats and pellets were placed in brown paper bags and stored in an airtight container prior to delivery to "Scatsabout" a company specialising in the field of hair and scat analysis. During these walks characteristic signs, tracks, and scats and other indirect evidence of fauna species from all fauna groups were recorded when observed.



Figure 13 Fox scats are easily distinguishable from domestic dog scats in the field. Identifiable elements of the animal's diet are evident such as seeds, beetle carapaces, hairs, feathers and bones. Detailed analysis of scats can determine the genus and often the species of vertebrate prey through hair/fur analysis.



Research Licensing

The survey and research of fauna during the 2016 -2017 was undertaken under the following licences and approvals in accordance with the Animal Research Act (1991).

Principal: Anne Carey; Associates: Meredith Brainwood, Caroline Forest

Office of Environment and Heritage Scientific Licence SL101080

Department of Primary Industries Animal Research Authority Trim 12/4893 (2)

Department of Primary Industries Director-General's Animal Care and Ethics Committee DG ACEC Trim 12/4893

3.1 Key dates and equipment locations

Table 9 Anabat deployment dates and locations

BUSHLAND CORRIDOR	RESERVE	SURVEY DATES	# NIGHTS
1. DARLING MILLS CREEK CORRIDOR	Plateau above Rifle Range Creek	3/2-12/2/2017	10 nights
	Darling Mills Creek – Ventura Road	14-17/10/2016	4 nights
2. HUNTS CREEK CORRIDOR	Lake Parramatta –lake edge near wall	25-26/10/2016	2 nights
	Lake Parramatta north of loop walk	21-29/12/2016	9 nights
	Hunts Ck Reserve below Roberts road	25-31/1/2017	7 nights
3. DEVLINS CREEK CORRIDOR	Nth of Plympton Rd	4-8/1/2017	5 nights
4. TERRYS CREEK CORRIDOR	Upper Terrys Creek Reserve	13-14/1/2017	2 nights
	Lucknow Park	1-2/11/2016	2 nights
	Dence Park	16-24/1/2017	9 nights
5. QUARRY BRANCH CREEK CORRIDOR	Moxham Park	18-22/10/2016	5 nights
6. VINEYARD CREEK CORRIDOR	Vineyard Creek Reserve	6-10/11/2016	5 nights
7. UPPER PONDS CREEK CORRIDOR	Galaringi Reserve	20-26/12/2016	6 nights
8. LOWER PONDS-SUBIACO CREEKS CORRIDOR	The Ponds Walk	21/10- 2/11/2016	13 nights
9. UPPER TOONGABBIE CREEK CORRIDOR	Sue Savage Reserve	8-10/12/2016	3 nights
	Palestine Park	29-31/12/2016	3 nights
	Backhousia Reserve	20-26/2/2017	7 nights
10. LOWER TOONGABBIE CREEK CORRIDOR	Lower Toongabbie - Toongabbie Creek reserve	15-17/11/2016	3 nights
	Lower Toongabbie- Parabianga Reserve	16-17/1/2017	2 nights
11. BALUDARRI WETLAND	Baludarri Wetlands	10-13/10/2016	4 nights
12. ERMINGTON BAY	Ermington Bay – off board walk at Mangroves	28/12-3/1/2017	7 nights
13. EDNA HUNT SANCTUARY	Edna Hunt Sanctuary	9-15/1/2017	6 nights
14. HAINES AVE RESERVE	Haines Reserve – east end, west end	24-28/11/2016, 4-8/4/2017	10 nights

Table 10 Key survey dates

	SPOTLIGHTING	SESSIONS	DIURNAL BIRD CENSUS	SESSIONS	HERPS	SESSIONS	CAMERAS DEPLOYMENT DATES
DARLING MILLS CREEK CORRIDOR	14.10.16/25.11.16/2 1.12.16/3.2.17/6.3.1 7	5	13.10.16/16.10.16/18.10. 16/27.10.16/13.11.16/13. 11.16/13.11.16/13.11.16/ 21.10.16/26.11.16/26.11. 17/21.12.16/28.12.17/9.1 .17/3.2.17/14.3.17/28.3.1 7/28.4.17/28.4.17/28.4.1 7	20	13.10.16/ 27.10.16/ 12.12.16/ 3.1.17/3.2 .17	5	13.10.16/21.10.16 /14.10.16/21.10.1 6/24.11.16/12.12. 16/13.12.16/9.1.1 7/3.2.17/3.2.17
HUNTS CREEK CORRIDOR	7.10.16/25.10.16/13. 12.16/17.12.16/1.2.1 7/8.2.17/21.2.17/27. 2.17/2.3.17/13.3.17/ 13.3.17/26.3.17	12	8.11.16/10.11.16/10.11.1 6/10.11.16/29.11.16/8.12 .16/8.12.16/21.12.16/29. 12.16/29.12.16/29.12.16/ 12.1.17/12.1.17/25.1.17/ 1.2.17/3.2.17/8.2.17/27.2 .17/2.3.17/26.3.17/28.3.1 7	35	25.10.17/ 18.11.16/ 8.12.16/2 1.12.16/2 5.1.17/3.2 .17	6	25.10.16/3.11.16/ 10.11.16/18.11.16 /8.12.16/17.12.16 /28.12.16/12.1.17 /12.1.17/25.1.17/ 25.1.17/24.2.17/2. 3.17
DEVLINS CREEK CORRIDOR	8.11.16/24.11.16/13. 3.17	3	8.11.16/23.11.16/6.12.16 /4.1.17/9.2.17/9.3.17/13. 3.17/24.3.17/27.4.17/	12	8.11.17/6. 3.17/9.3.1 7/13.3.17/ 24.3.17	2	8.11.16/23.11.16/ 13.3.17
TERRYS CREEK CORRIDOR	1.11.16/10.11.16/6.1 2.16/19.12.16/16.1.1 7/20.3.17	6	1.11.16/1.11.16/10.11.16 /24.11.16/1.12.16/6.12.1 6/16.1.17/19.1.17/19.1.1 7/1.2.17/21.2.17/13.3.17 /20.3.17/24.3.17	22	1.11.16/2 4.11.16/6. 12.16/13. 3.17/20.3. 17	5	1.11.16/10.11.16/ 24.11.16/19.1.17/ 30.1.17/
QUARRY BRANCH CREEK CORRIDOR	4.11.16/2.12.16/16.1 .17/9.3.17/13.3.17	5	7.10.16/21.10.16/25.10.1 6/7.11.16/1.2.17/1.2.17/ 1.2.17/3.2.17/8.2.17/9.3. 17/9.3.17/9.3.17	15	7.10.16/1 8.10.16/2 5.10.16/7. 11.16/13. 3.17	5	18.10.16/25.10.16 /13.3.17
VINEYARD CREEK CORRIDOR	8.12.16/29.12.16/16. 1.16/13.2.17	4	8.11.16/11.11.16/29.12.1 6/4.1.17/2.3.17/6.317/1 3.3.17/24.3.17/	15	16.1.17/2. 3.17/13.3. 17	3	7.11.16/29.11.16/ 24.2.17/2.3.17/6.3 .17/24.3.17
UPPER PONDS CREEK CORRIDOR	29.11.16/9.12.16/25. 1.17	3	23.11.16/1.12.16/1.12.16 /21.12.16/4.1.16/1.2.17/ 24.2.17/6.3.17/9.3.17/13. 3.17/24.3.17	15	23.11.17/ 1.12.16/1 3.3.17	3	21.10.17/3.11.17/ 24.11.16/2.12.16/ 8.12.16/19.12.16/ 3.1.17
LOWER PONDS-SUBIACO CREEKS CORRIDOR	29.11.16/16.1.17/13. 2.17/23.3.17	4	19.10.17/27.10.16/7.11.1 6/7.11.16/7.11.17/2.3.17 /2.3.17/2.3.17/9.3.17/9.3 .17/11.4.17/11.4.17	9	7.11.16/9. 3.17/11.4. 17	3	15.11.16/2.12.16/ 6.12.16/17.12.17
UPPER TOONGABBIE CREEK CORRIDOR	4.11.16/13.12.16/9.1 .17	3	18.10.16/3.11.16/7.11.16 /15.11.16/18.11.16/24.11 .16/8.12.16/12.12.16/12. 12.16/12.12.16/17.12.16/ 19.12.16/29.12.16/3.1.17 /19.1.17/3.2.17/3.2.17/8. 2.17/21.2.17/24.2.17/24. 3.17/28.3.17	20	18.10.16/ 7.11.16/1 2.12.16/8. 2.17	4	18.10.16/3.11.16/ 24.11.16/2.12.16/ 17.12.16/8.12.16/ 17.12.16/19.12.16 /3.1.17/3.1.17/1
LOWER TOONGABBIE CREEK CORRIDOR	10.12.16/12.1.17/16. 1.17	3	15.11.17/15.11.16/18.11. 16/2.12.16/6.12.16/12.1. 17/12.1.17/19.1.17/25.1. 17/25.1.17/9.2.17/23.3.1 7	19	10.12.17/ 2.12.17/1 6.1.17	3	15.11.16/6.12.16
BALUDARRI WETLAND	15.11.16	1	11.10.2016131.10.16111. 11.16115.11.16128.2.171	7	11.10.16/ 31.10.16	2	11.10.16/14.10.17
ERMINGTON BAY	19.10.17/9.12.16	2	11.10.16/19.10.16/25.10. 16/15.11.16/11.4.17/6.5. 17	7	11.10.16/ 11.4.17/1 1.4.17	3	11.10.16/14.10.17
EDNA HUNT SANCTUARY	9.12.16/29.12.16/16. 1.17	3	27.10.16/8.11.16/16.1.17 /21.2.17	5	8.11.16/2 1.2.17	2	27/10/16

	SPOTLIGHTING	SESSIONS	DIURNAL BIRD CENSUS	SESSIONS	HERPS	SESSIONS	CAMERAS DEPLOYMENT DATES
HAINES AVE RESERVE	24.11.16/8.12.16/1.2 .17	3	23.11.16/8.12.16/27.3.17 /5.4.17	5	8.12.17/2 7.3.17	2	23.11.16/8.12.16/ 5.4.17



Figure 14 Remote sampling equipment locations



Figure 15 Ground trapping locations

4 **RESULTS**

See Appendix A for detailed project species list and Appendix B for observations by Council, volunteers and contractors and from ebird and the NSW Wildlife Atlas (Bionet) during the same survey period.

148 vertebrate species (excluding fish) were detected during the survey including:

- 12 threatened species
- 4 species listed under the Bonn convention and/or JAMBA/CAMBA/ROKAMBA
- 15 exotic species

97 species of bird, 28 mammals, 7 amphibians, 16 reptiles and one threatened invertebrate (Gastropoda) - the threatened Dural Woodland Land Snail were recorded.

An additional 8 species (all birds) were recorded by others during that period.

Species richness for each corridor varied considerably but was correlated to the patch size, current disturbance regime, vegetation/habitat types and location in the landscape (connectivity). Further analysis of the results can be found in chapter 6.1 page 145 of this report.



Figure 16 Species richness

Most species were directly observed (most birds, most mammals and all reptiles) or heard (owls, frogs) or a combination of both. This did vary from corridor to corridor. One terrestrial species, the Long-nosed Bandicoot, was only detected by remote techniques. All microbats were detected by anabat. A total of 14 species of microbats were identified. Of these, 6 species are listed as Vulnerable under the NSW Threatened Species Conservation Act 1995. One genus of microbats cannot be identified to species using echolocation calls, and has been assumed to be a single species. An additional group of calls were also identified to genus, but two species of this genus were identified and it has been assumed that these calls belong to one of these species, rather than represent an additional species. Further discussion on threatened microbat species can be found in Section 6.7, page 174.

Scat & hair analysis provided the best understanding of the distribution of terrestrial mammal species while arboreal mammals were spotlighted or heard or captured by remote cameras or a combination of these techniques. A detailed analysis of indirect evidence (scat, hair, pellet analysis) is provided in Chapter 5 page 140 of this report.

4.1.1 SPECIES PROFILES

Species profiles are provided for each species within this section showing the species' distribution by corridor across the LGA. Bird species were mapped as absent through to abundant based on the likelihood of encountering a member of that species during any given site visit.

0 = absent, 1 member of the species only sighted = rare, 1-20% = uncommon, 21-60%=common, > 60% = abundant. The colour ramp (right) is used on the species profiles.



Figure 17 Colour coding for distribution maps

A colour coding system was also added as a quick reference to summarise a birds typical mobility or combination of typical seasonal movements and to describe category of presence in the study area during this survey. **Note that many species are a combination of these categories**. These are:



Species profile information is drawn predominantly from "Birds in Backyards" profiles, <u>http://www.birdsinbackyards.net</u> with additional information from Morecombe, M. 2009. Field Guide to Australian Birds. Steve Parish Publishing, Archerfield, Qld and Menkhorst et al. (2017) The Australian Bird Guide, CSIRO Publishing.

Nomenclature used is consistent with that used in Menkhorst et al. (2017) The Australian Bird Guide, CSIRO Publishing. There are minor differences between this nomenclature and that used by the IOC at the time of development of this report.

4.2 MEGAPODES

Australian Brush-turkey

Alectura lathamí





Status: Locally Common Sedentary Guild: ground omnivore Size: 60 cm to 75 cm Average weight: 2 274g Clutch Size: 50 eggs (from several females) Incubation: 49 days Mainly black body plumage, bare red head, yellow throat wattle and laterally flattened tail.

A male Australian Brush-turkey tends his mound- Excelsior Reserve, Northmead (Photo: AE 2016)

Feeding: insects, seeds and fallen fruits, which are exposed by raking the leaf litter or breaking open rotten logs with their large feet. The majority of food is obtained from the ground, with birds occasionally observed feeding on ripening fruits among tree branches.

Breeding: Eggs are incubated in a large mound of organic matter. The male maintains a constant temperature of 33 - 38°C by digging holes in the mound and inserting his bill to check the heat, then adding and removing vegetable matter as required. After hatching, the chicks burrow out of the mound, at which point they are left to fend for themselves. These hatchlings are fully feathered and are able to walk and fend for themselves immediately.



A male Australian Brush-turkey high in a Blue gum at Edna Hunt Sanctuary, Epping (Photo: AE 2016)

4.3 BIRDS OF THE EDGE

Some species of birds have been able to adapt to, and ultimately exploit, changes made to the natural environment by urbanisation such as the Noisy Miner. Other species, such as the Welcome Swallow, often hawk over open space and water bodies near suitable roosting habitat. The species in this section were observed in the bushland corridors but primarily on the edges or in open space within the corridors. Many people will readily identify these species from their backyards, urban parks and sportsfields.

Australian White Ibis

Threskíornís molucca



Adult White Ibis foraging at Ermington Bay, group at Subiaco Creek (Photo: AE 2017)

Feeding: The Australian White Ibis' range of food includes terrestrial and aquatic invertebrates and human scraps.

Breeding: Australian White Ibis nest in large colonies, often with the Straw-necked Ibis, *T. spinicollis*. Young are born naked and helpless. One or two broods may be reared in a year.



Status: Locally common, restricted Sedentary and/or can be seasonally dispersive Guild: insectivore/carnivore Size: 69 cm to 76 cm Almost entirely white body plumage and black head and neck. The head is featherless and its black bill is long and down-curved. During the breeding season the small patch of skin on under-surface of the wing changes from dull pink to dark scarlet.

Australian Magpie Cracticus tibicen



Australian Magpie at Ray Park, Beecroft (above) & at Sevilles Reserve, North Rocks (Photo: AE 2016)

28

Status: **Common, Widespread Sedentary** Guild: ground insectivore /carnivore Lifespan: 25 years Mass: 220 – 350 g (Adult) Clutch size: Female: 2 – 5 (Adult) Nape, upper tail and shoulder are white in males, grey in females, the remainder of the body is black

Feeding: Walks along the ground searching for insects and their larvae

Breeding: The nest is a platform of sticks and twigs (occasionally wire), with a small interior bowl lined with grass and hair. The nest is constructed in the outer branches of a tree, up to 15 m above the ground.





Australian Raven Corvus coronoídes



Status: **Common, Widespread Sedentary** Guild: C**arnivore** Size: 46–53 cm Lifespan: 22 years All-black plumage, beak and mouth, as well as strong grey-black legs and feet, obvious long throat hackles



Australian Raven at Yana Yirabana Reserve Northmead (Photo: AE 2016)

Feeding: The Australian Raven is mainly carnivorous - diet may include grains, fruits, insects, small animals, eggs, refuse and carrion.

Breeding: construct a large untidy nest, normally consisting of bowl or platform of sticks, lined with grasses, bark and feathers. Both sexes construct the nest and feed the young. The incubation of the eggs is performed solely by the female, and only one brood is raised in a year.

Crested Pigeon Ocyphaps lophotes



Status: Locally Common Sedentary Guild: ground granivore Size: 31-35 cm Stocky pigeon with a conspicuous thin black crest. Most of the plumage is greybrown, becoming more pink on the underparts. The wings are barred with black, and are decorated with glossy green and purple patches. The head is grey, with a pinkish-red ring around the eye.



Feeding: diet consists mostly of native seeds, as well as those of introduced crops and weeds. Some leaves and insects are also eaten.

Breeding: Builds a delicate nest of twigs, placed in a tree or dense bush. Both sexes share the incubation of the eggs, and both care for the young.

Channel-billed Cuckoo

Scythrops novaehollandíae



(photo Jenny Stiles 2016)

Feeding: The favoured foods of the Channel-billed Cuckoo are native figs and native fruits, though some seeds, insects and even baby birds are also taken.

Breeding: The Channelbilled Cuckoo lays its eggs in the nests of the Australian Magpie, *Gymnorhina tibicen*, the Pied Currawong, *Strepera graculina* and members of the crow family (Corvidae).



Status: Uncommon Migratory Guild: Arboreal frugivore Size: 58–66 cm World's largest cuckoo. Large, grey cuckoo, down-curved bill with long barred tail. The feet and legs are black, and the eye is surrounded by prominent red skin. Juvenile's bill is dirty pink in colour, and the skin around the eye is not red.

Eastern Koel



Feeding: Food consists of fruits, especially figs, taken directly from the tree.

Eudynamys orientalis

Breeding: brood parasite, that is, it lays its eggs in the nests of other bird species. Common hosts are the Red Wattlebird, *Anthochaera carnunculata*, friarbirds, the Magpie-lark, *Grallina cyanoleuca*, and figbirds. A single egg is laid in the host's nest and once hatched the chick forces the other eggs and hatchlings out of the nest.

Cracticus torquatus **Feeding:** Aggressive predators. They prey on small animals, including birds, lizards and insects, as well as some fruits and seeds. Uneaten food may be stored in the fork or a branch or

Breeding: Nest is bowl-shaped,

normally located within 10 m of the

ground. The eggs are incubated by

the female and the young birds are

the breeding territory and help the

parents raise the young of the following

fed by both parents. Young remain in



Status: Common, Widespread Migratory Guild: Arboreal frugivore

Size: 40-46 cm

Male Eastern Koel glossy black plumage, tinged with blue and green, and striking red eye. The female has glossed brown upperparts, heavily spotted with white, and a black crown. The underparts are generally buff-cream with numerous fine black bars. Young birds resemble the adult female, but have considerably more buff and a dark eye.

Grey Butcherbird



Grey Butcherbird at Edna Hunt Sanctuary, Epping (Photo: AE 2016)

Magpie-lark



Grallina cyanoleuc*a*

Status: Locally common Sedentary/seasonal migrant Guild: ground insectivore Size: 26-30 cm

season.

impaled.

Thin whitish bill and pale iris separate it from other similarly coloured species. The adult male Magpielark has a white eyebrow and black face, while the female has an all-white face with no white eyebrow.

Feeding: Usually seen slowly searching on the ground for a variety of insects and their larvae, as well as earthworms and freshwater invertebrates.

Breeding: Builds an unusual mud nest and generally breed from August to December. aggressively defend their nest and territory, which may occupy up to 10 ha. Both parents share the incubation duties and care for the young.

Young in nest at Palestine Park Photo: (Applied Ecology 2016)

L S

Status: Locally common Sedentary Guild: ground insectivore/carnivore Size: 25-30cm

Black crown/face, grey back, with a thin white collar. Wings grey, large areas of white, underparts are white. The grey and black bill is large, with a small hook at the tip of the upper bill. Eye is dark brown, legs and feet are dark grey. Both sexes are similar in plumage, but the females are slightly smaller than the males.



Masked Lapwing Vanellus miles



Status: Uncommon Sedentary Guild: ground insectivore Size:35-39 cm Large, ground-dwelling birds that are closely related to the waders. Mainly white below, with brown wings and back and a black crown. Birds have large yellow wattles covering the

is yellow with a black tip.



Upjohn Park was the only location this species was observed (Photo: AE 2017)

Feeding: feed on insects and their larvae, and earthworms. Most food is obtained from just below the surface of the ground, but some may also be taken above the surface.

face, and are equipped with a thorny spur that projects from the wrist on each wing. The spur

Breeding: Both sexes share the building of the nest, which is a simple scrape in the ground away from ground cover. This nest is often placed in inappropriate locations, such as school playing fields or the roofs of buildings. Both sexes also incubate the eggs and care for the young birds. The young birds are born with a full covering of down and are able to leave the nest and feed themselves a few hours after hatching. The Masked Lapwing is notorious for its defence of its nesting site.

Pied Currawong

Strepera graculina





Status: Widespread, common Sedentary/seasonal migrant Guild: Omnivore Size: 42-50cm Large, mostly black, bright yellow eye. Small patches of white confined to under tail, tips and bases of the tail feathers,

confined to under tail, tips and bases of the tail feathers, small patch towards the tip of wing (visible in flight). Bill is large and black, legs are dark grey-black. Both sexes similar, female may sometimes be greyer on the underparts.

Pied Currawong at nest at Excelsior Reserve on Darling Mills Creek (Photo: AE 2016)

Feeding: takes a variety of foods including small lizards, insects, caterpillars and berries. May also take a large number of small and young birds, especially around urban areas where suitable cover is scarce. Birds will occasionally hunt as a group. Prey may be stored in a 'larder' (hung on a hook or in a tree fork or crevice **Breeding:** nesting material is gathered by both sexes, female incubates the eggs whilst fed by male. Male supplies food to female to feed chicks after hatching.

Noisy Miner



Welcome Swallow

Manorína melanocephala

Feeding: feeds on nectar, fruits and insects. Very occasionally they will eat small reptiles and amphibians. Food is either taken from trees or on the ground. In keeping with its highly social nature, the Noisy Miner usually feeds in large groups.

Breeding: Noisy Miners breed in small to large colonies and several broods may be reared during a single season. The female constructs the nest and incubates the eggs alone, but both sexes will care for and feed the young birds. Additional 'helpers' usually also feed the young. Interestingly, these helpers are almost always male birds.

Palestine Park has abundant Noisy Miners (Photo: AE 2016)



Status: Abundant Sedentary Guild: nectarivore/insectivore Size: 25-28 cm Mostly grey body and black crown and cheeks. The bill is yellow, as are the legs and the naked skin behind the eye.



Hírundo neoxena



Status: **Common Dispersive** Guild: **aerial insectivore** Size: 25-28 cm Metallic blue-black above, light grey below on the breast and belly, and rust on the forehead, throat and upper breast. It has a long forked tail, with a row of white spots on the individual feathers.

Feeding: feed on a wide variety on

insects. They catch prey in flight. The prey is guided into the bird's wide, open mouth with the help of short rictal bristles bordering the bill. These bristles also help protect the bird's eye.

Breeding: nest is an open cup of mud and grass, made by both sexes, and is attached to a suitable structure, such as a vertical rock wall or building. The nest is lined with feathers and fur. The female alone incubates the eggs but the young are fed by both parents. Often two broods are raised in a season.



4.4 PARROTS

Nine species of parrots were recorded during the survey. Several species have become naturalized in the region due to aviary escapes and changing landuses both locally and within their former ranges. The **Yellow-tailed Black Cockatoo** was not recorded during this survey but was sighted by bushcare volunteers in Beecroft .

Australian King-Parrot





Australian King Parrot (young male at left, female right) at Excelsior Reserve on Darling Mills Creek (Photo: AE 2016)

Feeding: The King-Parrot mostly forages in trees for seeds and fruit





Breeding: King-Parrots lay their eggs on a bed of decayed wood-dust at the bottom of a deep hollow in the trunk of a tree. Often the entrance is high in the tree (10 m) but the eggs are near the ground (0.5 m).

Crimson Rosella

Platycercus elegans

Feeding: Natural foods include seeds of eucalypts, grasses and shrubs, as well as insects and some tree blossoms.

Breeding: nest is a tree hollow, located high in a tree, and lined with wood shavings and dust. The female alone incubates the white eggs, but both sexes care for the young. The chicks remain dependent on their parents for a further 35 days after leaving the nest.



L S

Status: locally common, not widespread Sedentary Guild: ground/arboreal granivore Size: 32-37cm

Mostly crimson (red) plumage and bright blue cheeks. The feathers of the back and wing coverts are black broadly edged with red. The flight feathers of the wings have broad blue edges and the tail is blue above and pale blue below and on the outer feathers.

My nestbox!, (right) Quarry Branch, Northmead. (Photo: AE 2016)

At Dence Park, Epping (Photo: AE 2017)

Eastern Rosella

Platycercus exímíus



Feeding: feeds on the ground, especially amongst grasses in lawns, pastures and other clearings. Also feeds in trees and bushes. Main dietary items include: seeds, fruits, buds, flowers, nectar and insects.

Breeding: Eastern Rosellas mate for life. The female chooses and prepares the nesting site, usually a hollow in a eucalypt tree (but will sometimes use a nest-box or other artificial site). Eggs are laid on a decayed wood bed and the female incubates the eggs while the male regularly feeds her. The young may be fed for a while after they fledge.



Status: locally common, not widespread Sedentary Guild: ground/arboreal granivore

Guild: ground/arboreal granivore Size: 29-33cm

Sexes similar. White cheeks, red head, neck and breast, with yellowish to greenish upper parts, a yellow underbody and a yellow-green to blue-green rump, with a red undertail. The shoulders are bright blue.

Galah

Eolophus roseícapíllus



Galah –adult & juvenile Ermington Bay, (Photo: AE 2016)

Feeding: feed on seeds, mostly from the ground. Breeding: Galahs form permanent pair bonds, although a bird will take a new partner if the other one dies. The nest is a tree hollow or similar location, lined with leaves. Both sexes incubate the eggs and care for the young.



Status: uncommon, not widespread Sedentary/seasonal migrant Lifespan: 40 years Guild: ground granivore Size: 35-38cm Rose-pink head, neck and underparts, with paler pink crown, and grey back, wings and under tail and on the outer feathers.

Little Corella

Cacatua sanguínea



Little Corella, Upjohn Park, Rydalmere. (Photo: AE 2017)

Feeding: feed mainly on the ground, and have to drink on a daily basis. The most common foods are grains and grass seeds. Some bulbs and fruits may also be eaten.

Breeding: pair for life and will start breeding at the start of a long period of rain. Nest site is a suitable tree hollow, both sexes

incubate the eggs and both care for the young chicks. Breeding pairs nest in large colonies, and several nests may be found in the same tree.



Status: uncommon, not widespread Sedentary/seasonal migrant Guild: ground granivore Size: 36-39cm mostly white, with a fleshy blue eye-ring and a pale rose-pink patch between the eye and bill. In flight

yellow underwing & under tail visible.



Long-billed Corella



Hollow inspection Quarry Branch Corridor (Photo: AE 2017)

Musk Lorikeet



Musk Lorikett pair, Haines Ave Reserve, Carlingford (Photo: AE 2017)

Cacatua tenuírostrís

Status: uncommon, not widespread Sedentary/seasonal migrant Guild: ground granivore Size: 38-41cm

White cockatoo with a short crest (not always visible) and short tail, stocky body and a distinctive long upper mandible to its bill. There is a faint yellowish wash on the undersides of its wings and tail, and orange-red splashes on its forehead, throat and an orange-red crescent across its upper breast. The eye ring is pale greyblue.



Feeding: preferred food is grass seeds. corms, bulbs and roots, especially from the weed onion grass, *Romulea*. Insects are also eaten.

Breeding: forms monogamous pairs and both parents prepare the nest, incubate the eggs and feed the young. Nests are made in the hollows of large old eucalypts.

Glossopsítta concínna

Feeding: feed in all levels of the canopy and are very active when foraging. Mainly eats pollen and nectar, also eat seeds, fruits and insects and their larvae.

Breeding: breed in hollow branches and holes in living eucalypts, often near watercourses. The entrance holes are usually very small, so they have to squeeze in. Eggs are laid on a base of chewed or decayed wood. The female incubate the eggs and both parents roost in the hollow at night.



Status: **uncommon,** sporadic in response to flowering events, not widespread **Nomadic** Guild: **arboreal nectivore** Size: 21-23cm Mostly green, yellow patch at the side of the breast. Bright red forehead and band through the eye to the

Bright red forehead and band through the eye to the ear coverts. Crown is blue, females having less blue than males. In flight, brown flight feathers and the golden tail are revealed.



Hollow inspection Haines Ave Reserve, Carlingford (Photo: AE 2017)

Rainbow Lorikeet Trichoglossus haematodus

Breeding: Eggs laid on chewed, decayed wood, usually in a hollow limb of a eucalypt tree. Both sexes prepare the nest cavity and feed the young, but only the female incubates the eggs

Feeding: forages on the flowers of shrubs or trees to harvest nectar and pollen, but also eats fruits, seeds and some insects.



Status: Abundant, widespread Sedentary Guild: nectivore Size: 26-31cm Sexes alike. Blue (mauve) head and belly, green wings, tail and back, and an orange/yellow breast.
Red-rumped Parrot

Psephotus haematonotus



A pair at Palestine Park, Old Toongabbie (Photo: AE 2017) Feeding: feeds in pairs or small flocks on the ground, preferring seeds and leaves of grasses. It also will feed on seeds, fruits and flowers in trees.

Breeding: Red-rumped Parrots mate for life. The female chooses and prepares the nesting site, usually a hollow in a eucalypt tree (but will sometimes use a nest-box or other artificial site). Eggs are laid on a decayed wood bed and the female incubates the eggs while the male regularly feeds her. The young can be fed for a while after they fledge.

Scaly-breasted Lorikeet Trichoglossus chlorolepidotus



Feeding: feeds on nectar and pollen, occasionally in company with Rainbow Lorikeets.

Breeding: Females lay eggs on a bed of decayed wood in a hollow limb, at a height of between 3 m and 25 m above the ground. Both

sexes modify the nest hollow by chewing off pieces of wood, and this can take six weeks. Only the female incubates the eggs, but the male feeds her on the nest. Both sexes feed the young.

High in the canopy, Sue Savage Park, Old Toongabbie (Photo: AE 2017)



Status: Locally common in west only, not widespread Sedentary Guild: ground granivore Size: 26-28cm Male is bright green, blue-green head, a red rump, and yellow shoulders and belly. The female is a duller, olive-green, with a green rump and faint yellow or light green scales on the belly.

Status: uncommon Sedentary Guild: nectivore Size: 23cm Beak and eyes are red, and it is the only lorikeet with an all-green head combined with a red beak. Sexes appear the same, with green upper-wings and body, marked with yellow 'scales' on the breast and neck.



At Edna Hunt Sanctuary, Epping (Photo: AE 2017)

Feeding: diet consists of berries, seeds, nuts and roots. Breeding: The eggs are laid in a suitable tree hollow, which is prepared by both sexes. Both birds also incubate and care for the chicks. The chicks remain with the parents all year round and family groups will stay together indefinitely.



Status: **Abundant** Sedentary Guild: ground granivore Size: 45-50cm Large white parrot with distinctive yellow crest.

Sulphur-crested Cockatoo Cacatua galerita



4.5 LARGER BUSH BIRDS

This section contains birds observed during the surveys undertaken in October 2016- April 2017 that are typically larger than 20cm in size and were consistently observed within bushland, rather than on reserve edges.

Australasian Figbird



At Baludarri Wetland, Parramatta (Photo: AE 2016)

Sphecotheres vieilloti

Status: uncommon Sedentary/ seasonal migrant Guild: frugivore Size: 28-29cm Males have bare, red skin around the eye, contrasting against a black crown and grey neck and throat. The remainder of the body is olive-green, except for a white under-tail area. Females have grey skin around the eye and lack distinctive head markings. They are brown-green above and dull-white below, streaked with brown. Both sexes have a blackish bill.



Feeding: Feeds in flocks, often ~20 birds Figs are a key food item, although most soft fruits and berries in canopy trees are taken. Insects are also important components of their diet.

Breeding: small groups of birds nest semi-colonially. Nest is cup-shaped, built of vine tendrils and twigs. It is supported by its rim from the horizontal fork of an outer branch of the canopy, up to 20 m above the ground. Both males and females incubate the eggs and feed the young.

Black-face Cuckoo-shrike Coracina novaehollandiae



Impreesa Reserve (Photo: AE2017)

Status: **Common** Sedentary/seasonal migrant Guild: insectivore Size: 30-36cm black face and throat, blue-grey back, wings and tail, and white underparts. They are slender, attractive birds.

Feeding: feeds on insects and other invertebrates. These may be caught in the air, taken from foliage or caught on the ground. Some fruits and seeds are also eaten. Breeding: may mate with the same partner each year, and may use the same territories year after year. The nest is remarkably small for the size of the bird. It is a shallow saucer of sticks and bark, bound together with cobwebs. Both partners construct the nest and care for the young birds.

Dollarbird Eurystomus orientalis



Perching, Robin Hood reserve (Photo: AE2016)

Status: Common

Migratory -visits Australia each year to breed. Guild: arboreal insectivore

Size: 25-29cm

Sexes similar, female duller. Dark brown upperparts, washed heavily with blue-green on back and wing coverts. Breast brown. Short, thick-set bill is orange-red, tipped with black. In flight, the pale blue coin-shaped patches towards the tips of its wings, that gave the bird its name, are clearly visible..



exclusively on flying insects.

They search for food from a conspicuous perch and then capture it in skillful aerial pursuits, before returning to the same perch. **Breeding:** The white eggs are laid in an unlined tree hollow and are incubated by both adults. The young birds are also cared for by both parents. The same nesting site may be used for several years.

Eastern Whipbird Psophodes olivaceus



Usually very secretive, emerged for a moment - Backhousia Reserve (Photo: AE 2017)

Feeding: feeds on insects and other small invertebrates, which are caught on the ground by bill. Feeding takes place alone, in pairs or in small family groups.

Breeding: A breeding pair of Eastern Whipbirds occupies a territory, which is defended year round, with the mates staying together for many years. The female makes a cup nest of sticks and bark, which is lined with finer grasses, and placed in dense vegetation near the ground. The female also incubates the eggs. The young birds are fed by both parents. Sometimes two broods are raised in a single season.

Status: Common, widespread Sedentary Guild: ground insectivore Size: 25-30cm dark olive-green above, with a long tail, and a greywhite belly. The head and breast are black, with a broad white patch on the side of the face and a black crest. The eye is pale cream and the bill is black.

Laughing Kookaburra

Dacelo novaeguíneae



A pair perched in mangroves at Baludarri Wetland (left), bird droppings at the entrance of a burrow into a termite mound indicating its use as a nesting site- Backhousia Reserve. This may be a Laughing Kookaburra nest site or a number of other species (photos: Applied Ecology 2016)



Status: Common, widespread Sedentary Guild: carnivore/insectivore Size: 40-47cm

Off-white below, faintly barred with dark brown, and brown on the back and wings. Tail is more rufous, broadly barred with black. There is a conspicuous dark brown eye-stripe through the face, large beak.

Feeding: feeds mostly on insects, worms and crustaceans, although small snakes, mammals, frogs and birds may also be eaten.

Breeding: believed to pair for life.

The nest is a bare chamber in a naturally occurring tree hollow or in a burrow excavated in an arboreal (treedwelling) termite mound. Both sexes share the incubation duties and both care for the young. Other Laughing Kookaburras, usually offspring of the previous one to two years, act as 'helpers' during the breeding season. Every bird in the group shares all parenting duties.



Little Wattlebird Anthochaera chrysoptera



Most commonly sighted at Parabianga Reserve (Photo: AE 2016)

Feeding: Primarily nectarbut also insects, flowers, berries and some seeds. Breeding: Female constructs the nest, which is a large cup of twigs and grass, lined with soft materials, such as feathers and wool. The nest may be placed in a range of places from the ground up to about 15m. The female also incubates the eggs alone.

Both sexes care for the young chicks. Can have up to 3 broods a year.



Status: Uncommon Sedentary/dispersive Guild: nectarivore/insectivore Size: 28-35cm Smallest of the wattlebirds. Mostly dark greybrown above, with faint white shafts on each of the feathers. Underparts grey and heavily streaked with white.. In flight, there is a large rufous patch in the wings. The eye is blue-grey.

Noisy Friarbird Philemon corniculatus



Status: Rare Seasonal migrant Guild: insectivore/nectivore Size: 30-35cm distinctive naked black head and a strong bill with a prominent casque (bump) at the base. The upperparts are dark brown to grey, the underbody is off-white.

Noisy Friars at Dence Park Epping.Not common locally – best seen during flowering events photos: Jenny Stiles 2014)

Feeding: eats nectar, fruit, insects and other invertebrates and sometimes eggs or baby birds. They spend most of their time feeding on nectar high up in trees, only coming down to the ground occasionally to feed on insects.

Breeding: forms long-term pairs, with both parents defending the nest and surrounds. The female builds the large, deep cup-shaped nest from bark and grass, bound with spider webs, slinging it in a tree-fork. She alone incubates the eggs, but both parents feed the young, up to three weeks after fledging.

Olive-backed Oriole Oriolus sagittatus



Female feeding in lantana at Hammers Road Reserve (Photo: AE 2016)

Status: Uncommon Seasonal migrant in Parramatta LGA Guild: frugivore Size: 30-35cm Olive-green head and back, grey wings and tail, and cream underparts, streaked with brown. They both have a bright red eye and reddish beak. Females can be distinguished from males by a paler bill, dullergreen back, and an extension of the streaked underparts up to the chin.

Feeding: feeds on insects and fruit in canopy trees.

Breeding: female builds a cup-shaped nest attached by its rim to a horizontal fork on the outer-edge of the foliage of a tree or tall shrub, usually around 10 m above the ground. Built of strips of bark and grass, bound with spider web. The male does not build the nest, or incubate the eggs, but he feeds the young after the eggs hatch.



Red Wattlebird

Anthochaera carunculata



Status: Common Sedentary Guild: nectarivore/insectivore Size: 32-36cm Fleshy reddish wattle on the side of the neck. The plumage is grey-brown on the body, with prominent white streaks and yellow on the belly.

Feeding: feeds on nectar, some insects are also

eaten, taken either from foliage or caught in mid-air. Berries and the honeydew produced by some insects add to the bird's diet.

Breeding: raise one or two broods in a season. Both sexes have been recorded sharing incubation duties, but often the female will do this alone. Both parents feed the young.

A common sight at Galaringi Reserve (Photo: AE 2016)

Sacred Kingfisher

Todíramphus sanctus



Sacred Kingfisher at Lake Parramatta Reserve (left) and at hollow/burrow in termite mound- Hammers Road Reserve (Photo: AE 2016)

Feeding: forage mainly on the land, only occasionally capturing prey in the water. They feed on crustaceans, reptiles, insects and their larvae and, infrequently, fish. The birds perch on low exposed branch on the lookout for prey.

Breeding: For most of the year Sacred Kingfishers are mainly solitary, pairing only for the breeding season. Usually two clutches are laid in a season. Both sexes excavate the nest, which is normally a burrow in a termite mound, hollow branch or river bank. The nest chamber is unlined and can be up to 20m above the ground. Both sexes also incubate the eggs and care for the young.



Status: Moderately common Seasonal migrant Guild: carnivore/insectivore Size: 19-24cm

Medium sized kingfisher. It has a turquoise back, turquoise blue rump and tail, buff-white underparts and a broad cream collar. There is a broad black eye stripe extending from bill to nape of neck. Both sexes are similar, although the female is generally lighter with duller upper parts. Young birds are similar to the female



S

Satin Bowerbird Ptilonorhynchus violaceus



"Green" bird (above) & bower at Backhousia Reserve(below), Northmead (Photo: AE 2016).Inset: male at Galaringi (photo: Jenny Stiles)



Status: Locally **Common** Sedentary/ dispersive Guild: frugivore/insectivore Size: 28-34cm

Adult male has striking glossy blue-black plumage, a pale bluish white bill and a violet-blue iris. Younger males and females are similar in colour to each other, and are collectively referred to as 'green' birds. They are olive-green above, off-white with dark scalloping below and have brown wings and tail. The bill is browner in colour. Young males may begin to acquire their adult plumage in their fifth year and are not fully 'attired' until they are seven.

Feeding: feeds on nectar, some insects are also eaten, taken either from foliage or caught in midair. Berries and the honeydew produced by some insects add to the bird's diet.

Breeding: The male constructs a bower consisting of two parallel walls of sticks, is built on the ground, and is used as a courtship arena during the breeding season. The male decorates it with bright blue coloured objects that it collects.

Willie Wagtail Rhipidura leucophrys



Feeding: hunts insects on the ground and in the air



Status: Locally **Common** Seasonal migrant Guild: ground insectivore Size: 19-22cm Differs from flycatchers by black throat and white eyebrows and whisker marks.

Breeding: Nests a neatly woven cup of grasses, covered in spiderweb and lined with soft grasses/hair/fur. Often reused or rebuilt in successive years. Successive broods may be raised and young stay with parents until next brood hatch.

4.6 SMALLER BUSH BIRDS

Bell Miner Manorína malanophrys



Bell Miner at Hammers Road Reserve (Photo: AE2017)

Feeding: feeds as part of a colony, remaining in the canopy at or above eight metres from the ground. They mainly eat insects, especially



Four colonies were observed during the survey period. Two large established colonies are located on Toongabbie Creek at Hammers Road Reserve and Sue Savage Park. Smaller colonies are located in Darling Mills Creek and lower Toongabbie Creek.

Status: Locally abundant
Sedentary
Guild: arboreal insectivore
Size: 18-20cm
Sexes similar but male larger

Sexes similar but male larger. mostly olive-green, with a short, down-curved, bright yellow bill, a red-orange bare eye patch and orange-yellow feet and legs.

psyllids and their lerps (sugary secretions used as protective shelters by the tiny psyllid insects) from the foliage of eucalypts. They also eat nectar and manna. It has been shown that Bell Miners maintain psyllid populations at high levels by protecting them from other birds and by maintaining sufficiently large territories so that they don't overfeed on the psyllids themselves.

Breeding: Bell Miners have a complex social structure, based on breeding pairs which each have their own feeding range that overlaps with those of non-breeding members (e.g. their offspring), making up a colony of 8 - 200 birds. The breeding pairs generally mate for life and are 'obligate co-operative breeders', which means that they are always helped by between 1 and 20 'auxiliaries' in their parental duties. These helpers are usually young or unpaired birds, but may also include other breeding adults who are also raising their own young.

Black-faced Monarch Monarcha melanopsis



Black-faced Monarch at Lake Parramatta Reserve (Photo: AE2016)

Feeding: forages for insects among foliage, or catches flying insects on the wing.

Breeding: arrives in September and returning northwards in March. It may also migrate to Papua New Guinea in autumn and winter.builds a deep cup nest of casuarina needles, bark, roots, moss and spider web in the fork of a

tree, about 3 m to 6 m above the ground. Only the female builds the nest, but both sexes incubate the eggs and feed the young.

Status: Uncommon Seasonal migrant – summer breeding Guild: arboreal/aerial insectivore Size: 18-20cm

Distinctive black face that does not extend across the eyes, grey upperparts, wings and upper breast, contrasting with a rufous (red-orange) belly. The dark eye has a thin black eye ring and a lighter area of pale grey around it.

Brown Gerygone Gerygone mouki



Brown gerygone at Excelsior Reserve on Darling Mills Creek (Photo: AE 2016)

Feeding: feeds throughout the canopy on flying insects but particularly in the midde strata.

Breeding: builds a rounded dome nest with a tapering 'tail' from roots, plant fibres, spider web, moss and lichens, which is suspended from a low branch or vine. Both parents feed the young.

Brown Thornbill Acanthiza pusilla



Status: **Common Sedentary** Guild: **insectivore** Size: 9.5-10.5cm olive-brown to grey upperparts, with a warm reddish-brown forehead scalloped with paler markings. The rump has a reddish-brown patch, the tail is greybrown with a black band and a pale tip, and the underparts are off-white, streaked blackish on the chin, throat and chest. The eye is dark red.

Feeding: feeds mainly on insects, but may sometimes eat seeds, nectar or fruit. They feed, mainly in pairs, at all

levels from the ground up, but mostly in understorey shrubs and low trees. **Breeding:** Breeding pairs hold territories all year round for feeding and breeding purposes, and the bonds between pairs are long-lasting. Females build a small oval, domed nest with a partially hooded entrance near the top out of grasses, bark and other materials, lining it with feathers, fur or soft plant

down. The nest is usually low down, in low, prickly bushes, grass clumps, or ferns. The female incubates the eggs and both parents feed the young, who stay with the parents until early autumn.

Brown Thornbills at Lake Parramatta Reserve (Photo: AE 2017)

A S

Status: Abundant Sedentary Guild: insectivore Size: 9-11cm Small bird, olive-grey, with a pale grey face and underparts, with the flanks washed brown. It has a long white eyebrow and a red-brown eye. The tail band is dark and the tail tips are white.



Eastern Spinebill Acanthorhynchus tenuírostrís



Eastern Spinebills (juvenile at left, adult at right) at Lake Parramatta Reserve (Photo: AE 2017)



Status: Moderately common Mainly sedentary, some local movements Guild: nectarivore/insectivore Size: 14-16cm Recognised by its very long, fine, down-curved beak white outer tail feathers are prominent in flight. Sexes similar with female have less distinct markings.

Feeding: feeds on insects and nectar while perched or while hovering. **Breeding:** nest is a small cup of twigs, grass and bark, combined with hair and spider's web, built in a tree fork, generally between 1 and 5 metres from the ground. Only the female builds the nest and incubates the eggs, but both parents feed the young when they hatch.

Eastern Yellow Robin *Eopsaltría australis*



At Galaringi Reserve (Photo: AE 2017)

Status: **Common, widespread** Sedentary Guild: ground insectivore Size: 15-16cm Grey back and head, and yellow underparts. The throat is off-white and, in flight, there is a pale off-white wing bar. The bill is black. Both sexes are similar. C S

Feeding: Feeds on insects, spiders and other arthropods. These are caught mostly on the ground, and are pounced on from a low perch. **Breeding:** Female builds the nest and incubates the eggs. The nest is a woven cup of bark, grasses and other vegetation, bound together with spider web and lined with finer material and leaves. Both parents, and sometimes some other helpers, care for the young birds.

Golden Whistler Pachycephala pectoralis



Feeding: feed on insects, spiders and other small arthropods. Berries are also eaten. **Breeding:** Both sexes build the nest, share incubation and rearing of young. Nest a shallow bowl of twigs, bark bound with spider's web.



Status: **Common, widespread** Sedentary Guild: arboreal insectivore Size: 16-18cm

Males are bright yellow on the underside, olivegreen on the back and wings, and black on the head with a bright yellow collar. The throat is white, separated from the yellow chest by a broad black band. Females lack bright plumage. They are generally grey above, with a pale olive tinge, and paler grey below, with a buff wash.



Grey Fantail Rhipidura albiscapa



Status: Common Seasonal migrant Guild: arboreal insectivore Size: 16-18cm Sexes similar. Grey above, with white eyebrow, throat and tail edges. Buff breast.



Feeding: feeds on flying insects, which it catches by chasing them from the edge of foliage at all levels in the canopy.

Breeding: Both sexes build the nest, share incubation and rearing of young. Nest is made of fine grass bound together with large amounts of spider web and built in a tree fork usually 2-5 metres above ground.

Grey Fantail at Terrys Creek Corridor (Photo: AE 2017)

Leaden Flycatcher Myiagra rubecula



A male at Terrvs creek corridor (photo Jenny Stiles 2016)

Status: Uncommon Seasonal migrant Guild: arboreal/aerial insectivore Size: 15-16cm Males -entirely dark blue-grey upperparts, head and chest. Females - blue-grey head and back with a distinctive reddish orange chin, throat and breast merging gradually into white lower parts, as well as a pale eye-ring.



Feeding: feeds on insects caught while on the wing or gleaned from foliage. **Breeding:** Both sexes build the nest, share incubation and rearing of young. Nest is a shallow, cup-shaped made of bark and grass held together by spider web and decorated with pieces of bark and lichen.

Lewins Honeyeater Meliphaga lewinii



Status: Locally common Sedentary Guild: frugivore/insectivore Size: 19-22cm Dark greenish grey in colour, with a creamy yellow gape (fleshy corners of the mouth). It has large, yellowish crescent-shaped ear patches.



Feeding: feed mostly on fruits, favouring berries and small fruits, but also eat insects and nectar. **Breeding:** It is unclear what roles each parent performs in nest building and incubation, but both care for the young birds. Nest is a large cup of vegetation and other materials, bound together with spider web and lined with soft material

Lewins Honeyeater at Excelsior Reserve on Darling Mills Creek (Photo: AE 2016)

Mistletoebird

Dícaeum hírundínaceum



Status: Uncommon Nomadic outside breeding period Guild: frugivore Size: 10-11cm

Males have a glossy blue-black head, wings and upperparts, a bright red throat and chest, a white belly with a central dark streak and a bright red undertail. Females are grey above, white below, with a grey streak on the belly, and a paler red undertail.

Feeding: highly adapted to its diet of mistletoe berries.

Breeding: builds a silky, pear-shaped nest with a slit-like entrance, made from matted plant down and spider web, which is suspended from a twig in the outer foliage of a tree. The female alone builds the nest and incubates the eggs, while both sexes feed the young.

Male Mistletoe Bird in a mistletoe at Lake Parramatta Reserve, Inset male at Sue Savage Park (Photo: AE 2016).

New Holland Honeyeater

Phylidonyris novaehollandiae

Feeding: mostly eat the nectar of flowers. Other food items include fruit, insects and spiders. Breeding: builds cup-shaped nest is made of bark and grasses, bound together with spider web, lined with soft material and is placed in a bush or tree, anywhere from ground level up to 6 m. Both sexes feed the chicks. A pair of adults may raise two or three broods in a year.

Status: Locally common Seasonal migrant Guild: insectivore/nectivore Size: 18cm black and white, large yellow wing patch and yellow sides on the tail, small white ear patch.

NHHE at Sue Savage Park, Toongabbie Creek (Photos: AE 2017)





appliedecology

Red-browed Finch Neochmía temporalís





RBFs at Hammers Road Reserve. note darker beaks and smaller eyebrow on juveniles above(adult in forefront)Toongabbie Creek (Photo: AE 2017)



Status: Common, widespread Sedentary Guild: ground granivore Size: 11-12cm bright red eyebrow, rump and beak, on an otherwise green and grey bird.

Feeding: feeds on seeds and insects on the ground, but sometimes perches on seeding grass heads. Breeding: builds large and domed nest, with a side tunnel for an entrance. It is a rough construction of twigs and grass stems built in a dense shrub between 1 and 2 metres from the ground. Both parents share nest-building, incubation of the eggs and feeding of the young when they hatch.



Rufous Fantails at Lake ParramattaReserve (top), juvenile (Photo: AE 2016)

Distinctive rufous rump and eyebrows, chin and throat white with black dapples on breast.

Feeding: feeds on insects, which it gleans from the middle and lower levels of the canopy. Breeding: builds a small compact cup nest, of fine grasses bound with spider webs, that is suspended from a tree fork about 5 m from the ground. The bottom of the nest is drawn out into a long stem. Both sexes share nest-building, incubation and feeding of the young. One or two broods may be raised in a season.

Scarlet Honeyeater Myzomela sanguínolenta

Scarlet Honeyeaters at Lake Parramatta Reserve (Photo: AE 2016).



Feeding: feeds mainly on nectar and sometimes on fruit and insects. **Breeding:** breeds in pairs, with the male calling and displaying to the quieter females. The small cup nest is suspended from a horizontal branch or in a fork, and is made from fine bark and grass bound with spider web and lined with fine plant materials. The female incubates the eggs alone, but both sexes feed the young. Up to three broods may be produced per season.

Silvereye Zosterops lateralis



Status: **Common** Seasonal migrant Guild: **omnivore** Size: 11-13cm small bird with a conspicuous ring of white feathers around the eye, grey back and olive-green head and wings.



Feeding: feeds on insect prey and large amounts of fruit and nectar **Breeding:** pairs actively defend a small territory. Nest- small, neatly woven cup of grasses, hair, fine vegetation, bound with spider web in a horizontal tree fork up to 5m above the ground. The nest is constructed by both sexes, who both also incubate the bluish-green eggs. If conditions are suitable two to three clutches will be raised in a season.

Status: Locally common Seasonal migrant/nomadic

Size: 10-11cm

Guild: insectivore/nectivore

indication of their presence.

Male striking scarlet head/breast/back, black wings, female/juv grey-brown, pink tint on chin and cheeks.

They were observed in good numbers during spring

and early summer. Often high in the canopy their distinctive call is the best, and usually first,

Silvereye at Parabianga Reserve (photo: AE 2016)

Spotted Pardalote *Pardalotus punctatus*



Status: Common Sedentary/local movements Guild: omnivore Size:8-10cm

wings, tail and head of the male are black and covered with small, distinct white spots, pale eyebrow, a yellow throat and a red rump.Females similar but duller, lacks yellow throat patch.

Male at Lake Parramatta Reserve (photo: Bill de Belin 2016).



Adult at burrow, Excelsior Reserve- Darling Mills (photo: AE 2016)

Feeding: forages on the foliage of trees for insects, especially psyllids, and sugary exudates from leaves and psyllids. **Breeding:** pairs actively defend a small territory. Nest- small, neatly woven cup of grasses, nest is an enlarged, lined chamber at the end of narrow tunnel, excavated in an earth bank. Sometimes they nest in tree hollows and occasionally in artificial structures. Both parents share nest-building, incubation of the eggs and feeding of the young when they hatch.



They were observed in good numbers during spring and early summer. Appeared to leave the LGA over summer returning in late April/May 2017

appliedecology

Striated Thornbill Acanthiza lineata



Status: Rare Sedentary Guild: canopy insectivore Size: 10cm Greenish upperparts, an orangebrown cap, streaked distinctively with white and off-white to cream

are similar.



Rarely seen on the ground - Excelsior Reserve (photo: AE 2017)

Feeding: feeds mainly on insects, but may sometimes eat seeds, nectar or fruit.

Breeding: breeds in small related groups, defending a particular nesting territory. Both sexes build the oval, domed nest, with a hooded entrance near the top, out of bark mixed with lichen, mosses and spider webs and egg sacs lining it with feathers, fur or soft plant down. The nest is usually in the outer branches of trees, shrubs and vine-covered saplings, mainly of eucalypts. The female incubates the eggs and both parents feed the young, along with other members of the breeding group

underparts, heavily streaked on chin, throat and breast. The sexes

Superb Fairy-wren Malurus cyaneus



SFW (Male above, female at right) at Baludarri Wetland (Photo: AE 2016) Status: Abundant Sedentary Guild: ground insectivore Size: 10cm

Males - rich blue and black plumage above and on the throat. The belly is grey-white and the bill is black. Females- mostly brown, orange area around eye and brown bill, brown tail with greeny gloss.

Feeding: feeds on insects and other small arthropods. These are caught mostly on the ground, but may also be taken from low bushes. Feeding takes place in small social groups. **Breeding:** nest-dome-shaped structure of grasses and other fine material, usually placed in a low bush - constructed by the female. The female incubates the eggs alone, both

sexes feed the young. Other members of the group will also help with the feeding of the young.

Variegated Fairy-wren Malurus lamberti



Male at Lake Parramatta Reserve (Photo: AE 2016).

Regular spots for this species were dry forest in Lucknow Park, central/west side of Hunts creek above Lake Parramatta and central area of Hunts Creek Sanctuary. Status: Uncommon, localised Sedentary Guild: canopy insectivore Size: 10cm Male- The crown and sides of the head are blue, and the shoulder patch is a rich chestnut. Non-breeding males, females and young birds are brownish grey.

Feeding: feeds on insects and a small amount of seeds.

Breeding: Male <u>does not</u> have a harem – the small groups actually consist of an adult female with younger or non-breeding birds. Nest is an oval-shaped dome, constructed of grasses, and placed in a low shrub. The female alone constructs the nest and incubates the eggs, but is assisted by other group members in feeding the chicks.



Check for chestnut shoulder patch to confirm species



Varied Sitella

Daphoenosítta chrysoptera

Status: Rare Sedentary Guild: arboreal insectivore Size: 11-13cm

iris is orange-yellow, and the eyering, legs and feet are yellow. The bill is long and slender and slightly up-turned. All adults are greyish above and white below, with varied streaking. The upper tail coverts are pale, with dark-barring underneath.

A small party of up to 6 individuals was observed at Lake Parramatta Reserve. All photos are from this single encounter (AE 2016).

Feeding: feed mainly by gleaning on tree trunks or branches, <u>moving downwards</u> or along branches, searching for insects. **Breeding:** nest is a deep open cup, like a cone, of bark and spider web, decorated on the outside with long pieces of bark, camoflaged to look like the fork or branch where it is placed. Usually breeds cooperatively, with the breeding pair having several helpers. They will sometimes also breed in single pairs. Only the breeding female incubates the eggs and broods the young. All help to feed the young and remove faecal sacs.

The Varied Sittella is a sedentary species, with family groups inhabiting a single area. They have been recorded at densities of 0.2-0.3 and 0.46 ha⁻¹ near Armidale (Ford et al. 1985) with Marchant (1984) and Noske (1998) recording similar densities in SE and NE NSW. Typical family groups consist of 4-6 birds (Noske 1998). The family group observed potentially defends a territory of 13 -20ha with territory size dependent on the abundance and density of their preferred foraging trees which are rough barked eucalypts. The size and quality of habitat in the Lake Parramatta Reserve could potentiallyaccomodate several family groups.

It is unlikely the species would occur in the smaller corridors within the LGA as fragmentation of bushland inhibits the movements of small woodland birds across the landscape as they will avoid crossing open space if possible. The species could potentially occur in Darling Mills and Terrys Creek corridors.

Threatened species determination

Gazetted 12/02/2010 as a VULNERABLE SPECIES in Part 1 of Schedule 2 of the Act.

The species is widely distributed in NSW from the coast to the far west in suitable forest and woodland habitats. Using reporting rates for the first national bird atlas in 1977-81 to the second national bird atlas in 1998-2002 there was a significant decline in reporting rates. Assuming a linear decline this is equivalent to a state wide decline of 35% over 3 generations (15 years).

Land clearing, reduction in quality of habitat and the dominance of Noisy Miners in many woodland patches are implicated in the decline of this species .





White-browed Scrubwren Sericornis frontalis



Status: **Common** Sedentary Guild: ground insectivore Size: 11-13cm mostly dark olive-brown above, while the throat is buff grey and the flanks, belly and rump are dull rufous. They have a white line above the eye and another below the eye.



Feeding: feed mostly on insects and other small arthropods. Occasionally, they eat some seeds.

Breeding: Breed communally-nest consists of a large ball of grasses and other plant material, a side entrance tunnel leading to a cup lined with feathers. This is normally located on or near to the ground, in thick vegetation, but may be in a tree fork a few metres high. The eggs are pale blue to pale purple and are spotted with brown at the base.

WBSW at Baludarri Wetland (Photo: AE 2016)

White-cheeked Honeyeater Phylidonyris niger



Status: Uncommon Sedentary/blossoming events nomad Guild: ground insectivore Size: 11-13cm Black and white, large bright yellow tail and wing panels, with a large conspicuous white cheek patch on a mainly black head.



Feeding: feed mainly at flowers, in foliage, on bark or in the air and mainly eat nectar, but also insects.

Breeding: pair monogamously for the breeding season, with males defending breeding territories that can be held for several years. Female builds a cup-shaped nest from twigs, bark, and other plant materials, lined with pieces of flowers. The nest is placed low in forked branches of trees or shrubs, often close to the ground, but well-concealed in dense foliage or in grass below shrubs and ferns. Both parents feed young.

WCHE at Lake Parramatta Reserve (Photo: AE 2016)

Often a gregarious species it was seen only twice during surveys- once Excelsior Reserve Northmead and once in Lake Parramatta Reserve.



Note the much larger white cheek patch of the White-cheeked Honeyeater(left) as compared to the similar New Holland Honeyeater (right) (Photos: AE 2016)



White-plumed Honeyeater Lichenostomus penicillatus



Status: Uncommon Sedentary/seasonal migrant Guild: nectarivore/insectivore Size: 15-17cm yellowish-olive to grey above, pale brown-grey below, with a yellowish head and a distinctive white neck-plume. Sexes similar, male a bit larger.

WPHE at Palestine Park (Photo: AE 2016)- pairs and individuals could consistently be found at Sue Savage/Palestine Parks near the bridge.

Feeding: main foods are nectar, insects (eg lerps and honeydew), manna and fruit, with some seeds. Very strongly associated with River Red Gums.

Breeding: females build a small cup-shaped nest in the crown of a tree from 1 m to 20 m off the ground. It is woven from grass and spider web and lined with wool, hair or feathers. Females incubate the eggs but both parents feed the young, sometimes with the assistance of helpers. Two to three clutches are laid each year

White-throated Treecreeper Cormobates leucophaea



Status: Uncommon, localised Sedentary Guild: nectarivore/insectivore

Size: 14 cm

dark brown, with a distinctive white throat and chest, and white streaks on its flanks, edged with black. The wings have a red bar that is visible in flight and the undertail is barred. The female has an orange mark on the sides of the face.

Status: Locally common

Guild: canopy mid-storey insectivore

Greenish-olive on the back, with white

Sedentary

Size: 10 cm



Feeding: feeds mainly on ants, but will eat other invertebrates as well as nectar. Forages in an upward direction.

Breeding: female builds the nest and incubates the eggs, but both sexes care for the young. Two broods may be raised in a season. The nest is made in a tree cavity, which is lined with bark, fur and hair.

Female WTTC at Lake Parramatta Reserve (Photo: AE 2017). This species was found regularly at Dence Park, Epping and the central area of Lake Parramatta Reserve north of the loop creek crossing- always sinale birds.

Yellow Thornbill Acanthiza nana



Yellow Thornbill at Backhousia Reserve on Toongabbie Creek, Winston Hills (Photo: AE 2017)



Feeding: feeds mainly on insects, but may sometimes eat seeds. **Breeding:** female builds the nest and incubates the eggs, but both sexes Sometimes with helpers) care for the young. Females build a rounded domed nest, with a narrow, hooded entrance near the top out of grass/bark lining with fur or soft plant material.



Yellow-faced Honeyeater Lichenostomus chrysops chrysops



Status: Locally common Migratory Guild: nectarivore/insectivore Size: 16-18 cm

dark grey-brown above, with some brown streaking on the head, and paler below with lighter streaks, distinctive broad yellow face-stripe, bordered with black. The males are slightly larger but the sexes are otherwise similar.



YFHE were abundant in Lake Parramatta Reserve (Photo: AE 2017). Small flocks, in an intermittent stream, were observed in April migrating north. They were observed stopping off briefly at Terrys Creek and Darling Mills/Hunts Creek corridor.

Feeding: feed on nectar, pollen, fruit, seeds, insects and their products.

Breeding: Breeding pairs of YFHEs defend territories during the season. The female builds a neat, woven, sometimes fragile, cup from green materials such as moss, in the understorey of forests or in hedges, vines and other garden shrubs. She incubates the eggs alone, but both parents feed the young.

4.7 UP IN THE AIR

White-throated Needletail Hirundapus caudacutus

Although not observed in the reserves, large feeding flocks (potentially 100-300) were observed in the skies over the LGA. Research has shown that the birds do rest on a regular basis but they are very rarely observed doing so. Applied Ecology observed flocks over Upper Toongabbie Creek and Jenny Stiles (pers comm) observed large flocks over Terrys Creek in the east of the LGA. (*photos: Jenny Stiles*)



Feeding: feeds on flying insects, such as termites, ants, beetles and flies. **Breeding:** White-throated Needletails are non-breeding migrants in Australia. Breeding takes place in northern Asia.

4.8 WATER BIRDS Birds on the River.



A variety of water/shore birds were observed primarily on the Parramatta River along the foreshore from Ermington Bay to George Kendall Riverside Park. These birds included the **Australasian Darter**, Royal Spoonbill, Silver Gull, **Little Black Cormorant, Australian White Ibis, Great Egret, White-faced Heron**, White-headed Stilt, **Little Pied Cormorant** and Australian Pelican. The species in bold type (above) were observed within the bushland corridors and are described separately within this chapter.



Silver Gulls and Little Black Cormorants area common sight along the foreshore (Photo: AE 2017)







Numerous White-faced herons frequent the Bay - here at low tide a Royal Spoonbill can be seen foraging at the waterline while a White-faced Heron works the mud flats. (Photos: Applied Ecology 2016)

It was not until May 2017 that White-headed Stilts were observed at Ermington Bay.



The aptly named White-headed Stilt at Ermington Bay (Photo: AE 2017)



Crested Terns can be observed from the bird observation platform/boardwalk at Ermington Bay diving for prey in the River. This individual was captured taking a rest near the boat ramp (Photo: AE 2017)



Australasian Darter



Anhínga novaehollandíae

Status: Uncommon Seasonal nomad/ dispersive Guild: carnivore/omnivore Size: 85-90 cm long snake-like neck, sharp pointed bill, and long, rounded tail, pink feet.



Feeding: catches fish with its sharp bill partly open while diving in water deeper than 60 cm. Insects and other aquatic animals, including tortoises, may also be eaten, as well as some vegetable matter.

Breeding: usually a solitary bird, forming pairs only while breeding. Breeding is erratic, happening whenever water levels and food supplies are suitable, but most often occurs in spring and summer. Nests are usually solitary, but Darters may nest within loose colonies with other water birds that nest in trees, such as cormorants, spoonbills and ibis.

Australasian Darter at Lake Parramatta Reserve (Photo: AE 2016)

Australasian Grebe

Tachybaptus novaehollandiae



Status: Locally common Dispersive Guild: insectivore/carnivore Size: 23-25 cm two distinct plumage phases -nonbreeding plumage is dark grey-brown above and mostly silver-grey below, with a white oval patch of bare skin at the base of the bill. During the breeding season, both sexes have a glossy-black head and a rich chestnut facial stripe which extends from just behind the eye through to the base



Australasian Grebes (adult and 2 juveniles) at Lake Parramatta Reserve (Photo: AE 2016).

This grebe raised successive broods.

Feeding:. mainly feeds on small fish and water insects.

Breeding: may raise up to three successive broods in a season. Eggs are laid in a nest which is a floating mound of vegetation, normally anchored to a submerged branch or reed. The striped downy chicks are able to swim from birth and are cared for by both parents.

of the neck.

Australian Wood Duck Chenonetta jubata



Status: Locally common Sedentary/ Dispersive Guild: herb/gran/insectivore Size: 45-60 cm two distinct plumage phases -non-breeding plumage is dark grey-brown above and mostly silver-grey below, with a white oval patch of bare skin at the base of the bill. During the breeding season, both sexes have a glossy-black head and a rich chestnut facial stripe which extends from just behind the eye through to the base of the neck.



Wood Ducks roost in trees along Toongabbie Creek at Sue Savage Park (Photo: AE 2017).

Feeding: eats grasses, clover and other herbs, and occasionally, insects. Prefers dabbling in shallow water, or on grass. **Breeding:** forms monogamous breeding pairs that stay together year round. It nests in tree holes, above or near water, often re-using the same site. Both parents feed young and young birds remain with them up to a month after fledging.

Chestnut Teal Anas castanea



Chestnut Teals at Lake Parramatta- also found on the River as this species frequents salt & brackish waters (Photo: AE 2017).

Feeding: eats seeds and insects, along with some vegetation + molluscs and crustaceans in more coastal habitats. **Breeding:** monogamous pairs that stay together outside the breeding season. Both parents choose and defend a nest site and the males stay with the female while she incubates the eggs. The nest is usually located over water, in a down-lined tree hollow about 6 m to 10 m high. Sometimes nests are placed on the ground, among clumps of grass near water. Young hatch ready to swim and walk within a day, are strongly defended by both parents.

Dusky Moorhen Gallínula tenebrosa



Status: Locally common Sedentary/ dispersive Guild: omnivore Size: 35-40 cm Medium-sized, dark grey-black water bird with a white undertail. It has a red bill with a yellow tip and a red facial shield. L S

Feeding: feeds in the water and on land on algae, water plants and grasses, as well as seeds, fruits, molluscs and other invertebrates. It will also eat carrion (dead animals) and the droppings of other birds.

Adult at left, juvenile at right – Third Settlement Reserve (Photo: AE 2017).

Breeding: forms breeding groups of two to seven birds where members build nests, defend territory and rear young. Nests – constructed of reeds & grasses, floating platform and/or amongst reads. Two or more females will lay their eggs in the same nest and all members of the group help to incubate the eggs and feed the young.

(Eastern) Great Egret Ardea alba





Confirm ID from other Egrets: commissural line extends behind eye Great Egret at Parabianga Reserve on Toongabbie Creek, Wentworthville (Photo: AE 2016) Status: Uncommon Dispersive Guild: ground insectivore/carnivore Size: 85-105 cm Overall white, distinctive kink in neck.Nonbreeding: bill& facial skin yellow, legs black. Breeding: Bill black, facial skin green + plumes across lower back, legs pinkish above knees.

Feeding: feeds on molluscs, amphibians, aquatic insects, small reptiles, crustaceans and occasionally other small animals, but fish make up the bulk of its diet.

Breeding: breeds in colonies, and often in association with cormorants, ibises and other egrets. Nest -large platform of sticks, placed in a tree over the water. The previous years' nest may often be re-used. Both sexes build the nest, incubate the eggs and care for the young (usually two or three).







Eurasian Coot Fulica atra



Status: Uncommon Sedenatry/dispersive Guild: primarily herbivore in Australia Size: 35-38 cm Dark, sooty overall. White beak and forehead shield, red eye.



Eurasian Coots were observed frequently on and above Lake Parramatta but never more than 1 or 2 individuals in any location (Photo: AE 2016)

Feeding: feed almost entirely on vegetable matter, supplemented with only a rew insects, worms and rish, can be taken in deep dives, also grazes on land/water surface.

Breeding: breeding season pairs establish and maintain territories with vigour - Nests of ducks are often seized and used as roosting sites, both young ducks and grebes observed being killed. Nest is often a floating raft of vegetation or is built on logs or tree stumps that are surrounded by water. Both sexes share incubation and care of the young.

Little Black Cormorant Phalacrocorax sulcirostris



Status: Locally common Sedenatry/dispersive Guild: carnivore Size: 55-65cm One of only two totally black cormorants in Australia, green eve. black/bronze reticulation/lacing across wings.

Feeding: feeds on fish, crustaceans and aquatic insects. It catches prey underwater Breeding: nests colonially, often on the fringes of heron or ibis colonies, building large stick nests in the fork of a tree or on the ground. Both sexes share nest-building, incubation and feeding of the young.

Little Black Cormorant on Toongabbie Creek – Third Settlement Reserve (photo: Applied Ecology 2016) and rafting on the river at Ermington Bay (2017) below.





Young Little Pied Cormorant on Hunts Creek (Photo: AE 2017)

Status: Locally common Sedenatry/dispersive Guild: carnivore Size: 50-66 cm Black above and white below. The face is dusky and, in adult birds, the white of the underside extends to above the eye.

Feeding: feed on a wide variety of aquatic animals, from insects to fish. Breeding: breed either in colonies or, less commonly, in single pairs. The nest is a flat platform of sticks, lined with green leaves and is usually placed in a tree. Both adults share in egg incubation and care of the young.

Applied Ecology | RESULTS

Pacific Black Duck Anas supercíliosa



Pacific Black Ducks on Hunts Creek (Photo: AE 2017)



Nomadic Guild: herb/gran/insectivore Size: 50-60 cm Mostly mid-brown in colour, with each feather edged buff. The head pattern is characteristic, with a dark brown line through the eye, bordered with cream above and below and a dark brown crown.

Feeding: mainly vegetarian, feeding on seeds of aquatic plants. Also small crustaceans, molluscs and aquatic insects. **Breeding:** coincides with availability of sufficient food and water, and often with the onset of heavy rains or when waterways are at their peak. Female often initiates breeding , and, other than copulation, the male helps little in the breeding process. Often, two broods will be raised in a year.

White-faced Heron Egretta novaehollandiae





Status: Locally common Sedentary/Dispersive Guild: ground insectivore/carnivore Size: 60-70 cm Light blue-grey in colour, with a characteristic white face, black-grey bill, yellow legs. Nuptial plumes on the head, neck and back during breeding season

Feeding: feeds on a wide variety of prey, including fish, insects and amphibians

Breeding: White-faced Herons may breed outside the breeding season in response to rainfall. Both sexes share the building of the nest, incubation of the eggs and care of the young. The nest is an untidy structure of sticks, placed in a tree. Normally only one brood of young is raised in a year.

White- faced Heron hunting on the edge of waterfall at Hunt's Creek. Very commonly observed on mudflats of Ermington Bay- often up to 10 individuals (Photo: AE 2017)



4.9 **BIRDS OF PREY**

Brown Falcon

Falco berígora



Status: Rare

Sedentary/Nomadic/Irruptive Guild: insectivore/carnivore Size: 41-51 cm ♀ larger than ♂. Varies from very dark brown to light brown above and off-white below. Characteristic tearstripe below the eye



Observed flying over Sue Savage Park heading west . **Species more commonly observed further west in the basin** – **likely temporary visitor to the LGA only** (photo: File image Applied Ecology 2014)

Feeding: searching for food from an exposed perch-feeds on small mammals, insects, reptiles and, less often, small birds.

Breeding: June to November-often uses other raptor nests, occasionally use open hollow. The pair incubates the eggs and care for young – female performs most of these duties while male provides food.

Brown Goshawk Accipiter fasciatus / Collared Sparrowhawk Accipiter cirrocephalus



Brown Goshawk at Terrys Creek Corridor (Photo: Jenny Stiles 2016)



Brown Goshawks and Collared Sparrowhawks require a "good" look to distinguish. Female Goshawks are larger than males and female Sparrowhawks are around the same size (35 cm - 38 cm) as male Brown Goshawks. Male Sparrowhawks are significantly smaller (29 cm - 33 cm).During surveys several birds were observed – one on the ground in Lake Parramatta (♀ Brown Goshawk – by size) and several as glimpses through vegetation as they took flight. It is likely that both species were observed. The saying "Goshawks glare and Sparrowhawks stare" is in reference to the heavier brow of the Brown Goshawk and the more wideeyed look of the Sparrowhawk.

Feeding: Collared Sparrowhawks mainly eat small birds caught in flight. They hunt during the day, and also at dawn and dusk to catch birds at their roost sites.

Brown Goshawks feed on small mammals, with rabbits a particularly important prey item, as well as birds, reptiles and insects and sometimes, carrion (dead animals).

Breeding: Brown Goshawk - Established pairs will reuse the same area year after year, and often use the same nest. The female incubates the eggs, with the male helping when she needs to leave the nest to feed. The male does the bulk of the hunting to feed the young, which remain dependent on their parents for up to three weeks after fledging. Young birds disperse widely.

Collared Sparrowhawk - builds a rather flat nest of twigs and sticks in the fork of a tree, usually high among the foliage. The nest is lined with fresh leaves. Mainly the female incubates, with the male helping at times, though he provides her with food. The female broods the young for the first week or so and then shelters them in very hot or cold weather. The young are fed with small pieces of food, bill to bill.

Pacific Baza Aviceda subcristata



Status: Uncommon
Sedentary/Nomadic/Irruptive
Guild: insectivore/omnivore
Size: 35-45 cm
♀ heavier than ♂. Head, neck and breast are grey with underparts heavily banded.
Prominent crest and large yellow eyes. Wings are well rounded.



Feeding: favourite prey is large insects, particularly stick insects and mantids, and frogs. They sometimes eat fruit as well. Bazas will move through the canopy, or perch and watch, then make short dives, with feet extended, to snatch prey from the foliage or from the air.

Breeding: builds a flimsy flat nest of sticks, which is placed high in the upper leafy branches of a tree. Often the nest blows down. They are very secretive when breeding and the parent sits quietly on the nest, with its long tail sticking out over the rim. Both parents brood and feed the chicks. Bazas have a spectacular tumbling display-flight

Pacific Baza at Cox Park, Carlingford (Photo: AE 2016).





White-bellied Sea-eagle Haliaeetus leucogaster



Status: Uncommon Sedentary Guild: carnivore Size: 75-85 cm Sexes similar, female slightly larger.White on the head, rump and underparts and dark grey on the back and wings.



One of the local White-bellied Sea-eagles (left and below) at the Parramatta River (photo: Jenny Stiles 2013).

Feeding: feeds mainly on aquatic animals, such as fish, turtles and sea snakes, but it takes birds and mammals as well. It is a skilled hunter, and will attack prey up to the size of a swan.

Breeding: Breeding habitat for the White-bellied Sea-eagle consists of large trees, usually living or less often dead, within mature open forest, gallery forest or woodland (Marchant and Higgins 1993). Nest trees are usually emergent (Thurstans 2009), typically eucalypts (O'Donnell and Debus 2012) and often have emergent dead branches which are used as 'guard roosts' (Dennis et al. 2011b; Debus et al. 2014).

In subtropical eastern NSW White-bellied Sea-eagles nest at least 220 m from human settlements (mean 460 m, O'Donnell and Debus 2012). Spencer and Lynch (2005) report the White-bellied Sea-eagle avoids nesting near urban areas. Nests may be abandoned if disturbed (Debus et al. 2014; DoE 2015). The nest is a large stick nest, which is used for many seasons in succession. The nest can be located in a tree up to 30m above the ground, but may also be placed on the ground or on rocks, where there are no suitable trees. At the start of the breeding season, the nest is lined with fresh green leaves and twigs.



The female carries out most of the incubation of the white eggs, but the male performs this duty from time to time. White-bellied Sea-eagles only raise one clutch per year although a second clutch may be laid in the same nest or in a nearby repaired nest if a nest fails early in incubation (Marchant and Higgins 1993). The breeding period extends from June to January, eggs are typically laid in June to September and young birds remain in the nest for 65–70 days (Marchant and Higgins 1993). After fledging, young birds may associate with their parents for a few years before dispersing, potentially over large distances (Marchant and Higgins 1993). The generation length of the White-bellied Sea-eagle is uncertain but around 13 years is likely to be fairly accurate.

Threatened species determination

Gazetted 16/12/2016 as a VULNERABLE SPECIES in Part 1 of Schedule 2 of the Act.

The NSW population of the White-bellied Sea-eagle is estimated to be moderately low. Debus (2008) and Debus et al. (2014) estimated the population size of White-bellied Sea-eagle in NSW to be approximately 800 breeding pairs, or 1600 mature adults. Allowing for a floating population and considering uncertainty associated with the estimate, the total NSW population probably exceeds 2,500 but is highly likely to be fewer than 10,000 mature individuals. Long-term studies on population trends of this species in NSW or population modelling are required for accurate estimation of the magnitude of decline however Debus et al. (2014) speculate a decline of at least 10% (possibly exceeding 30%) over three generations in NSW. In NSW there is evidence of declines in the White-bellied Sea-eagle population around industrial or population centres. For example, in the 1960s in Sydney, 27 nests were documented in the 40 km stretch of coastal plain between Royal National Park and the Hawkesbury River (Bowden 1996; Debus 2008). This has now been reduced to **approximately three breeding pairs** with low breeding success (S. Debus in litt. February 2014). The birds observed in this study at Ermington Bay are very likely to be the breeding pair from Newington. One ebird observation was recorded in the survey period at Lake Parramatta reserve in April 2017 with the observer stating *"Two adults. Appeared to be male and female. Possibly the pair from Newington. Pair coming in towards south at approximately 150 meters altitude."*

The determination details multiple threats including increased mortality, decreased nesting success and reduced foraging resources. Mortality of White-bellied Seaeagles is likely to be above historical levels with potential causes including:

- non-target poisoning during vertebrate pest control (Clunie 2003), deliberate poisoning, shooting or trapping (Clunie 2003; DoE 2015),
- bioaccumulation of contaminants from environmental sources (Bilney and Emison 1983; Clunie 2003; Olson and Osgood 2006),
- entanglement from discarded fishing gear (Anon 2012; DoE 2015),
- collisions with wind turbines, vehicles or power lines (Smales 2006; Debus 2008; N. Mooney *in litt.* August 2014) and;
- entanglement in fish farm nets (Debus 2008)

Owlet Nightjar *Aegotheles cristatus*



Owlet Nightjar at lake Parramatta Reserve (Photo: Jenny Stiles 2016)

Feeding: feeds at night on a variety of insects. Birds will readily take flying prey, or will pounce on prey either on the ground or in trees.

Breeding: Both sexes construct the nest, which is a bed of green leaves, placed in a suitable tree hollow or rock crevice. Both birds also incubate the eggs and care for the chicks. The birds form permanent bonds, and pairs occupy the same territory throughout the year.



Powerful Owl

Nínox strenua

Status: Locally common Sedentary Guild: carnivore

Size: 55 cm

Largest Australian Owl - relatively small head and a rounded tail. Dark grey to dark grey-brown above, with white barring, and off-white below, with distinctive dark v-shaped chevrons. eyes are yellow, set in a dark grey/brown facial mask. The legs are feathered and the yellow to orange feet are massive, with sharp talons. The sexes are alike but the female is smaller, with a narrower head. Juvenile birds are downy white on the head and underparts, the underparts are sparsely streaked.





Feeding: The Powerful Owl is a carnivore, eating mainly medium to large tree-dwelling mammals, particularly the Common Ringtail Possum and various gliders. It will also take roosting birds, flying-foxes and sometimes small ground-dwelling mammals. It forages mainly in trees, attacking silently, taking prey with its feet. Most of the prey biomass for the species is from mammals (Higgins 1999; Kavanagh 2002a).

Breeding and social biology: mates for life (over 30 years in some cases) and pairs defend exclusive nesting territories within larger, defended home ranges of 400-4000 ha, depending on habitat quality and prey densities. Habitat modelling in the Sydney basin was undertaken by Bain et al. (2014) using data collected by the Birdlife Australia's "Powerful Owl Project" revealing pairs in high density breeding site areas (includes the City of Parramatta) is one site (one pair of owls) per 569 ha of modelled foraging habitat. Powerful Owls nest in large hollows up to 1 m wide and 2 m deep in big old trees (usually alive but sometimes dead). The male prepares the nest. A clutch of usually two eggs is laid in autumn to winter, with a single attempt per year. The incubation period is 38 days. The female incubates the eggs and broods the young. The nestling period is two months, and the male provides the female and young with a constant

A not uncommon sight- adult with Common Ringtail Possum. Terrys Creek.Photo: Jenny Stiles

supply of food during the early part of this nesting period with the female emerging later in the nesting period to hunt for food along with the male.

Young birds remain with the parents for several months after fledging and may stay within their parents' territory for over a year. Breeding productivity is 0.4-1.4 young per pair per year, depending on habitat quality (low in dry, fragmented inland forest, high in productive coastal forest). Bain et al. (2014) reports the average annual fledging rate in Sydney from 2011 to 2014 as 1.22 chicks, noting this was similar to the annual fledging success of 1.28 chicks (51 fledglings from 40 breeding attempts) reported by Kavanagh (2003).

The established Lucknow Park pair roosting along Terrys Creek (right).



Applied Ecology | RESULTS

65



One of two owlets at Quarry Branch Creek in Spring 2016 (photo: AE 2016).



Breeding pair on Terrys Creek corridor (Photo: Jenny Stiles 2017).

Applied Ecology can confirm the presence of a breeding pair in the Quarry Branch corridor, and two pairs in the Terrys Creek corridor. These latter pairs' breeding hollows are on The "Parramatta" side of Terrys Creek with another pair breeding on the "Ryde side". A pair is commonly observed at Vineyard Creek but have not bred for many years (pers comm. Jenny Stiles) after damage to their hollow and the predation of one of their owlets (probably fox). The Powerful Owl project volunteers observed a breeding pair at the Hunts Creek Sanctuary that moved just prior to this survey and returned (with owlets) in April 2017. An Owlet was observed just north of the M2 (outside the LGA) while surveying Devlins Creek. Surprisingly no Powerful owls were seen or heard in the Darling Mills corridor during this survey.

Threatened species determination

All the large forest owls in NSW including the largest, the Powerful Owl, were included in the Endangered fauna (Interim Protection) Act 1991 and automatically transferred to schedule 2 (Vulnerable) when the Threatened Species Act came into effect in 1995. Literature pertaining to the species was reviewed in 2008 to assess status of the species.

Reviewed September 2008 as a VULNERABLE SPECIES in Part 1 of Schedule 2 of the Act.

The reasons contributing to the listing of the Powerful Owl were: population size between 1,000 and 10,000 individuals, population suspected to be declining, current distribution within NSW is between 10001 – 100 000 Km. Area of occupancy within this range is about 20 000 km². The number of mature individuals of the Powerful Owls has been estimated as 7 000 globally (Garnett & Crowley 2000), of which over half would occur in NSW on the basis of geographic range, or more than 3 500 birds. This estimate is assigned a medium level of reliability (Garnett & Crowley 2000). Other estimates suggest a minimum population in NSW of 2 000 pairs, or 10 000 birds (DEC 2006).

Bain et al. (2014) estimates the population of Powerful owls in Sydney to be **120 adult birds**. Based on observations made during this survey over 10% of this "Sydney" population has core breeding and/or roosting areas within the City of Parramatta with foraging areas likely to extend well beyong the LGA boundaries.



The NSW Scientific Committee details the threats to this species in the committee's review of literature and includes the following key issues, most of which are applicable to the resident owls of the LGA:

- Land clearing
- Loss of hollow bearing trees with OEH (2014) noting the species require "large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old"
- Competition for hollows (nest sites and prey nest sites) by feral honey bees
- Inbreeding- Powerful Owls are known to disperse up to 18 km, including across sparsely wooded areas (Higgins 1999; Cooke & Hogan 2008), so population fragmentation is unlikely. However, dispersal may be somewhat inhibited in urbanised areas, with consequent inbreeding (Hogan et al. 2008)
- Predation of owlets by the Red Fox
- Too frequent fires
- Reliance on protocols and codes to protect breeding & roost sites
- Injury or death from vehicle collisions, overhead wires, entanglement on fences

In addition to these threats Bain et al. (2014) has documented disturbance of breeding sites by bird watchers and photographers (including one site in Carlingford) that ultimately resulted in Powerful Owls abandoning the site. In the sixteen nesting failures documented between 2011 – 2014 by the Powerful Owl Project, two were directly attributed to Sulphur-crested Cockatoos taking over a breeding site prior to resident Powerful Owl chicks fledging, with a further two failures also likely to be directly attributable to Sulphur-crested Cockatoos. Competition for breeding sites with Sulphur-crested Cockatoos is likely to be a key threat in the City of Parramatta, noting that locally abundant parrot species also compete for hollows with key prey species.



The resident pair at Vineyard Creek are not fazed by being photographed from a respectable distance of approximately 15 metres (Photo: AE 2016).

It is strongly recommended that the location of roosting sites are not dessiminated widely by Council or Bushcare volunteers that work within the reserves , this includes the removal of all GPS-embedded data from any images prior to sharing particularly on any form of social media. Nest sites locations should never be publicised with Birdlife Australia recommending that the location of nesting sites of rare species or species of conservation significance only being bedivulged to relevant conservation authorities.

It is recommended that Council actively promote ethical bird watching through signage and its education programmes.

Southern Boobook

Nínox boobook



Status: Locally common Sedentary

Guild: carnivore

Size:25-33 cm

Smallest and most common owl in Australia. Dark chocolate-brown above and rufous-brown below, heavily streaked and spotted with white. The bill is grey with a darker tip, and the feet are grey or yellow. The facial disc is chocolate brown and the eyes are large and yellowish.

Feeding: feeds on insects, small mammals (such as the House Mouse, *Mus musculus*) and other small animal species

Breeding: nest is normally a tree hollow, which is usually sparsely lined with wood shavings, leaves and small twigs, but may be left bare. The female alone incubates the eggs, but both sexes, and sometimes a second female helper, feed the young.



Unlike the Powerful Owl, the Southern Boobooks at Quarry Branch (top and right) and Darling Mills (left) are likely to take flight when observed roosting during the day (Photo: AE 2016-17). All owl species should be given a minimum 10-20m buffer during the day and observers should approach as singles or pairs and retreat if the bird appears agitated. Keep observations brief. Do not use flash photography. Do not approach nesting birds.

Tawny Frogmouth Podargus strigoides



Status: Common Sedentary Guild: carnivore Size: 34-53 cm Silver-grey, slightly paler below, streaked and mottled with black and rufous.Large yellow eyes.

Tawny Frogmouth family at Ermington Bay (Photo: AE 2016)



Feeding: diet is made up of nocturnal insects, worms, slugs and snails. Small mammals, reptiles, frogs and birds are also eaten. Most food is obtained by pouncing to the ground from a tree or other elevated perch. Some prey items, such as moths, are caught in flight **Breeding**: August – December. Both sexes incubate the eggs. The male sits during the day, but both sexes share sitting at night. The nest is a loose platform of sticks, which is usually placed on a horizontal forked tree branch. Normally only one brood is raised.

Tawny Frogmouth at Yana Yirabana Reserve on Toongabbie Creek, Northmead (Photo: AE 2016)



White-throated Nightjar

Eurostopodus mystacalis

Status: **Rare Migratory** Guild: insectivore Size: 32-37 cm

Largest nightjar – dark, mottled. black, brown, fawn and grey, with just a small area of white on the throat enables it to blend in well with leaves and twigs as it rests on the ground during the day. Black bill, brown eyes. At rest- wing tips extend to tail tip. No white on tail, small white spots on wing tips.



Feeding: feeds on insects close to the ground.

Breeding: Usually October – December. Lays a single egg on the ground in leaf litter, stones and bark – no real nest is made. Both parents incubate the egg and care for the chick, with fledging occurring at just over four weeks old.



Heard more often than seen- a rare sighting during the day at Lake Parramatta Reserve (Photo: AE 2016)

4.11 **INTRODUCED SPECIES**

Common Myna Sturnus tristis



Common Starling



A Common Myna foraging in mown grass areas on the edge of remnant bushland at Palestine Park (Photo: AE 2016)

Common in Ermington Bay around boat ramp and dog park. Doesn't penetrate into good bush areas.

Only observed in Lower Toongabbie Creek. Frequented the bridge area on Briens Road (Photo: AE 2017)

Did not penetrate into good bush.

Domestic Duck Anas platyrhynchos domesticus

U

U







Turdus merula



European Blackbird (male) at Robin Hood Reserve on Toongabbie Creek, Northmead (Photo: AE 2016).

Secretive. Most often observed in more degraded areas where weed thickets provide cover.

House Sparrow Passer domesticus





Young House Sparrows taking refuge from the summer heat in privets along the creek at Sue Savage Park (Photo: AE 2016)

Not observed in most reserves or on most edges.





Nutmeg Mannikin





beds and call loudly before alighting to fly quickly across the wetland

Observed at Baludarri Wetland only. Small flock. Would drop into Typha

(photo: Stock photo 2010)

Red-whiskered Bulbul *Pycnonotus jocosus*

A Red-whiskered Bulbu



A Red-whiskered Bulbul at Baludarri Wetland (Photo: AE 2016)

Abundant & widespread- along all weedy riparian zones. Penetrates into bushland reserves where suitable habitat exists.

Rock Dove Columba livia





Rock Doves are breeding under the bridge between Palestine Park and Sue Savage Reserve (Photo: AE 2016).

Absent from good bush areas. Common in open degraded areas.

Spotted Turtle-Dove Streptopelia chinensis





Spotted Turtle-dove at Sue Savage Reserve (Photo: AE 2016).

Often heard calling from nearby backyards. Only on edges or along weedy narrow corridors.
The following species profiles conatin species information, species image and a distribution map. Distribution maps illustrate the corridors where a species was present during this survey and are not an indication of the species abundance or distribution within a corridor.

A symbol denotes indicative abundance during this survey and should be read in conjunction with the notes in the species table relating to "CoP" (City of Parramatta).

4.12 AMPHIBIANS

Seven species of frogs were recorded in the LGA during this survey. Very hot and dry weather over summer limited the area where frogs would typically call from, potentially limiting the number of species detected. **Maps denote distribution by corridor.**

The following profiles are primarily compiled from Cogger (2014) Reptiles and Amphibians of Australia, ²<u>https://frogs.org.au</u>, OEH species profiles and Robinson (2002). A Field Guide to Frogs of Australia, and calling periods from : ³ Lemckert, F. and Mahony, M. 2008. Core calling periods of the frogs of temperate New South Wales, Australia. Herpetological Conservation and Biology 3: 71-76.





4.12.1 Southern frogs (families Myobatrachidae & Limnodynastidae)

Brown-striped Frog Limnodynastes peronii





Striped Marsh Frog at Beecroft Reserve South on Devlins Creek, Beecroft (Photo: AE 2016) and foam mass (below) at Dence park 2017.

Status	Protected
Other Common Names	Striped marsh Frog
Call	A "tock" or "poc" with similar inflections to a hen's "cluck".
Description	A large wetland-dwelling frog and voracious hunter, this frog eats almost any animal smaller than itself, including small frogs.
	Adult length: 45-75mm. Range from pale fawn to golden-brown with dark brown or black longitudinal stripes along the back. Juveniles may have only a series of longitudinally aligned spots or streaks. Tadpoles are usually light brown or silvery grey on both body and fins.
Habitat	Found in open forests and usually associated with permanent water. This species does well in disturbed habitats
Habitat availability in CoP	Widespread
Breeding	Males call from the water concealed in vegetation or sometimes concealed under the egg masses. Females lay their eggs in floating foam masses attached to vegetation in still waters. Tadpoles grow to a maximum length of 60 mm.

2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Breeding												
³ Calling												
Eggs												
Tadpoles												





Multiple individuals observed in a drainage line in Hunts Creek Sanctuary below Roberts Road in late February. Many males calling and pairs mating in numbers in response to rain after extended dry period (Applied Ecology 2017). Note the variability in colouring/pattern and smooth skin (right) to "warty" (left) from this single breeding group.

Status			F	rotect	ed									
Ot	her C	omm Nam	on (ies	Common Froglet, "Crinia"										
		C	all (a	Cricke a chirp crick c	t-like Ding q rick".	hearo uality	d yea v, rap	ir lon _{ bidly r	g. Serio epeato	es of ed in	three a lonរ	to fiv g serie	e pulsed calls, with es - "crick crick crick	
	Des	cripti	on A	A sma comm	ll grou on an	ınd d d wic	welli Jespr	ng fro read s	og, it is pecies	s one s.	of Ea	stern	Australia's most	
				Adult length: 18-28mm. Highly variable even within a single location. have a granular belly which is white or muddy white, heavily mottled with black or dark brown. The patterning on the back is variable but three patterns (morphs) are common: [1] ridged (longitudinal ridges along back); [2] lyrate (boomerang shaped ridges over the shoulder and on the back); and [3] smooth (back smooth, unpatterned, or with small warts). Tadpoles are light grey or brown all over with scattered dark flecks.										
		Habi	tat F C C S	Found debris uncom and ta swam	in na , usua nmon dpole ps, flo	tural lly in to fir s are oded	and moi nd do aqu gras	distur st dep zens atic a ssland	bed a pressic of ind nd car , ditch	reas ons or ividua n be f nes ar	- shel ^a near als un ound nd hol	ters u wate der o in po llows.	nder logs and other er. It is not ne log or rock. Eggs nds, dams,	
Habitat	availa	bility C	in N oP	Nides	pread									
Breeding Males call from among vegetation at the waters edge or floating in open water supported by vegetation.														
2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec]	
Breeding														
Calling														

Eggs Tadpoles



Α

Bibron's Toadlet

Pseudophryne bibronii





(photo CSIRO)

Status	Protected
Other Common Names	Brown Toadlet
Call	a short squelchy "cre-ek" repeated every few seconds
Description	A small, secretive frog, rarely seen
	Adult length: 22-30mm. Female larger than male. Brown, almost black above, belly smooth with marbling in black, grey and white. Pair of boomerang-shaped ridges over the shoulder. On the base of each arm there is always an orange or yellow patch. Tends to walk rather than hop. Tadpoles are dark brown with clear fins that are finely flecked with black or brown.
Habitat	They live in areas that are likely to be inundated after rain (Robinson 2002). They shelter in damp areas under leaf litter, logs, or other forms of cover. A study by Chambers et al. (2006) found that soil pH at sites where <i>P. bibronii</i> were recorded as present was lower than pH at sites where <i>P. bibronii</i> were recorded as absent. They conclude soil pH and/or fungi associated with high-pH soils (>5) may play a major role in influencing the local distribution of this species.
СоР	uncommon – potentially threatened by quality of runoff
Breeding	The males call from within a burrow or nest (a concealed area under a rock or log, or within damp leaf-litter) near water (Robinson 2002). Between 70 and 200 eggs are deposited in loose clumps in shallow burrows under litter at the calling site, or nearby in a concealed place near water. The rain washes them into the water. Tadpoles are found in ponds, flooded grassland and roadside ditches. Eggs can survive unhatched for many weeks, and the tadpoles begin to develop inside these unhatched eggs

2	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Breeding												
³ Calling												
Eggs												
Tadpoles												

U

Red-crowned Toadlet

Pseudophryne australis



Red-crowned Toadlet, Darling Mills Corridor, below Sophia Crescent above Rifle Range Creek tributary. Found during works in Excelsior Reserve (Photo Bushland Management Resources 2016).

Status	Threatened
Other Common Names	Brown Toadlet
Call	Its call is similar to a grating 'ark' or 'squelch' sound. Can be heard all year round. They call several times in quick succession as these frogs commonly live in small colonies and answer each other.
Description	A small, secretive frog, rarely seen
	Adult length 30mm. It is dark brown to black, with distinctive reddishorange patches, one between the eyes and one along the rump. It also has a white patch at the base of each arm. The belly is marbled black and white. The tadpoles are black and reach about 25 mm.
Habitat	Only found around temporary creeks and soaks in sandstone habitats in woodland, heathland and dry sclerophyll forest around the Sydney basin.
СоР	Restricted- potentially threatened by quality of runoff and management of vegetation around suitable breeding habitat. In this survey found only on the south facing slopes where ephemeral drainage lines were fed from urban areas. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Red-crowned Toadlets <u>have not</u> been recorded breeding in waters that are even mildly polluted or with a pH outside the range 5.5 to 6.5. OEH advises "Red-crowned Toadlets are usually found as small colonies scattered along ridges coinciding with the positions of suitable refuges near breeding sites. Due to this tendency for discrete populations to concentrate at particular sites, a relatively small localised disturbance may have a significant



	site."
Breeding	It is a non-seasonal, iteroparous breeder and fecundity is relatively low, with clutch sizes averaging 24 eggs. Reproductive success is very low, as demonstrated by a local population at Hornsby Heights where 1,368 eggs were laid over three years and only 11 tadpoles reached metamorphosis (Thumm and Mahony 1999). Eggs are laid in moist leaf litter, hatching occurs when the tadpoles are well developed and the site has had heavy rainfall. Until then, the male frog usually stays close to the developing eggs, but this is probably to defend the breeding site rather than the eggs. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
³ Callina												

Thumm and Mahony (1999) examined the 417 records for the species in the Sydney basin and using geological formation mapping found that "89% of locations were associated with the Hawkesbury Sandstone which is exposed in 26.6% of the total area of the Sydney Basin. There were 7.8% of records within the areas dominated by the Narrabeen Group of sandstones which comprise 42.1% of the Basin (11 144km²). Only two records were located within the Wianamatta Shale formation of the Cumberland Plain, and both were based on relatively old (1889, 1923) museum specimens".

The two records for the species during this survey (2016-2017) were both on Hawkesbury sandstone.



Location of Hawkesbury Sandstone in relation to key corridors

Thumm and Mahony (1999) conclude that the general perception (Barker and Grigg 1997) that red-crowned toadlets are found on "Sydney sandstone" (including the Narrabeen Group) is misleading. Records on the Narrabeen Group (including sandstones) made up only 7.8% of all records.

Additional characteristics of preferred habitat examined in the study by Thumm and Mahony relate to the characteristics of 56 known breeding sites in the Sydney basin. 60% of these breeding sites were located just below the first escarpment or in areas with large outcrops and 87% of breeding sites were in the top 40% of the slope with many (67%) associated with ephemenral natural drainage lines.

The figures (right & below) are taken from the study and depict the location of breeding sites in relation to development on the plateaus.



Schematic cross section of the Hawkesbury Sandstone soil landscape illustrating that redcrowned toadlet breeding sites are found below the first escarpment on the talus slope (Thumm and Mahony (1999).



Distance (in vertical metres) from the ridge-top of Red-Crowned Toadlet breeding sites, indicating a strong association of the breeeding sites with the area just below the ridge (Thumm and Mahony (1999).

Tadpoles were most often found in small ephemeral ponds/depressions in rock shelves, or

of leaf litter around the edges. Ponds did not contain fish and had very few macroinvertebrates present – probably due to the short period of standing water. Thumm and Mahony (1999) postulate that Red-crowned toadlets are adapted to take advantage of ephemeral waterbodies that support few predators.

Threatened species determination

Gazetted 19/07/2002 as a VULNERABLE SPECIES in Part 1 of Schedule 2 of the Act.

The NPWS profile (2001) for the species notes that listing the species is due to:

- population reduction;
- reduced distribution;
- the threatening process are severe; and
- the species is an ecological specialist.

Threats include inappropriate fire regimes, bush rock removal/disturbance, disease – particularly Chytrid fungus, urbanisation of ridgetops, water pollution and changed hydrological regimes.

when located in an ephemeral watercourse, in a small pool below a drop often with accualation

Management actions, many appropriate to the management of the species n the City Of Parramatta LGA, include:

• Prevention of habitat loss;

• Development and implementation of fire management plans with an appropriate fire regime for known areas of habitat. This should include appropriate buffers and a 'mosaic-burn' strategy where necessary;

• Active prevention of bushrock removal, and education concerning the collection and use of bushrock;

• Strategies to reduce stormwater runoff from ridgetop development and existing urban areas which alter the natural hydrology;

• Development of erosion and sediment control measures, particularly at the urban bushland interface to minimise nutrient loads.

• Those investigating Red-crowned Toadlets or working in their habitat should implement the NPWS frog disease hygiene protocol.



Rain filled depressions on sandstone at Darling Mills corridor below Sophia crescent are examples of potential tadpole habitat for the Red-crowned Toadlet althought they are likely to prefer even shallower depressions. These depressions contained abundant Common Eastern Froglet and Brown-striped Frog tadpoles.

4.12.2 Tree frogs (Family Hylidae)

Eastern Dwarf Tree Frog *Litoria fallax*







Heard more often than seen from generally still water/deep ponds only- (left) calling from the dam at Vineyard Creek Reserve (Photo: AE 2016) and close up showing diagnostic white and dark stripe (very wide on this individual) above lip/through eye (photo: Jan Smith)

Status	Protected
Other Common Names	Dwarf Tree Frog
Call	Its call is similar to a grating 'ark' or 'squelch' sound. Can be heard all year round. They call several times in quick succession, as these frogs commonly live in small colonies and answer each other.
Description	A small, secretive frog, rarely seen
	Adult length 25mm. small slender frog, usually all green, but can be green with fawn legs or all fawn. A white stripe runs underneath the eyes. The backs of its thighs and groin are orange to yellow-white. The skin on its back is smooth and its belly is granular. Its irises are golden and its pupils are horizontal.
Habitat	Coastal wetlands, swamps, dams and streams, and can also be found in urban areas.
СоР	Only found in this survey in still, or primarily still ponds, detention basins and impounded waters.
Breeding	Males call during spring and summer with breeding occuring around water with lots of vegetation. Females lay between 2-35 eggs on vegetation and the male quickly fertilizes them. Tadpoles are dark with pale or patterned bodies.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
³ Calling												



Green Stream Frog Litoria phyllochroa



Note the colour differences of these frogs both photographed in the Haines Avenue Reserve creekline (Photo: AE 2016)

Status	Protected
Other Common Names	Leaf Green Frog
Call	Variable - often 'erkerk' sound
Description	A small, secretive frog, rarely seen
	Adult length 40mm. Light green to dark olive green in colour, but can change rapidly to match its surrounding environment. It has a pale yellow or gold stripe running down its sides from behind its eyes, underlined with a black or brown stripe. The armpits, groin and the backs of its thighs are dark red. Its belly is granular and white with occasional darker flecks. The skin on its back is smooth. Irises are gold.
Habitat	Waterside vegetation lining rocky streams, swamps and mountain streams
СоР	Fairly common but nowhere abundant during this survey- found around shallow pools in many of the larger streams where there was some baseflow.
Breeding	The male can be heard calling from the ground near water or hidden in waterside vegetation. The female lays her eggs in clumps on submerged vegetation in streams and ponds.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
³ Calling												

Peron's Tree Frog Litoria peronii



A Construction of the cons

Peron's Tree Frog at one of the "ponds" in the Upper Ponds corridor Galaringi Reserve. (Photo: AE 2016).

Status	Protected
Other Common Names	Laughing Tree Frog, Emerald-spotted Tree Frog, Maniacal Cackle Frog
Call	The call is very long and drawn out, slowly pulsed and increasing in loudness - "cra-ah-ah-ah-ah-ah-ah-ah-ahhk" , drill-like.
Description	A small, secretive frog, rarely seen
	Adult length 40mm. The Peron's Tree Frog has the ability to quickly change colour. By day it is usually a pale green-grey colour that changes to a reddish brown with emerald green flecks at night. It also has bright black and yellow markings on its thighs. It has a cross-shaped pupil and a silver iris.
Habitat	Adults frequent wet and dry forest, woodlands, shrublands, and open areas; often long distances from the water where they spawn during breeding season.
СоР	Fairly common & widespread, abundant at semi-permanent ponds in Upper Ponds, Haine Avenue detention basin and the disused quarry abutting Moxham Park during this survey. Patchily distributed elsewhere.
Breeding	Eggs and tadpoles are found in still water in swamps, dams, streamside ponds, and lagoons

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
³ Calling												

4.13 REPTILES

Sixteen species of reptiles were recorded in the LGA during this survey. Very hot and dry weather over summer potentially limited the number of species detected. **Maps denote distribution by corridor.**

The following profiles are primarily compiled from Cogger (2014) Reptiles and Amphibians of Australia, Atlas of Living Australia http://bie.ala.org.au, Australian Museum https://australianmuseum.net.au and OEH species profiles

4.13.1 DRAGONS



Male (above showing the red breeding flush) – Third Settlement Reserve (Photo: AE 2017)

Status	Protected
Other Common Names	Water Dragon
Description	Large semi-aquatic, arboreal dragon. A male Water Dragon can reach a length of 90-100cm and weigh about 1 kg. Two-thirds of the length of a Water Dragon is its tail. Females are notably smaller and less robust.
	Distinctively deep angular head and nuchal crest of spinose scales that joins the vertebral crest extending down the length of its body to the tail. The jowls are large and ear is exposed and of almost equal size of the eye. The dorsal ridge and tail are laterally compressed and the limbs are strong and robust with particularly long toes on the hind legs. The tail is capable of regeneration when lost, furthermore, regenerated tails can also grow back if severed.
Habitat	Flowing water with ample tree cover and basking sites appear to be the key to habitat preference for this species. Water dragons will be found in built-up urban areas provided that the above conditions can be found and water quality is fair.
Diet	Insectivorous as juveniles, however as they grow they become more omnivorous with vegetable matter gradually making up to almost half of the diet

СоР	Widespread and common in the larger corridors, particularly in the northern half of the LGA.
Biology/Breeding	Groups of dragons are usually comprised of several females, juveniles of various ages and a dominant male who will defend as much of the territory as possible from other males. Water Dragons communicate through a variety of dominant and submissive signals including head-bobbing, saluting and substrate licking. In the Sydney region, the breeding season begins in September, when courtship and mating begins, and concludes in January when the last clutches of eggs are laid. Usually active in the Sydney region from September to June, becoming inactive during the cooler months. To survive the low winter temperatures Water Dragons will enter established burrows or scrape their own between boulders and logs in or near creek banks and pack dirt into the opening to seal themselves off. Once entombed they will slow their metabolism and enter a state of brumation until spring arrives.



Young EWD (above) on Toongabbie Creek, Backhousia Reserve (Photo: AE 2017) and females at Terrys Creek (2016).



Jacky dragon Amphibolurus muricatus



Jacky Dragon sunning on a trail in the central, elevated and drier area of Lake Parramatta Reserve (Photo: AE 2017)

Status	Protected
Other Common Names	Jacky Lizard
Description	Snout-vent length of about 100 millimetres, weighs up to 60 grams. Males usually have a larger head than females. The tail is very long (up to about 200 millimetres) and the lining of the mouth is bright yellow. It is pale grey to dark brown in colour with black patches along the middle of the back and two paler stripes on either side of these dark patches, large and prominent scales along its back in rows from the neck to the base of the tail and spiny scales on the sides of the neck.
Habitat	Dry sclerophyll forest, rocky ridges and coastal heathlands.
Diet	Insectivorous
СоР	Observed in Lake Parramatta Reserve only. Potentially present in other large corridors.
Biology/Breeding	Adult females probably breed every summer and may have 3-9 eggs. These eggs are laid in shallow burrows and the sex of the young is partly determined by the nest temperature.



4.14 GECKOES



Status	Protected
Other Common Names	Leaf-tail Gecko, Southern Leaf-tailed Gecko
Description	A moderately-large gecko with a flat body and a broad flat tail tapering to a point. Brown to grey with a mottled pattern that resembles the habitat where it lives. It has rough, scaly skin. Females tend to be larger than males. Body length up to 9.9 cm.
Habitat	Coastal sandstone woodland and heath where sandstone escarpment is present, including urban areas
Diet	Insectivorous
СоР	Common where suitable habitat exists
Biology/Breeding	Nocturnal species. Females usually lay two eggs in a crevice; after eight to ten weeks the young hatch and have to fend for themselves.



In a crevice (above) on Terrys Creek (photo Merryn Horrocks 2016), cast skin (below) is common in sandstone crevices (Hunts Creek 2016)







Status	Protected
Other Common Names	Wood Gecko, Eastern Stone Gecko
Description	Snout-vent length of about 60mm, total length 90mm.Dumpy body. Dark brown with a pale, deeply notched zigzag stripe down back from neck to tip of a short plump tail. When tail is regenerated, this stripe stops abruptly at the breakage point. Toes slightly expanded to form pads.
Habitat	Found in a wide variety of habitats from arid scrubs to wet sclerophyll forest.
Diet	Insectivorous
СоР	Locally common in specific areas of the Hunts Creek corridor, restricted distribution
Biology/Breeding	Nocturnal species. Generally breed during the early spring to early summer period with clutches of 2 eggs.



4.15 SKINKS

Eight species of skink were observed during the current surveys. Four of these are the "little brown lizards" commonly observed. Of these the Dark-flecked Garden Sunskink was the most abundant. It was typically observed at an approximate ratio of 10:1 with the Pale-flecked Sunskink, except at Upper Toongabbie Creek where in certain areas the latter was observed at approximately the same rate. The other two "little brown skinks", the Weasel Skink and the Elegant Snake-eyed Skink typically occupy different niches and are not as readily confused by observers.



Status	Protected
Other Common Names	Delicate Skink, Garden Skink, Garden Sun-skink.
Description	Average snout-vent length of about 40mm, up to 51mm with total length 90mm. Grey to copper-brown above with a broad dark brown zone on the upper flanks. The flank and back colours are often separated by a thin pale line. A well-defined white stripe may be present on the lower flanks.
Habitat	Found in open and closed forests, woodlands, coastal heaths and modified landscapes
Diet	Insectivorous
CoP	Common to abundant throughout

Dark-flecked Garden Sunskink Lampropholis delicata



Biology/Breeding	Communal nesting is well-known in this genus and the eggs of many
	females can be found in the same nest site. Eggs are laid by the females
	within a short time of each other so they hatch more or less together.
	Because of their small size, this species is sometime preyed on by
	invertebrate predators. It has been found tangled in spider webs and is
	also captured by huntsman spiders. This species reaches sexual maturity
	within one year. Females lay a clutch of 1–7 eggs.



Pale-flecked Garden Sunskink Lampropholis guichenoti





Status	Protected
Other Common Names	Grass Skink, Grass Sun-skink, Common Garden Skink
Description	Average snout-vent length of about 40mm, up to 51mm with total length 90mm. Grey-brown to copper-brown above with dark and pale flecking usually with darker vertebral stripe.
Habitat	Broad array of habitats -found in open and closed forests, woodlands, coastal heaths and modified landscapes – often with <i>L. delicata</i> .
Diet	Insectivorous
СоР	Common
Biology/Breeding	Communal nesting is well-known in this genus and the eggs of many females can be found in the same nest site. Eggs are laid by the females within a short time of each other so they hatch more or less together. Because of their small size, this species is sometime preyed on by invertebrate predators. It has been found tangled in spider webs and is also captured by huntsman spiders. This species reaches sexual maturity within one year. Females lay a clutch of 1–7 eggs.



The Pale-flecked Garden Sunskink was common in Upper Toongabbie Creek and (picture here) in Quarry Branch Corridors (photos Applied Ecology 2016).

Copper-tailed skink *Ctenotus taeníolatus*



This species was only observed around exposed rock in the drier, central area of Lake Parramatta Reserve. Photo: AE 2017.

Status	Protected
Other Common Names	Australian Striped Skink, Copper-tailed Ctenotus
Description	Average snout-vent length of about 60mm, up to 77mm. Brown above with a black vertebral stripe that is pale edged, and a narrow pale dorsolateral stripe that is dark edged. Side of body black with bold white mid-lateral and lower lateral stripes. Tail often with orange or red flush. Top of head a complex pattern of pale streaks.
Habitat	Woodland, coastal and sandstone heathlands.
Diet	Insectivorous
CoP	Rare during this survey, likely uncommon
Biology/Breeding	Often shelters in burrows under rock slabs on sandy soil. Mating occurs in spring, with females laying a single clutch of between 1-7 eggs in summer.



Eastern Blue-tongue Lizard Tu





This Eastern Blue-tongue Lizard at Baludarri Wetland was the only observation during the survey. This species likely to be more widespread within the corridors than the current survey revealed.

Status	Protected
Other Common Names	Common Blue-tongue Skink, Blue-tongue, Bluey
Description	Average snout-vent length of about 300mm with a total length up to 600mm. Variable colouring but is overall silvery-grey or white with broad dark brown or blackish bands across the back and tail. Sometimes bright flushes of yellow or orange can be present, usually on the skinks sides, often has a black stripe between the eye and the ear which can extend backwards along the neck
Habitat	Inhabits open areas including woodlands and grasslands with plenty of ground cover such as tussock grasses, rocks or logs under which they shelter at night or during cold periods. Within urban environments Common Blue-tongues have adapted to shelter under a variety of human debris (tin, tiles), garden plants, or buildings and are common inhabitants of many suburban yards in Eastern Australia.
Diet	Omnivorous – slow moving prey such as the introduced garden snail, low growing flowers, fleshy leaves and some fruits.
СоР	Rare during this survey, likely uncommon
Biology/Breeding	Between September and November males pursue females and mating occurs. Birth takes place between December and January. They do not lay eggs, instead giving birth to live young. The embryos develop in the female's oviduct with the help of a placenta, which is as well-developed as that of many mammals. When the young are born, they are covered in a placental membrane, which they eat. Within a few days, they shed their skin for the first time and are ready to look after themselves, dispersing into the bush.

Eastern Water-skink Eulamprus quoyii

Α Revision of this genus is ongoing and potential splitting of the genus may occur. Shea (2010) excludes Eulamprus heatwolei from the Sydney herpetofauna and Eulamprus tenuis, previously recorded in the Parramatta River cathcment, has been shown to be a composite of five species, and has been separated into the genus Concinnia.





Status	Protected
Other Common Names	Eastern Water Skink
Description	Average snount to vent 95mm, total length up to 300mm. Golden olive brown above with black flecks and with a narrow whitish to pale yellow dorsolateral stripe from the eye extending back midway along the body or to the upper tail. The under-surface is white to pale yellow, often with fine grey or black specks.
Habitat	Often found near creeklines but can also also be found on ridges away from water.
Diet	Omnivorous – small invertebrates, worms, insects and, occasionally, fruits and berries.
СоР	Abundant
Biology/Breeding	After a spring mating, female water skinks carry the developing young until they are born in summer. Up to nine tiny skinks may be born in one litter.



An adult (above) at Third Settlement Reserve

Eastern Water-skinks are very common in most corridors. They are quite variable in colour and can easily be mistaken for other species in the genus. A "dark" individual (above right) and a "light" individual (below right) both from the Devlins Creek Corridor.



Elegant Snake-eyed Skink Cryptoblepharus pulcher pulcher

Revision of this genus has recently occurred. *Cryptoblepharus virgatus*, previously recorded in the LGA, has been renamed in this location *C. pulcher subsp. pulcher*



Status	Protected
Other Common	Fence Skink, Wall Skink, White-lined Skink
Names	
Description	Snout to vent is typically 50mm. Coppery-brown with a pair of dark- edged pale stripes along its back.
Habitat	Arboreal – often seen on tree tunks, fences.
Diet	Insectivorous - an active hunter and feeds on invertebrates such as small insects.
СоР	Common
Biology/Breeding	Lays a clutch of 2 eggs



This Elegant Snake-eyed Skink (left) lives on the treated pine fence at the entrance to Lake Parramatta Reserve off North Rocks Road.

(Above) at Quarry Branch

(Photos: Applied Ecology 2017)



Three-toed Skink

Saíphos equalís





A Three-toed Skink caught by a Laughing Kookaburra at Lake Parramatta (Photo: AE 2016). Hot and dry weather conditions made this burrowing &cryptic species more difficult to detect during the survey.

Status	Protected
Other Common Names	Yellow-bellied three-toed Skink
Description	Snout to vent is typically 65mm. Grey-brown to dark brown above with a glossy sheen, sometimes with darker spots. Sides are darker, brown to black. Under-surface yellow to orange. A long tail as thick as the body and short limbs with only three very short toes. Limbs with three digits.
Habitat	Burrowing species – most common in moist forests under logs and rock in soil, also suburban gardens.
Diet	Insectivorous
СоР	Probably more common than the survey observations
Biology/Breeding	Burrows, usually under logs or rocks in soil or in litter piles. Common in coastal areas of eastern Australia. In urban areas they are often found in compost heaps and in the garden. When disturbed they can look like a snake, because they thrash about with their legs out of sight, trying to burrow to safety. This is one of only three reptile species in the world that are known to display geographic variation in reproductive mode. Different populations are: oviparous (egg-laying) with long (15-day) incubation periods; or oviparous with short (5-day) incubation periods; or viviparous (live- bearing: 0-day incubation periods).

Weasel Skink Saproscincus mustelinus





Weasel Skink at Vineyards Creek (Photo: AE 2016)

Status	Protected
Other Common Names	None
Description	Snout to vent is typically 65mm. Light brown to golden above, with scattered paler flecks. Lateral surface (sides) similar, but with a distinctive cream-white spot at the corner of the eye and an orange-red dorsolateral hip-stripe that runs above the hind limbs to the base of tail and continues over much of its upper surface. Underneath white with yellowish flush to abdomen. Body size up to 6.5 cm.
Habitat	Surface active species – most common in moist forests, also suburban gardens.
Diet	Insectivorous
СоР	Probably more common than the survey observations
Biology/Breeding	Surface active; usually only seen amongst leaf litter or ground debris at dusk or shortly after dark on warm nights. It feeds on small invertebrates. Females lay up to four eggs per clutch, sometimes in a communal nest containing the eggs of numerous females



Weasel Skink foraging at night (above) at Hunts Creek (photos: Applied Ecology 2017)



Note diagnostic white spot behind eye.

4.16 MONITORS

Lace MonitorVaranus varius



U

Both these images are of Lace Monitors at Lake Parramatta Reserve – a semi-regular sight on the eastern side of the Lake/Hunts Creek. A remote camera also captured a Lace Monitor visiting a rabbit warren at Terrys Creek.

Status	Protected
Other Common Names	Goanna, Tree Goanna
Description	Body colour varies, but usually includes black with yellow markings (spots and narrow stripes across the body). Up to 2 m long (head- tail).
Habitat	Dry sclerophyll forests and woodlands.
Diet	Carnivore – including birds, insects, bird eggs, reptiles and small mammals. They will readily feed on carrion, including road kills, gorging themselves when the opportunity arises. After a large feed they are able to go for many weeks without feeding again.
СоР	Uncommon
Biology/Breeding	Lace Monitors are active lizards that forage over large areas. Their diet is varied, including insects, reptiles, small mammals, birds, eggs and carrion. They are a semi-arboreal species, mainly moving about in trees and sheltering in tree hollows. They do sometimes also forage on the ground, fleeing up trees when alarmed. Females lay up to 12 eggs, often in termite nests, where the constant temperature assists with incubation.



4.17 SNAKE-LIZARDS



File Photo: AE

Status	Protected
Other Common Names	Burton's Snake-lizard
Description	Triangular head - body colour varies, including cream, grey, brown, dark red with head usually darker. Two narrow white stripes from the nose along the side of the body. Long, pointed, triangular head. Up to 29 cm long (snout-vent).
Habitat	Both wet and dry forests/woodlands and arid areas
Diet	Carnivore – primarily a skink feeder.
СоР	Uncommon – observed only once (at night) at Lake Parramatta Reserve.
Biology/Breeding	Burton's Snake-lizards are the most widespread reptile in Australia. They suffocate live prey, usually other lizards, before swallowing the animals whole, head first. They are active at night and during the day



4.18 SNAKES

Red-bellied Black Snake Pseudechis porphyriacus





At Terrys Creek (left) and a typical view of a Redbellied Black Snake (below) as it disappears from view once sighted – at Baludarri wetland 2016. (Photos: Applied Ecology 2016)

Status	Protected
Other Common	Black Snake
Names	
Description	Body black and shiny, underneath red to white often extending along the side. Up to 1.7 m long.
Habitat	Usually near streams, swamps or lagoon areas.
Diet	Carnivore – primarily frogs but also other reptiles (including snakes), small mammals and birds.
СоР	Widespread. Volunteers reported recent sightings in the Hunts
	Creek corridor
Biology/Breeding	Live-bearer- gives birth to up to 20 live young.



4.19 TURTLES

Eastern Long-necked Turtle





At Terrys Creek (left) this large female was making her way away from the creek near Epping Road – potentially looking for a site to lay her eggs (Photo: AE 2016)

Status	Protected
Other Common Names	Snake-necked Turtle
Description	Carapace up to 28cm, black to brown. Neck is long, typically 60% of shell length. Females larger with deeper body.
Habitat	Broad range of freshwater aquatic habitats but is more abundant in shallow, ephemeral wetlands often remote from permanent rivers
Diet	Carnivore that feeds on a broad range of plankton, nekton and benthic macro-invertebrates, carrion, as well as terrestrial organisms that fall upon the water.
СоР	Appears to be currently widespread but nowhere abundant - this status is likely to be threatened in the future due to nest predation by foxes.
Biology/Breeding	It is relatively slow to mature (7–8 yrs for males and 10–12 yrs for females), lays between 6 and 23 hard-shelled eggs during spring and late summer, and can produce up to 3 clutches per year.



4.20 MAMMALS

Twenty-eight species of mammal were recorded during the current survey, of these fourteen were microbats and six are introduced species. Mammal observations includes seven threatened species and two locally significant species (the Swamp wallaby and Longnosed bandicoot).

Species profile information from: ¹ Department of Environment and Heritage Protection www.ehp.qld.gov.au ²Australian Museum <u>https://australianmuseum.net.au</u> ³ http://www.environment.nsw.gov.au

Common Brushtail Possum





Male at Terrys Creek (Applied Ecology 2016)

Status	Protected
¹ Other Common Names	Brush-tailed Possum
Description	It is a large possum with a bushy tail and pointy ears. Usually silvery grey in colour with a black band across the snout, they have a white to brownish-yellow belly. Adults can weigh around 1.5-4 kg. The combined head and body length is between 35 and 55 cm and tail length is 25-40 cm.
Habitat	Urban areas, forests and woodlands and heath.
Diet	In the wild, the Common Brushtail Possum's diet consists of leaves, blossoms and fruits, also insects, eggs and meat may also be eaten infrequently. In suburbia the diet becomes more opportunistic and will eat a variety of other foods.
СоР	Common- widepread
Biology/Breeding	Nocturnal -retreats to a hollow or similar during the day. Breeds throughout the year, with the majority of births occurring between March and November. Females reach sexual maturity of approximately one year and males in their second year. A single furless young is born after a 17.5 day gestation, weighing 200 mg and measuring approximately 15 mm. It makes its first pouch exit at around 121 days and permanently leaves the pouch at around 150 days.

Common Brushtail Possums were regularly captured on remote cameras deployed during the survey revealing the wide variety of habitats they persist in. They were also one of the most common species detected by hairtubing. These remote techniques were more successful in detecting the species than spotlighting.



A still (left) taken from a remote camera film of a CBP walking through the mangroves at Ermington Bay Two CBP (right) in degraded creekline near the junction of Subiaco Creek and Lower Ponds, Rydalmere.



In good bush at Lucknow Park, Epping



Common Ringtail Possum *Pseudocheirus peregrinus*





Α

Status	Protected
² Other Common Names	Ringtail Possum
Description	Body 300 mm - 350 mm, Tail 300 mm - 350 mm, weight 700 - 1100 g. Short rounded ears, rounded head with dlightly bulging eyes, variable grey to near-black back, sometimes tinged red-orange, white to red-orange below; red-orange legs. Tapering prehensile tail with a white tip, naked underside, furred above. Carried in coil when not used.
Habitat	Exclusively tree-dwelling, the Common Ringtail Possum lives in in forests, woodlands, rainforests, dense scrub and suburban gardens
Diet	Herbivore-eats a variety of leaves of both native and introduced plants, as well as flowers and fruits. By eating its own faecal pellets, it digests its food twice to extract the maximum amount of nutrients.
СоР	Widespread, common
Biology/Breeding	During the day, the Common Ringtail Possum sleeps in its spherical nest or 'drey' made from grass and shredded bark. It builds the drey in a tree hole, tree fork or dense vegetation, and several individuals may share the one nest. The majority of the young are born between May and July. The average litter is made up two young and very occasionally triplets. They leave their mother's pouch at 120–130 days. However, lactation usually continues until 180–220 days after birth. When the mother is feeding, the male carries the young on his back and cares for them.



Posing for the remote camera at Darling Mills Creek 2016



■ ● 072F 22℃ 09/12/2016 22:18:34

Applied Ecology | RESULTS

Grey-headed Flying-fox *Pteropus poliocephalus*





Grey-headed Flying-fox feeding on a fig tree at Palestine Park 2017

Status	Threatened
³ Other Common Names	Fruit Bat
Description	Largest Australian bat, with a head and body length of 23 - 29 cm. It has dark grey fur on the body, lighter grey fur on the head and a russet collar encircling the neck. The wing membranes are black and the wingspan can be up to 1 m. It can be distinguished from other flying-foxes by the leg fur, which extends to the ankle.
Habitat	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.
Diet	Nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also gardens and crops.
СоР	Widespread- observed feeding in most corridors – particularly in response to flowering events
Biology/Breeding	Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km



Long-nosed Bandicoot *Perameles nasuta*



Status	Protected
³ Other Common Names	None
Description	Nocturnal marsupial of medium size. Adults range from 310 - 425 mm in head and body length, tail length varies from 120 - 155 mm and body weight may vary from 850 - 1100 grams. Males are larger than females. Colour is typically dark, greyish-brown above and creamy white below. The forefeet and upper surfaces of the hindfeet are also creamy white. The muzzle is long and pointed and the ears are distinctly larger and more pointed than short-nosed bandicoots of the genus <i>Isoodon</i> .
Habitat	Lives in forests and woodlands, and heath
Diet	Forages mainly at or after dusk, digging for invertebrates, fungi and tubers. The conical holes it leaves in the soil are often seen on tracks
СоР	Restricted to Terrys Creek Corridor
Biology/Breeding	Shelters during the day in a well-concealed nest based on a shallow hole lined with leaves and grass, sometimes under debris, sometimes hidden with soil and with the entrance closed for greater concealment. Mating takes place at night and may occur throughout the year in the Sydney region, although there is a trough in breeding activity from late autumn (April) to mid-winter (June). Has a very high reproductive capacity. There are 8 teats in the pouch and litter sizes range from one to five but usually two to three. Birth takes place during the daylight hours after a gestation of only 12.5 days. The young are carried in the pouch for 50 to 54 days and are then left in the nest. When the young are about 50 days old the mother may mate again and produce another litter several days after the previous one has been weaned. In good years, females may produce up to 4 litters. Female bandicoots may begin breeding at about four months of age and males at about five months.

L



Characteristic conical digging (above) at Dence Park, Epping 2017. The species was captured on camera and detected by hairtubes in dense bushland in Dence Park and Lucknow Park, Epping



Short-beaked echidna

Tachyglossus aculeatus





Out and about during the day at Terrys Creek Corridor (Photo: Jenny Stiles 2016)

Status	Protected
² Other Common Names	None
Description	Easily recognised by its sharp spines, short legs and long snout.
Habitat	forests and woodlands, heath, grasslands and arid environments.
Diet	Breaks into ant and termite nests and catches its prey by flicking its long sticky tongue in and out. It also catches a lot of dirt in the process and this is expelled in the droppings.
CoP	Moderately common
Biology/Breeding	the Short-beaked Echidna is an egg-laying mammal or monotreme and lays one egg at a time. The eggs hatch after about 10 days and the young, emerge blind and hairless. Clinging to hairs inside the mother's pouch, the young echidna suckles for two or three months. Once it develops spines and becomes too prickly, the mother removes it from her pouch and builds a burrow for it. It continues to suckle for the next six months.



This species was captured on remote camera (above) at Terrys Creek and (above right) at Haine Avenue Reserve. It was also observed during spotlighting sessions. Three were observed in one evening at Darling Mills Creek (right).


Sugar Glider Petaurus brevíceps





Sugar Glider in Acacia decurrens- Galaringi Reserve (Applied Ecology 2016)

Status	Protected
² Other Common Names	None
Description	Small arboreal marsupial- head-body length of 16 – 21 cm and a 16 – 21 cm tail. Adults weigh 100 – 160 grams, with males slightly heavier than females. The body is covered with grey to brown fur with a prominent dark dorsal stripe that extends to the forehead. Its tail is long, well-furred and prehensile. It has a membrane extending from its fifth finger to its ankle enabling it to glide up to 50 m between trees.
Habitat	Occurs in forest & woodland where suitable hollows are available
Diet	Food includes acacia gum, invertebrates, eucalypt sap and pollen. In in collecting eucalypt sap it leaves distinctive "glider chews" on trees.
СоР	Uncommon to locally common – <i>Corymbia gummifera</i> and <i>Acacia decurrens</i> are important local species for Sugar gliders
Biology/Breeding	The Sugar Glider is most active at night, sleeping by day in nests made of leaves in tree hollows. Groups of up to seven adults and their young may form a 'clan' and share a nest. Among their own clan they are playful and social but will defend their territory aggressively and noisily if threatened by other animals or approached by Sugar Gliders from a different clan. Dominant males mark other clan members and the territory around the nest with secretions from scent glands on their chest. The Sugar Glider commonly gives birth to twins, which remain in the pouch for just over two months. They then leave the nest to forage for food, usually with their mother.



During surveys the most effective method of detecting the species was by listening for its distinctive call, followed up by targeted spotlighting and remote cameras. The species was not detected by arboreal hairtube.



(074F 230

Remote camera images of the species at Lake Parramatta Reserve (left) and Vineyard Creek (right).



Sugar gliders at Galaringi Reserve 2016 (photos:Jenny Stiles)

"Glider chews" (below) on Corymbia gummifera, Lake Parramatta Reserve, 2017



Swamp Wallaby Wallabia bicolor



A male Swamp Wallaby at Terrys Creek, Epping 2016 captured on remote camera. A female with young at foot was captured by the camera at the same location (below).

Status	Protected
² Other Common Names	Black Wallaby
Description	Upper body fur dark brown with underparts yellow to orange- brown. Face dark, often with a white stripe. Hops with head and shoulders low, and tail held horizontal. Body up to 85 cm, tail up to 86 cm.
Habitat	Forest, woodland and heath where there are patches of dense undergrowth for cover during the day
Diet	Swamp Wallabies feed on the leaves of shrubs, ferns, fungi and grasses.
СоР	Uncommon to locally common
Biology/Breeding	A solitary species, home ranges often overlap substantially. Breeding occurs throughout the year. The pouch life of each joey is eight to nine months, although they may continue to suckle until 15 months of age.



Swamp Wallabies were primarily detected by remote techniques – hairtubing, scat collection and on remote cameras.



4.21 MICROBATS

White-striped Free-tailed Bat Austronomus australis





Austronomus australis - White-striped Free-tailed Bat (Photo Michael Pennay, <u>http://bie.ala.org.au</u>)

NSW status:	Protected
Distribution:	Most of Australia, except for Tasmania and northern Australia (north of tropic of Capricorn)
City of Parramatta	Widely distributed, mainly in larger reserves
Distinguishing features:	Large distinctive species with white stripes along the sides of the belly and on to the wings. Some individuals have white patches on the chest. Prominent throat pouch present in both sexes. Very low frequency echolocation makes this one of the few microbats with an audible call – heard as a regular metallic ting ting ting
Habitat:	Urban areas, forest, woodland, shrubland, open agricultural landscapes with scattered trees. In summer they move south to cooler areas, in the north they tend to forage later in the night. Migration is driven by average minimum temperature of the area – below 21°C to dissipate heat generated by flying.
Roosting:	Tree dwellers, roosting in small groups up to 25, usually less than 10, often solitary. Maternity colonies up to 300, usually in large trunk cavities with multiple entrances, sometimes sharing with possums but rarely with other microbats. Become torpid but do not hibernate.
Foraging:	Fast flying species to 60km/h, poor manoeuvrability, usually catch prey 50m or more above the ground. Very agile on the ground, but prefer to climb something before taking off.
Diet:	Moths, beetles, grasshopper, also ants and non-flying beetles which they catch on the ground.
Reproduction:	Copulate, ovulate, fertilise late August. Young born December to January, young are weaned by May, and females are sexually mature by August.

Gould's Wattled Bat

Chalinolobus gouldii





Photo:: weekendnotes.com

NSW status:	Protected
Distribution:	Throughout Australia, except Cape York Peninsula and Nullabor Plain
City of Parramatta	Widely distributed throughout LGA, most commonly recorded species
Distinguishing features:	Fur is brown on the back and belly, with blackish fur on the head and shoulders. Muzzle is short, ears are short and broad, and there is a large lobe of skin (wattle) at the corner of the mouth, and a secondary long lobe along the lower lip. Often emerge early after sunset while there is still a lot of light. Vulnerable to predation by owls, falcons, butcherbirds, currawongs, feral cats
Habitat:	Found from alpine regions to tropical rainforests, eucalypt forest, woodland, shrubland, agricultural landscapes and urban areas.
Roosting:	Most commonly in tree hollows, especially river red gums and cypress pine, but also buildings and other roost sites. Males are usually solitary, females form colonies up to 80, generally less than 40, depending on the roost size. Hibernate in cooler areas, torpor in other areas. Use torpor to regulate water loss in arid areas. Alternate daily between roost sites within a small area.
Foraging:	Usually forage 5-10km from the roost site, but can forage up to 15km away. Fast agile fliers up to 36km/h, feeding just below or within the lower level of the tree canopy, along forest edges and creeklines.
Diet:	Moths and bugs, also winged ants, cockroaches, stoneflies, katydids, field crickets, cicadas, beetles, flies, caterpillars.
Reproduction:	Copulate May to June, female stores sperm over winter, ovulate and fertilise late August. Usually bear twins, young are born in late September in the north, becoming later further south, until late November. Young reach adult size and independence in 6 weeks.

Chocolate Wattled Bat

Chalinolobus morio



Photo Michael Pennay <u>http://bie.ala.org.au</u>



NSW status:	Protected
Distribution:	Southern Australia, including Tasmania, along east coast north to Townsville, with several isolated inland populations
City of Parramatta	Sparsely distributed throughout LGA, not a common species
Distinguishing features:	Fur is uniform milk chocolate brown on the back and belly, sometimes paler on the belly. Head is steeply domed with a short muzzle and a distinct ridge of fur across the muzzle. Ears are short and broad, and a small lobe (wattle) at the corner of the mouth, but the secondary long lobe along the lower lip is semicircular and easily seen. Usually the last to enter hibernation and the first to emerge in spring.
Habitat:	Rainforests, eucalypt forest, woodland, shrubland, and water courses in inland areas. Prefer continuous forest to small patches.
Roosting:	Roost in tree hollows, houses, under bark, in fairy martin nests, culverts, bridges and caves (in some areas), but mostly in trees. Males are usually solitary, females form colonies of 6 to 70, although larger colonies will develop in buildings. Alternate daily between roost sites within a small area.
Foraging:	Usually forage up to 5km from the roost site, using the same area each night. Mostly forage in the open zone between the top of the understorey and the canopy. Flight is usually fast and direct (up to 28km/h), often using a gliding attack combined with sudden vertical drops.
Diet:	Moths and bugs, also termites, flies, bugs, ants, lacewings and wasps. Choice of prey tends to reflect the availability of aerial insects.
Reproduction:	Copulate autumn to winter, young are born late spring to early summer. Lactation is complete by early February.

Eastern False Pipistrelle

Falsistrellus tasmaniensis





Photo Michael Pennay <u>http://bie.ala.orq.au</u>

NSW status:	Vulnerable
Distribution:	Coastal Victoria, NSW and southeast Queensland, most of Tasmania
City of Parramatta	Sparsely distributed in larger reserves in LGA, not a common species
Distinguishing features:	Large and robust microbat with dark brown to reddish fur on the back, paler underneath. Sparsely hairy muzzle, slender ears extending well above the head, with a notch on the outer margin of the ear near the tip. Tragus more than half the length of the ear, with a lobe at the base. Two pairs of upper incisors and a gap between incisors and canines.
Habitat:	Prefer tall and wet forests where trees are more than 20m high with a dense understorey. Occur in open forests at lower altitudes, also riparian rainforest and cool temperate rainforest.
Roosting:	Most commonly in tree hollows in roosts of 3 to 80, usually almost entirely male or female although mixed colonies do occur. Alternate daily between roost sites within a small area. Hibernates in winter
Foraging:	Flight is swift and direct, within or just below the canopy. Agile hunters in gaps and spaces in the forest, but avoid thick understorey and dense regrowth. Prefer continuous forest where they forage along tracks, creeks and rivers. Will also forage in open areas in cleared landscapes. Usually forage 5-10km from the roost site, but can forage up to 15km away.
Diet:	Tend to target the largest prey around, mainly beetles and moths with some bugs, ants, and flies.
Reproduction:	Males store sperm over winter, females produce a "hibernation follicle" in autumn. Ovulate and fertilise late spring. A single young is born in December, and lactation continues through February.



Eastern Bentwing Bat

Miniopterus orianae oceanensis



Photo: Flora and Fauna Research Collective



East-coast Free-tailed Bat

Mormopterus norfolkensis





Photo: Pavel German

NSW status:	Vulnerable
Distribution:	East coast of NSW, south of Sydney to southeast Queensland near Brisbane
City of Parramatta	Sparsely distributed in LGA, not a common species
Distinguishing features:	Dark reddish brown to dark brown fur on its back, slightly paler on its belly. Ears are triangular and shorter than the head. Both sexes possess a long finger-like genital projection.
Habitat:	Dry sclerophyll forest and woodland on the coastal side of the Great Dividing Range.
Roosting:	Most commonly in tree hollows, usually in hollow spouts of large mature trees, but occasionally from buildings.
Foraging:	Show a preference for open spaces in woodland and forest, and are more active in the upper slopes of forest areas than riparian zones. They forage more commonly over larger waterways, and usually within a few km of their roost.
Diet:	Insectivore, presumably moths, bugs, beetles, flies
Reproduction:	Females give birth in late November to early December. Lactation lasts until late January, by which time juveniles are flying and ready to wean.



Ride's Free-tailed Bat

Mormopterus rídei



Photo Lindy Lumsden in Australian Bats 2nd Ed, Sue Churchill 2008

NSW status:	Protected
Distribution:	Eastern coastal Australia, from Cape York Peninsula to Geelong, Victoria, and along the Murray River
City of Parramatta	Widely distributed throughout LGA, a commonly recorded species
Distinguishing features:	Medium sized species, fur on the back is usually a rich brown colour with a light creamy base to the hairs, belly fur is slightly paler. The skin of the face, ears and wing is dark grey. The common name is derived from a length of "free" tail, projecting beyond the end of the uropatagium – the membrane that connects the base of the tail to the hind legs.
Habitat:	Rainforests, tall open forest, river red gum and yellow box woodland, riparian open forest, and dry sclerophyll forest.
Roosting:	Most commonly in tree hollows and under bark, also buildings and cracks in posts. Colonies up to several hundred, and will share with other microbat species, eg. <i>Chalinolobus gouldii, Scotorepens orion</i> .
Foraging:	Usually forage in spaces between trees, active in riparian habitats.
Diet:	Bugs, flies and beetles, with some ants, moths and spiders.
Reproduction:	Young are born in November, usually single. Lactation occurs until mid to late January when young are free flying.

Large-footed Myotis









Photos: Applied Ecology- Meredith Brainwood

NSW status:	Vulnerable
Distribution:	Primarily coastal, from Kimberleys around northern and eastern Australia Cape York Peninsula to Victoria, and along the Murray River
City of Parramatta	Widely distributed throughout LGA, a commonly recorded species
Distinguishing features:	Distinguished by its disproportionally large feet, over 8mm long, greater than half the length of the tibia, giving rise to the common name for the species. Fur colour varies from dark grey to reddish brown.
Habitat:	Strong association with streams and permanent waterways, mostly in flat to undulating country, and usually vegetated rather than cleared, but will live anywhere as long as it is near water.
Roosting:	Near water in caves, tree hollows, among vegetation, bridges, old mines, tunnels, culverts, stormwater drains.
Foraging:	Usually forage in spaces between trees, active in riparian habitats.
Diet:	Bugs, flies and beetles, with some ants, moths and spiders.
Reproduction:	Young are born in November, usually single. Lactation occurs until mid to late January when young are free flying.



a Long-eared Bat

Nyctophílus sp.

for example:

Nyctophilus geoffroyi

Lesser Long-eared Bat



Nyctophilus geoffroyi Photo Meredith Brainwood

NSW status:	Protected
Distribution:	Throughout NSW and most of Australia, except for east coast of northern Queensland
City of Parramatta	Widely distributed throughout LGA, a very commonly recorded species
Distinguishing features:	Distinguished by its very long ears, light grey fur over the back, and distinctly lighter often grey fur on the belly. Has ears that join across the top of the head, and a high muzzle ridge with a distinctive "Y" shaped groove.
Habitat:	Widespread in wet to dry sclerophyll forests, woodlands, grasslands, mangroves, agricultural and urban areas.
Roosting:	Common in crevices, under lifting and peeling bark, in tree hollows, fairy martin nests, and buildings. Usually roost alone or in small groups of two or three, but maternity colonies of 10 to 15. Occasionally in caves.
Foraging:	Slow and highly manoeuvrable flyers, foraging close to vegetation and into the canopy. Flight is characterised by sharp and sudden changes in direction.
Diet:	Moths, crickets and grasshoppers, but also ants, spiders, beetles, cockroaches, bugs, flies and lacewings.
Reproduction:	Mating starts in April, females store sperm till spring. Usually twins, born in October to November, young can fly by December, and weaned by early February.

Yellow-bellied Sheath-tailed Bat

Saccolaimus flaviventris







Greater Broad-nosed Bat

Scoteanax rueppellii



Photo Michael Murphy OEH http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10748

NSW status:	Vulnerable
Distribution:	East coast of NSW and parts of Queensland
City of Parramatta	Sparsely distributed throughout LGA, an infrequently recorded species
Distinguishing features:	Large, robust species with a long forearm (51-56mm), fur on the back is reddish brown to dark brown, paler on the belly. Ear is slender and triangular, with a notch on the rear edge. Tragus is triangular with a lobe on the rear edge. Two upper incisors, no gap between canines and incisors.
Habitat:	Moist gullies in mature coastal forest, rainforest, open woodland, wet to dry sclerophyll forests, cleared paddocks with remnant trees, tree lined creeks.
Roosting:	Roost in tree hollows, cracks, fissures in trunks and dead branches, under bark, in roofs of old buildings
Foraging:	Flight is characterised by limited manoeuvrability and moderate speed in open spaces. Usually forage within 5m of the edge of trees and forest remnants, or along forest crowns. Also use perch hunting.
Diet:	Beetles, with moths, ants, and large flies. Also eat ground dwelling spiders, and will eat other microbats if captured in traps.
Reproduction:	Females congregate in maternal colonies, single young born in January – later than other species. Males are excluded from birth and rearing.

Eastern Broad-nosed Bat Scotorepens orion



Photo Robert Bender, Photo jerrabomberrawetlands.org.au

NSW status:	Protected
Distribution:	East of the Great Dividing Range, Victoria to Queensland
City of	Moderately well distributed throughout LGA, a moderately common
Fallallalla	species
Distinguishing	Robust bat of moderate size, fur is rich dark brown on the back, and
features:	more drab on the belly, not markedly bicoloured. Pug nose, relatively
	broad ears, tragus tip narrow and pointed.
Habitat:	Rainforest, tall wet forests, low open forest, cypress pine woodlands,
	stringybark and box woodlands.
Roosting:	Roost in tree hollows, occasionally in buildings. Form maternity
	colonies and will share hollows with other species of microbats
Foraging:	Little is known of their feeding habits.
Diet:	Little is known of their feeding habits.
Reproduction:	A single young is born in late November or early December.



Large Forest Bat

Vespadelus darlingtoni





Photo Robert Bender

NSW status:	Protected
Distribution:	Along the Great Dividing Range from Gold Coast to Adelaide Hills, SA
City of Parramatta	Presumed to be widely distributed but rarely recorded in the LGA in the current study
Distinguishing features:	Distinctive <i>Vespadelus</i> species with long fur and comparatively large size, dark brown to rusty brown fur all over. Dark skin on the ears and wings.
Habitat:	Rainforest, wet to dry sclerophyll forests, open forest, woodlands, forested wetlands and regrowth areas.
Roosting:	Found in tree hollows, usually smooth barked species, and 15-20m above the ground. Solitary males, colonies of 5 or 6 females, but up to 80 bats. Sexes do not share roosts; also found occasionally in older buildings
Foraging:	Less manoeuvrable than most <i>Vespadelus</i> species. Fly fast and avoid cluttered regrowth, foraging mainly in the spaces between trees, or between the canopy and the understorey. Flight is characterised by rapid wing beats that are interrupted by gliding changes in direction to catch insects.
Diet:	Ants, beetles, bugs, flies and moths and spiders. Adapted to cool climates, able to forage during mild winters
Reproduction:	Mating in March, females store sperm till spring. Single young, born in late November to December, and weaned by early February.

<image>

Map at left depicts the distribution of Vespadelus vulturnus. The map at right depicts the distribution of a forest bat of the genus Vespadelus that cannot be refined to species level.

Both maps are included to illustrate the distribution of forest bats in the LGA.



Photos: Applied Ecology Meredith Brainwood





NSW status:	Protected
Distribution:	Throughout eastern NSW and into Victoria and Queensland
City of	Presumed to be widely distributed but rarely recorded in the LGA in
Parramatta	the current study
Distinguishing	One of the smallest microbats, fur colour is variable from brown to
features:	pale grey with lighter belly, tragus usually white or pale grey
Habitat:	In wet to dry sclerophyll forests, woodlands, mostly found in riverine habitats
Roosting:	Roost in hollows, usually in dead trees or dead branches, often with multiple small entrances. Occasionally in buildings. Colonies vary from solitary animals to 120, usually with sexes separate. Often near water, in large trees along creeks and rivers.
Foraging:	Forage within the upper levels of the forest understorey or in the spaces between trees and below the canopy. Fly with great aerial agility, spiralling, gliding with fast changes in direction. Normally only hunt flying prey.
Diet:	Moths, bugs and beetles, with flies, wasps, grasshoppers, termites, ants, spiders, and lacewings.
Reproduction:	Mating in March, females store sperm till spring. Single young, born in late November to December, and weaned by early February.

4.22 **Introduced mammals**







21/10/2016 00:32:42

Black rats were the species most commonly detected by remote cameras. Image from Lower Ponds 2016.

Status	
² Other Common Names	Roof rat, Ship rat
Description	Black Rat is usually brown or grey. A distinctive characteristic of rats that helps distinguish them from similarly sized carnivorous marsupials is their front teeth: a pair of chisel shaped incisors with hard yellow enamel on the front surfaces. Other characteristics that identify a Black Rat from other rats include the following:
	 Long pointed head (can be more rounded in juvenile). Large thin ears (20mm+) which reach middle of eye when bent forward.
	 Charcoal grey to black or light brown above, cream or white below; sleek smooth coat.
	 Scaly tail, much longer than head and body.
	Body 165-205 mm, Tail 185-255 mm, Weight 95-340 g.
Habitat	Urban areas, urban reserves
Diet	Omnivore - including seeds, fruit, stems, leaves, fungi, and a variety of invertebrates and vertebrates
СоР	Widespread and abundant. Common even in the centre of largest corridors.
Biology/Breeding	The Black Rat is a prolific breeder. Females have litters of about five to ten young and may have up to six litters per year. The young are born blind but develop rapidly and are weaned after 20 days.



Black Rats are very good climbers and visited arboreal baiting stations at every location they were deployed. Captured above at Vineyard Creek, 2017.

Cat *Felis catus*

During the survey cats were identified from hairtubes and remote cameras. They were also noted on the edges of reserves in several locations. It is likely that most of the cats observed or recorded by remote techniques were roaming domestic pets (as evidenced by lack of fear of observer, good body condition, collars) with the possible exception of a cat captured by remote camera in the centre of Darling Mills Corridor. However, numerous studies have shown that domestic cats have the potential to roam great distances.



The map at top depicts cats detected by hairtube only. Cats were caught on remote camera at

Darling Mills, Haine Street and observed at Ermington Bay (map below).







Top left – this cat was observed numerous times at Ermington Bay below Gregory Street.

Above – Cat at Darling Mills Corridor (remote cam 2017)

Left – Cat, clearly domestic, in the creekline at Haine Avenue Reserve (Remote cam 2016)





Numerous dogs were observed during the survey. Most were on leash with their owners on defined tracks. Some dogs were off leash but were clearly domestic as evidenced by collars, demeanour and condition.

Scats were collected that were dog, and in all probability are wild dog. Grooming hairs in the scats were identified as dog and the scats contained prey items like birds, beetles, rabbits and seeds. The map above denotes the two corridors where wild dog scats were collected.



Only two hairtubes in the survey contained House Mouse fur. The species was not observed during spotlighting sessions and was not captured on remote cameras.

Rabbit Oryctolagus cunículus



Rabbits were observed in only two of the study sites. They are quite common along the edges of Ermington Bay and can be observed on the mown grass areas of the commercial premises in that area where high chain mesh fences protect them from being harassed by dogs, thus they have become emboldened. Rabbits were captured on a remote cam at Terrys Creek that was placed near a warren. Characteristic rabbit scats were only observed at reserves where the animal was also directly observed. Abundant at Ermington Bay only.

Red Fox *Vulpes vulpes*



Red Fox at Lower Ponds, one of the many remote cameras that detected the species.

This introduced predator was directly observed, captured on remote camera and detected and identified by hairtubes and scat collection numerous times in most of the study sites.

Some of the prey items observed included rabbits, Rainbow Lorikeets, Pied Currawongs, Common Brushtail Possums, Crested Pigeons, Grey-headed Flying-foxes and Eastern Waterskinks. Prey items were observed near dens where, on occasion in spring, young foxes were observed playing with/eating prey items.

Status	Introduced, predation identified as Key Threatening Process
² Other Common Names	Fox, European fox
Description	Body red or sandy coloured with thin black legs. Chin and throat are white. Tail thick and often white at the tip. Body up to 74 cm, tail up to 45 cm.
Habitat	Widely distributed- urban, rural, forested areas, arid zone
Diet	Omnivore- eats introduced animals such as the rabbit and native animals, also insects and fruits.
СоР	Abundant , widespread
Biology/Breeding	Primarily nocturnal the species emerges at dusk to hunt (although it can be seen during the day – particularly early morning). Both males and females are sexually mature at the age of one year. Litters, averaging four cubs, are born during August and September, and emerge from natal dens in late spring. The cubs move away from the family territory in late summer or autumn.

4.23 INVERTEBRATES

This profile relies on the Commonwealth Listing Advice and references therein for this species, advice from Peter Ridgeway and papers listed separately in Section 9.8 pg. 219.

Dural Land Snail Pommerhelix duralensis





Adult Dural Land Snail at Hunts Creek Reserve, North Rocks (Applied Ecology 2016)

Status	Endangered
Other Common Names	Dural Woodland Snail
	Pommerhelix duralensis (Cox, 1868) (family Camaenidae), known as the Dural Land Snail or the Dural Woodland Snail (Stanisic et al. 2010), was described by Cox (1868) as "Shell umbilicated, depressly- turbinate, rather solid, roughly ribbed, especially at the suture, very minutely granulated, dark chestnut, somewhat lighter below; spire short, obtuse; whorls 5, gradually increasing in size, rather convex, the last keeled, rounded in front, a little descending; aperture diagonal, rotundately-lunar, pale rose-colour; peristome simple, straight, very thinly reflexed, columellar margin dilated above, and ½ covering the umbilicus." In addition, "Shell subglobose, 10.6–23.0 mm in height, 14.7–23.5 mm in width. Spire moderately elevated. Last teleoconch whorl rounded with weak to strong angulation. Shell dark brown to black. Vagina short to long." (Clark 2009).
Habitat	Strong affinity for communities in the interface region between shale-derived and sandstone-derived soils, with forested habitats that have good native cover and woody debris.
Habitat availability in CoP	Widespread – distribution of species poorly known within suitable habitat within the LGA. Further surveys required.
Breeding	Poorly understood



Common land snail (left) and DLS (right) – note obvious differences in shell colouring and more subtle differences in shell shape and sculpture (texture). All photos: Applied Ecology 2017.



Note pink lip – diagnostic in adults



Adult above was the first individual sighted at Hunts Creek. Note healed shell damage. Two individuals were noted squashed in this location over the following weeks.



Note the yellow "seal" (epiphragm) at the shell opening. This seal is formed by individuals as they aestivate (seal off their shell during dry periods)



Further information

A high proportion of terrestrial molluscs are narrow ranged endemics placing them at a high risk of extinction due to habitat removal and poorly known ecology that would assist in conservation (Ponder 1997, Lydeard et al. 2004, Ridgeway et al. 2014). In the Sydney basin two species of terrestrial snails are listed as threatened. The Cumberland Plain Land Snail *Meridolum corneovirens* and the Dural Land Snail *Pommerhelix duralensis*. The main difference between the genera are genetic (Clark 2005) and between the species there are minor internal morphological differences and, externally, differences in shell colour and sculpture (Clark 2005, Clark 2009).

Both species occurred within the "old" boundaries of the LGA although the Dural Land Snail is not recorded in Bionet (NSW Wildlife Atlas) as occurring within the LGA (See Figure 18). However, with the re- distribution of LGA boundaries it is likely the Cumberland Plain Land Snail no longer occurs within the City of Parramatta LGA. The Federal conservation advice (2015) mentions the occurrence of the Dural Land Snail (DLS) in Parramatta City referencing an unpublished report by Ridgeway 2010. The two species are parapatric, meaning they are found within the same region in potentially adjacent habitats but are restricted to specific habitats that do not significantly overlap (Clark 2005). The DLS is found on the north-west fringes of the Cumberland Plain and is a shale influenced habitat specialist (Ridgeway et. al., 2014, Clark 2009).

OEH (drawn from the Federal Conservation Advice) summarises known ecology as follows:

- The species has a strong affinity for communities in the interface region between shale-derived and sandstone-derived soils, with forested habitats that have good native cover and woody debris.
- It favours sheltering under rocks or inside curled-up bark. It does not burrow nor climb. The species has also been observed resting in exposed areas, such as on exposed rock or leaf litter, however it will also shelter beneath leaves, rocks and light woody debris.
- Migration and dispersal is limited, with overnight straight-line distances of under 1 metre identified in the literature and studies. The species is active from approximately one hour after dusk until dawn and no confirmed diurnal activity is reported. It exhibits no roost-site behaviour.
- The species is known to aestivate, and secretes an epiphragm to protect against dessication.
- The main food sources are hyphae and fruiting bodies of native fungi. It is possible other detritus may be consumed.
- Reproduction rates are very low, with few eggs (about 32) per season. Mortality is 90% in the first year, and 99.8% within four-five years

Mapping of suitable habitat indicates that there is a maximum of 638 km² of suitable habitat for the species and possibly much lower with current land clearing within the potential area of persistence (see James and Ridgeway, Federal Conservation advice 2015).



Figure 18 Bionet (Nsw Wildlife Atlas) records for the Dural land snail with counts (note "0" means no count of individuals undertaken and often indicates a single individual.

From the conservation advice "The Dural land snail occurs on both public and private land. The species occurs in a number of areas reserved for conservation including: the Blue Mountains National Park; Marramarra National Park; Yengo National Park; Berowra Valley Regional Park; Parr State Conservation Area; and Yellomundee Regional Park. The species is found within the following EPBC Act listed ecological communities: **Blue Gum High Forest** of the Sydney Basin Bioregion; **Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest**; **Turpentine-Ironbark Forest in the Sydney Basin Bioregion;** and **Shale/Sandstone Transition Forest** (Ridgeway, pers. comm., 2014). The species is also found within **Turpentine Ironbark Margin Forest**, Hinterland Sandstone Gully Forest and Sydney Hinterland Transition Woodland (unpublished Ridgeway 2010)." (our emphasis to illustrate communities mapped in Figure 19).

Ŵ

OUNTAINS CITY COUNCI

NSW WILDLIFE ATLAS RECORDS

ILLY SHIRE COL

DURAL LAND SNAIL

• 0

3

CITY OF

1 1 **0**20

SELECTED MAPPED VEGETATION COMMUNITIES



Figure 19 Selected shale influenced vegetation communities



Figure 20 DLS habitat in Hunts Creek Sanctuary - Sydney Turpentine is the co – dominant canopy tree in this location.

This survey recorded DLS in 2 corridors (Quarry Branch and Hunts Creek) and specific searches were undertaken in 3 other corridors (Terrys Creek, Devlins Creek, Darling Mills). It is important to note that all corridors searched had been surveyed at night, not specifically for DLS, nevertheless, the species would have been observed if it was as active as it was in late Febuary and March. As noted elsewhere in this report the study area experienced its driest summer on record followed by a very wet March (see Appendix D). It is hypothesized that the DLS emerged in numbers to feed in response to the wet weather after a period where preferred foods would have been unavailable for extended periods.

Peter Ridgeway is quoted in an article in the Hawkesbury Gazette (2016) as noting that "They're the forest's cleaners," Mr Ridgeway said. "They clean up bacteria and fungus. They don't eat plants, so they won't destroy your garden." They also scoff algae and lichen" and in reference to Ellerman Park at Round corner (the highest recorded density of DLS prior to this survey) can be observed "grazing on the moss on the side of the path".

This latter observation applies to many of the records for the Hunts Creek Sanctuary where snails were observed grazing on the edges of hardened areas of the shared path in the east and south of the reserve.



Figure 21 One of the key areas where DLS were observed in Hunts Creek Reserve

Little effort was made to find animals in adjacent habitat due to the risk of trampling them. Over 20 adult individuals were observed on 2 separate surveys during and following rain in late February and March (see Figure 22).









A further five individuals were observed in Lake Parramatta Reserve (1), Sevilles Reserve (1), and Moxham Park (3). A prescribed burn in October in Moxham Park occurred in habitat suitable for the species and subsequent searches found 6 individuals (deceased) within the burnt area indicating that searches on trails are adequate to confirm presence but are not particularly useful in understanding local abundance.

The prescribed burn also highlights the need to assess potential habitat for this species prior to any burns. The NSW Scientific Committee found that along with habitat loss and habitat fragmentation "another potential threat to the Dural Land Snail is inappropriate fire regimes since the snails do not seek shelter but aestivate above the leaf litter during the day (Ridgeway et al.2014). Clark (2005) suggested that fire causes extinction of local populations. Their low dispersal ability may increase their susceptibility to fire and limit their ability to recolonize".



Figure 23 Burnt individuals from the prescribed burn in Quarry Branch corridor. The DLS does not have a known strategy to survive fire in its habitat.

The Federal Conservation Advice lists the following management actions (we have added notes in red as appropriate for this LGA).

Management actions required

1. Implement an ongoing monitoring program to monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary.

2. Engage with private landholders and land managers responsible for the land on which populations occur and encourage these key stakeholders to contribute to the implementation of conservation management actions. Engage The Kings School and other adjoining landholders to the Hunts Creek corridor.

3. Engage local bushcare groups, such as the Ellerman Park Bushcare Group, to implement recovery actions for the species. Ensure bushcare volunteers can identify the species and take appropriate action if found on a bushcare site to avoid trampling and disturbing habitat.

4. Undertake appropriate maintenance of habitat in which the species may occur e.g. avoid underscrubbing in areas where the species is known to occur and maintain and/or recover coarse woody debris in habitat for this species.

5. Limit use of pile burning (burning composted material) and/or manage pile burning in areas where the species is known to occur. Survey prior to prescribed burns or exclude fire from potential habitat.

6. Investigate formal conservation arrangements, management agreements and covenants on private land with known occurrences.

7. Provide advice to developers, consultants and approval authorities about the existence of the species and its significance.

8. Develop and implement a management plan for the control of weeds currently occurring in the region.

9. Where necessary and appropriate, restrict access to important sites by installing gates, fencing and educational signs. Education of trail users in Hunts Creek, in particular, should be undertaken. Potentially alternative off track grazing habitat established.



Figure 24 Young DLS at Hunts Creek corridor. Breeding ecology is poorly known.