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FLORA AND FAUNA SURVEY

Volume 1 – Summary Report

February 2022

MOSMAN MUNICIPAL COUNCIL

Executive summary

Mosman Municipal Council is committed to improving the condition of bushland and unmade road reserves throughout the Mosman local government area. Ecosure was engaged in November 2021 to carry out a flora and fauna survey of 25 bushland reserves and 11 unmade road reserves. This assessment is reported on in three volumes:

- **Volume 1 – Summary of flora and fauna assessment**
- Volume 2 – Project Area A (Bushland Reserves)
- Volume 3 – Project Area B (Unmade Road Reserves).

Volume 1 provides a summary of the scope, methods and results of the assessment as a whole, while volumes 2 and 3 provide detailed information on each of the bushland reserves and road reserves, respectively.

The most widespread vegetation in the bushland reserves is Sydney Sandstone Gully Forest, with smaller areas of Coastal Sandstone Heath and Coastal Foredune Wattle Scrub.

The current survey by Ecosure and previous surveys in 2001, 2006/7, 2016 and 2019 have recorded 523 indigenous flora species, 22 non-indigenous native species and 250 exotic species adding up to a total of 795 flora species within the Mosman LGA.

The current survey by Ecosure recorded 463 flora species within the 36 reserves, including nine flora species that had not been recorded in previous surveys. Another 261 flora species that were previously recorded within the 25 bushland reserves were not observed during the current survey by Ecosure.

Two threatened flora species were recorded within several reserves; sunshine wattle (Acacia *terminalis* subsp. *eastern Sydney*) and magenta lilly pilly (*Syzygium paniculatum)*. Small areas of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions were identified in Reid Park, Quakers Hat Park, Wy-ar-gine Reserve, and Sirius Park East. Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions was recorded in Morella Road Reserve.

Overall weed cover was generally low in 2021. Approximately 80.5% of the area within bushland reserves had less than 10% weed cover. Only 1.6% had a weed cover over 70%, located in three reserves, one of which is very difficult to access for weed treatment (Parriwi Point Reserve). Approximately 10% of the area within road reserves had less than 10% weed cover. Six road reserves contained areas with an overall weed cover over 70%.

Road reserve condition varied depending on factors such as size, proximity to a bushland reserve and/or houses, and occurrence of buffers and bush regeneration/restoration effort. Based on a combination of physical and ecological characteristics, resilience of road reserves was generally low to moderate.

Sixty-four native fauna species were detected during the current survey by Ecosure in all bushland and road reserves, including four threatened species (powerful owl *Ninox strenua*, grey-headed flying-fox *Pteropus poliocephalus,* yellow-bellied sheathtail-bat *Saccolaimus flaviventris* and large-eared pied bat *Chalinolobus dwyeri*). Several reserves also contained evidence of pest fauna, including common myna (*Acridotheres tristis*), rock dove (*Columba livia*), feral cat (*Felis catus*), rabbit (*Oryctolagus cuniculus)*, red-whiskered bulbul (*Pynonotus jocosus*) black rat (*Rattus rattus*), spotted turtle-dove (*Streptopelia chinensis*), and European fox (*Vulpes vulpes*).

Glossary, acronyms and abbreviations

B Act	*Biosecurity Act 2015*
BC Act	*Biodiversity Conservation Act 2016*
BR	Bushland reserve
B Reg	Biosecurity Regulation 2017
DoAWE	Department of Agriculture, Water and the Environment
DPIE	Department of Planning, Industry and Environment
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
LEP	Local Environmental Plan
LGA	Local Government Area
MMC	Mosman Municipal Council
MNES	Matters of National Environmental Significance
NSW	New South Wales
OEH	Office of Environment and Heritage
RR	Unmade road reserve
SEPP	State Environmental Planning Policies
TEC	Threatened Ecological Community
WoNS	Weed of National Significance

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1 Introduction

Ecosure Pty Ltd was commissioned by Mosman Municipal Council (MCC) to undertake Flora and Fauna Surveys for bushland reserves (BR) and unmade road reserves (RR) in the Mosman Local Government Area (LGA). Management and restoration of these reserves has been undertaken since the early 1980s. The aim of this assessment is to assess the current status of flora and fauna in each of the BR and RR. Comprehensive flora and fauna surveys for bushland and unmade road reserves within the LGA were also undertaken in 2001, 2007 and 2016.

1.1 Study Area

The study area incorporates 25 BR and 11 RR within Mosman LGA in Sydney's northern suburbs (Figure 1). The study area is divided in two: Project Area A (Bushland Reserves) and Project Area B (Unmade Road Reserves).

1.2 Aims and scope

This assessment aimed to ground-truthing vegetation, identify and discuss threatened species and threatened ecological communities (TEC), collate flora and fauna species lists, identify fauna habitat and connectivity, and provide an evaluation of native vegetation and weed cover within each reserve. This assessment forms part of a third-party review of Council's Bushland Management Contract 2012-2022, and when compiled with results from previous surveys (Oculus 2001, Total Earth Care 2007, 2011, Ecosure 2016, 2019), identifies threats and current connectivity and provides a reflection on the achievements of current management practices within each reserve.

1.3 Report Structure

1.3.1 Overview

This assessment is reported in three volumes:

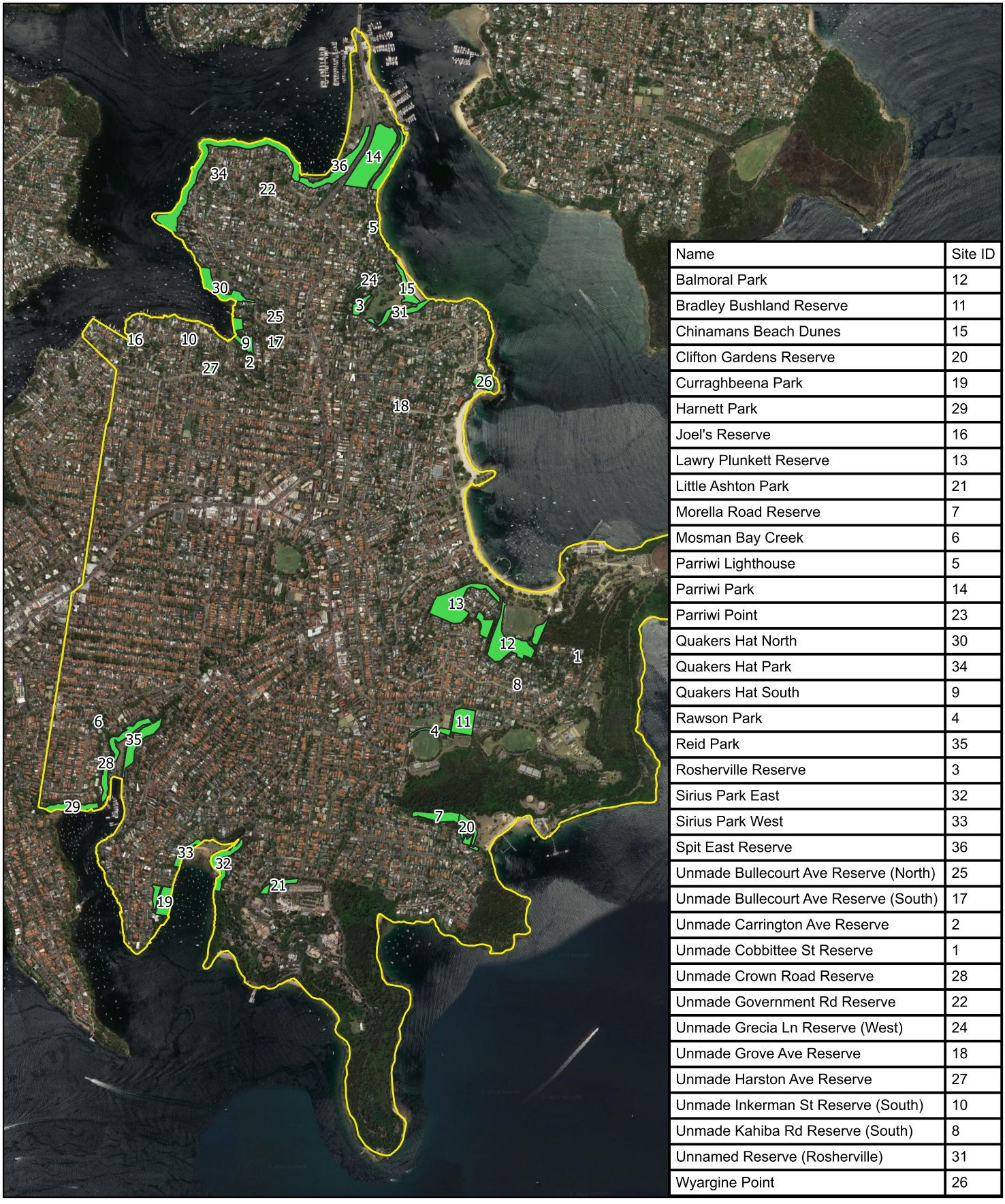
- **Volume 1 – Summary of Flora and Fauna Survey**
- Volume 2 – Project Area A (Bushland Reserves)
- Volume 3 – Project Area B (Road Reserves).

A summary of the contents of each volume is provided in Sections 1.3.2 - 1.3.4.

1.3.2 Volume 1 – Summary of Flora and Fauna Survey

This volume provides a summary of the scope, methods and key results of the assessment. It also describes the different vegetation mapping classifications used, and which vegetation communities are equivalent under the following vegetation classifications:

- The natural vegetation of the Sydney 1:100,000 map sheet (Benson and Howell 1994)
- The native vegetation of the Sydney Metropolitan Area, VIS_ID 3817 (OEH 2013a, 2013b, OEH 2013c)
- Keith class and formation (Keith 2004)
- Tozer et al. vegetation classification (Tozer et al. 2010).



Name	Site ID
Balmoral Park	12
Bradley Bushland Reserve	11
Chinamans Beach Dunes	15
Clifton Gardens Reserve	20
Curraghbeena Park	19
Harnett Park	29
Joel's Reserve	16
Lawry Plunkett Reserve	13
Little Ashton Park	21
Morella Road Reserve	7
Mosman Bay Creek	6
Parriwi Lighthouse	5
Parriwi Park	14
Parriwi Point	23
Quakers Hat North	30
Quakers Hat Park	34
Quakers Hat South	9
Rawson Park	4
Reid Park	35
Rosherville Reserve	3
Sirius Park East	32
Sirius Park West	33
Spit East Reserve	36
Unmade Bullecourt Ave Reserve (North)	25
Unmade Bullecourt Ave Reserve (South)	17
Unmade Carrington Ave Reserve	2
Unmade Cobbittee St Reserve	1
Unmade Crown Road Reserve	28
Unmade Government Rd Reserve	22
Unmade Grecia Ln Reserve (West)	24
Unmade Grove Ave Reserve	18
Unmade Harston Ave Reserve	27
Unmade Inkerman St Reserve (South)	10
Unmade Kahiba Rd Reserve (South)	8
Unnamed Reserve (Rosherville)	31
Wyargine Point	26

Figure 1: Reserve locations in study area

Mosman Council

Mosman Flora and Fauna Survey 2021

Reserve location

Mosman LGA (study area)

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Job number: PR6939
Date: 31/01/2022

0 0.25 0.5 km

GDA 1994 MGA Zone 56
Projection: Transverse Mercator
Datum: GDA 1994
Units: Meter

Appendix 1 provides a detailed description of the flora survey methods, so that these can be more readily repeated in the future.

This volume includes a bibliography of references for all volumes.

1.3.3 Volume 2 – Project Area A – Bushland Reserves

This volume provides detailed information on the ecology of each of the 25 bushland reserves, and includes the following:

- a description and map of the vegetation communities within each bushland reserve
- flora and fauna species lists, including threatened species
- an assessment of the native vegetation cover within each bushland reserve
- an assessment of weed cover within each bushland reserve, based on a modified version of Ku-ring-gai Municipal Council (1995)
- an evaluation of the fauna habitat against systematic criteria
- major threats to the biodiversity of that reserve
- an assessment of the current management practices.

1.3.4 Volume 3 – Project Area B – Unmade Road Reserves

In volume 3, the focus is on 11 unmade road reserves within the Mosman LGA. This volume has the same structure and content as presented in Volume 2. Fauna habitat of unmade road reserves is based primarily on information collected during flora surveys, and does not include the detailed criteria of that for the bushland reserves, as these areas are generally smaller with less structured fauna habitat components.

1.4 Previous Studies

1.4.1 Overview

Systematic survey of flora and fauna within the Mosman LGA began in 2001 (Oculus 2001), with a significant review and update completed in 2006-2007 (Total Earth Care 2007). Following this, a flora and fauna assessment was carried out in bushland reserves and road reserves by Ecosure 2016, and a bushland reserves audit assessment was also carried out by Ecosure in 2019. Details of these previous studies are presented in Table 1.

Table 1 A summary of previous reports relevant to this project

Title and author	Description
Mosman Flora and Fauna Survey, (Volumes 1-3) (Oculus 2001)	The aim of this initial survey was to determine the conservation significance of native vegetation and wildlife habitat and to develop sustainable management strategies for biodiversity conservation in the LGA.
Flora and Fauna Survey Mosman Municipal Council (Volumes 1-4) (Total Earth Care 2007)	The aim of this flora and fauna survey was to produce an up-to-date report that described flora and fauna within the bushland reserves and road reserves of Mosman and to compare the results to the previous 2001 survey.

Title and author	Description
Mosman Council Vegetation Mapping Reserves (Total Earth Care 2011)	The percentage of native vegetation cover of bushland areas within each reserve was surveyed. The aim of this study was to compare changes in bushland condition since the last comprehensive mapping in 2006 using total native cover.
Flora and Fauna Assessment Mosman Municipal Council (Ecosure 2016)	The aim of this flora and fauna survey was to produce an up-to-date report that described flora and fauna within the bushland reserves and road reserves of Mosman and to compare the results to the previous 2007 survey.
Bushland Assessment Mosman Municipal Council (Ecosure 2019)	The aim of this assessment was to monitor progress of bushland restoration contracts at 25 bushland reserve sites. The report identified improvement or decline in native vegetation cover and weed density.

1.4.2 Bushland reserve numbers

Table 2 summarises bushland reserve numbering systems used in the current survey, previous surveys (Oculus 2001, Total Earth Care 2007, Ecosure 2016, Ecosure 2019) and in the project brief provided by MMC.

Table 2 Mosman bushland reserves surveyed and how they are numbered in different documents

Bushland reserve name	Bushland reserve number				
	Oculus 2001	Total Earth Care 2007	Ecosure 2016	Ecosure 2019	Project brief MMC
Quakers Hat South	1	1	1	1	63
Quakers Hat North	3	2	2	2	64
Quakers Hat Park	4	3	3	3	65
Parriwi Park	5	4	4	4	61
Parriwi Point	6	5	5	5	62
Rosherville/ Parriwi Lighthouse	7	6	6	6	60
Wy-ar-gine Point	8	7	7	7	70
Lawry Plunkett Reserve	9 (north) 10 (south)	8	8	8	35
Balmoral Park	11	9	9	9	53
Bradley's Bushland Reserve	12	10	10	10	54
Morella Road Reserve	13	11	11	11	39
Little Ashton Park	14	12	12	12	37
Curraghbeena Park	15	13	13	13	57
The Spit Reserve	16	14	14	14	189
Rosherville South (unnamed) Reserve	Not surveyed	15	15	15	69
Rosherville Reserve	17	16	16	16	48
Sirius Park West	18	17	17	17	67
Reid Park	19	18 (part)	18 (part)	18 (part)	46
Reid Park East	Not surveyed	18 (part)	18 (part)	18 (part)	46
Sirius Park East	20	19	19	19	66
Harnett Park	21	20	20	20	183
Rawson Park	22	21	21	21	44
Clifton Gardens Reserve	23	22	22	22	27

Bushland reserve name	Bushland reserve number				
	Oculus 2001	Total Earth Care 2007	Ecosure 2016	Ecosure 2019	Project brief MMC
Mosman Bay Creek	Not surveyed	Not surveyed	23	23	165
Joel's Reserve	Not surveyed	Not surveyed	24	24	34
Chinamans Beach Dunes	Not surveyed	Not surveyed	25	25	55

1.4.3 Unnamed road reserve numbers

Table 3 summarises unmade road reserve numbering systems used in the current survey, previous surveys (Oculus 2001, Total Earth Care 2007, Ecosure 2016) and in the project brief provided by MMC.

Table 3 Mosman unmade road reserves surveyed and how they are numbered in different documents

Bushland reserve name	Bushland reserve number			
	Oculus 2001	Total Earth Care 2007	Ecosure 2016	Project brief MMC
Unmade Bullecourt Avenue Reserve South	NA	14	NA	82
Unmade Bullecourt Avenue Reserve North	NA	15	NA	81
Unmade Carrington Avenue Reserve	NA	79	NA	158
Unmade Cobbittee St Reserve	58	58	58	88
Unmade Crown Road Reserve	NA	45	NA	89
Unmade Government Road Reserve	NA	27	NA	98
Unmade Grecia Lane Reserve (West)	NA	23	NA	100
Unmade Grove Avenue Reserve	NA	44	NA	101
Unmade Harston Avenue Reserve	NA	11	NA	104
Unmade Inkerman Street (South)	NA	12	(North) 13	193
Unmade Kahibah Road (South)	NA	(South) 8	NA	108

2 Legislation and policy

2.1 *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) covers nine categories of nationally and internationally important flora, fauna, ecological communities, actions and heritage places, which are defined as matters of national environmental significance (MNES (DoAWE 2021)). These are include:

- world heritage properties
- Commonwealth marine areas
- migratory species listed under international agreements
- threatened species and ecological communities
- wetlands of international importance
- a water resource, in relation to coal seam gas development and large coal mining development
- nuclear actions
- Great Barrier Reef Marine Park
- national heritage places.

For Mosman LGA, the most likely MNES to occur are threatened species and ecological communities and migratory species.

2.2 *Biodiversity Conservation Act 2016*

The aim of the *Biodiversity Conservation Act 2016* (BC Act) is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. The BC Act allows and encourages conservation of native entities through the identification, conservation and recovery of threatened species, populations and ecological communities. The act also has scope to identify threats and develop threat abatement processes for identified threats.

2.3 *Local Government Act 1993*

The *Local Government Act 1993* requires the preparation of Plans of Management for all community land administered by councils in NSW. These Plans of Management categorise the land as being within one or more categories, according to their use, characteristics of the natural environment and significance to the community.

Plans of Management apply to the following reserves within the study area for this project:

- Natural Areas (Bushland) Plan of Management

- Balmoral Reserves Plan of Management
- Clifton Gardens Management Framework (awaiting gazettal by the Minister)
- Rawson Park Plan of Management
- Rosherville Reserve and Chinamans Beach Dunes Plan of Management (awaiting gazettal)
- The Spit Reserves Plan of Management.

Changes to the land categories can be made through a local environmental plan, which in this case is the Mosman Local Environmental Plan (LEP) 2012.

2.4 *Biosecurity Act 2015*

Weed management is legislated through under the *Biosecurity Act 2015* (B Act) and Biosecurity Regulation 2017 (B Reg). Under the B Act, local councils maintain local control authority for weeds within their area of operation by abiding by the Regional Strategic Weed Management Plan (RSWMP). A Greater Sydney RSWMP has been prepared (Greater Sydney Local Land Services 2021). The objectives of the B Act are to reduce the negative impacts of weeds on the economy, community and environment. *Biosecurity Weeds* are categorised into 5 Risk Ratings within the Mosman LGA and include:

- **Risk Rating 1 – Very High Risk – Prohibited Weeds**
  "The plant must be eradicated from the land and the land must be kept free of the plant."
- **Risk Rating 2 – High Risk – Prohibited Weeds**
  "The plant must be eradicated from the land and the land must be kept free of the plant."
- **Risk Rating 3 – Medium Risk – Controlled Weeds**
  "The plant must be fully and continuously suppressed and destroyed."
- **Risk Rating 4 – Marginal Risk – Controlled Weeds**
  "The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed."
- **Risk Rating 5 – Low Risk – Restricted Plants**
  "The growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed."

The rating will determine the required course of action to be taken. The different control classes and control requirements are shown in Table 4.

Table 4 Weed Category, Descriptions and Biosecurity Duty under the B Act.

Weed Category	Description	Biosecurity Duty
Weed of National Significance (WoNS)	Under the National Weeds Strategy, 32 introduced plants have been identified as Weeds of National Significance (WONS). A list of 20 was endorsed in 1999 and a further 12 were added in 2012. These weeds are regarded as the worst weeds in Australia because of their invasiveness, potential for spread, and economic and environmental impacts.	State Priority Weeds (see below)
National Environmental Alert Weeds	Under the National Weeds Strategy, 28 environmental weeds were identified National Environmental Alert Weeds. Alert Weeds are non-native plant species that are in the early stages of establishment and have the potential to become a significant threat to biodiversity if they are not managed.	State Priority Weeds (see below)
State Priority Weeds	State level determined priorities (A1.1). Specific regulatory requirements include Prohibited Matter, Biosecurity Zones, Mandatory Measures, Control Orders.	State Priority Weed Objective – PREVENTION: Weeds are currently not found in the state, pose significant biosecurity risk and prevention of the biosecurity risk is a reasonably practical objective. ERADICATION: Weeds are present in limited distribution and abundance in some parts of the state. Elimination of the biosecurity risk posed by these weeds is a reasonably practical objective. CONTAINMENT: These weeds are widely distributed in some parts of the state. While broad scale elimination is not practicable, minimisation of the biosecurity risk posed these weeds is reasonably practicable. ASSET PROTECTION: These weeds are widely distributed in some areas of the State. As WoNS, their spread must be minimised to protect priority assets.
Weeds of Regional Concern	Regionally prioritised weeds which require outcomes to demonstrate compliance with the General Biosecurity Duty. Recommended measures for these weeds are provided in the NSW DPI web and mobile based application WeedWise, as practical advice on achieving these outcomes.	Regional Priority Weed Objective – PREVENTION: Weeds are currently not found in the Greater Sydney region, pose significant biosecurity risk and prevention of the biosecurity risk posed by these weeds is a reasonably practical objective. ERADICATION: weeds are present in limited distribution and abundance. Elimination of the biosecurity risk posed by these weeds is a reasonably practical objective. CONTAINMENT: weeds are widely distributed in the region. While broad scale elimination is not practicable, minimisation of the biosecurity risk posed by these weeds is reasonably

Weed Category	Description	Biosecurity Duty
		practicable. ASSET PROTECTION: Outcomes to demonstrate compliance with the General Biosecurity Duty – *'any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised.'*
Other weeds of regional concern	These weed include species known to occur in the Greater Sydney region as well as species not currently known to occur but at risk of moving into the region in the future. They have been identified as a potential risk in some (not all) situations. Many of the species pose potential risks to biodiversity (i.e. the environment), for example if they were to spread to or be found in a National Park. Some of the species pose potential risks to agriculture and some of the weeds pose potential risks to human health.	Local Control Authorities take action in relation to these weeds in particular circumstances, for example where a weed threatens a high value asset and prevention, elimination or reduction of the risk is feasible and reasonable.

2.5 State Environmental Planning Policies

State Environment Planning Policies (SEPPs) are environmental planning instruments which address specific planning issues within NSW. These SEPPs often remove power from local councils in order to control specific types of development or development in specific areas. SEPPs often transfer decision-making from Council to the Planning Minister.

Of most relevance to this project is SEPP 19 – Bushland in Urban Areas, which has been prepared under Part 3 of the *Environmental Planning and Assessment Act 1979.*

The aim of SEPP 19 is to protect and preserve bushland within urban areas, specifically to protect its value to the community as part of the natural heritage, its aesthetic value, and its value as a recreational, educational and scientific resource.

The SEPP Coastal Management 2018 is also relevant as it assesses how development proposals are to be assessed if they fall within the coastal zone.

The 25 bushland reserves included in this assessment are all covered under this SEPP.

2.6 Mosman Local Environmental Plan 2012

The Mosman LEP is the principal legal document for the control of development within the Mosman LGA. It also assists in guiding planning decisions made by MMC.

There are ten aims of the LEP that are designed to balance the diverse needs of the community. The most relevant aims for this project are to:

- recognise and protect the natural, visual, environmental and heritage qualities of the scenic areas of Mosman and Sydney Harbour
- protect and conserve the natural, built and Aboriginal cultural heritage of Mosman
- protect, conserve and enhance the landform and vegetation, especially foreshores or bushland, in order to maintain the landscape amenity of Mosman.

The aims of the plan are implemented through zoning of land within the LGA, including C2 which is zoning for Environmental Conservation. The majority of bushland reserves are zoned as C2, with some zoned as RE1 (Public Recreation).

3 Methods

3.1 Desktop assessment

3.1.1 Legislative review

Relevant legislation, state environmental planning policies and local plans were reviewed and summarised for this project. These include:

- *Environment Protection and Biodiversity and Conservation Act 1999* (EPBC Act)
- *Biodiversity Conservation Act 2016* (BC Act)
- *Local Government Act 1993*
- *Biosecurity Act 2015* (B Act)
- State Environment Planning Policies (SEPPs)
- Mosman Local Environment Plan 2012 (Mosman LEP).

3.1.2 Previous reports and databases

Previous vegetation studies of reserves within the Mosman LGA were reviewed, including:

- Mosman Flora and Fauna Survey Vol 1-3 (Oculus 2001)
- Flora and Fauna Survey; Mosman Municipal Council (Total Earth Care 2007)
- Mosman Council Vegetation Mapping Reserves (Total Earth Care 2011)
- Flora and Fauna Assessment Mosman Municipal Council (Ecosure 2016)
- Bushland Assessment Mosman Municipal Council (Ecosure 2019).

Depending on scope, these studies incorporated some or all of these components:

- classification and mapping of vegetation communities
- mapping of overall weed cover and major weed species and density
- inventory of species within reserves
- estimation of condition or resilience
- comparison of native vegetation cover and weed density with previous reports.

The review also examined other vegetation mapping systems for the Sydney region, including:

- The native vegetation of the Sydney metropolitan area version 3 (OEH 2016a, 2016b, 2016c)
- Native Vegetation of Southeast NSW: a revised classification and map for the coast and eastern tablelands (Tozer et al. 2010)

- Ocean shores to desert dunes: the native vegetation of New South Wales (NSW) and the ACT (Keith 2012)
- The natural vegetation of the Sydney 1:100 000 map sheet (Benson and Howell 1994).

These mapping systems were examined to:

- identify potential vegetation communities present in the Mosman LGA
- identify potential TECs within the Mosman LGA
- cross-reference vegetation communities identified in previous studies of the Mosman reserves with other published mapping systems.

Several online search tools were used to identify potential ecological features within the Mosman LGA:

- The Protected Matters Search tool was used to identify the potential presence of species and ecological communities listed as threatened under the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- The NSW BioNet Atlas of NSW Wildlife was used to identify species recorded within the region, including:
  - species listed as threatened under the *Biodiversity Conservation Act 2016* (BC Act)
  - species listed as Rare or Threatened Australian Plants (ROTAP) by Briggs and Leigh (1996)
- The NSW WeedWise search tool was used to identify weeds listed under the *Biosecurity Act 2015* (B Act) including:
  - Weeds of National Significance (WoNS) under the National Weed Strategy (Australian Government 2018).

MMC provided spatial data for the project, including:

- reserve boundaries.

3.2 Flora assessment

One ecologist, Cameron Radford (Senior Ecologist), carried out flora surveys throughout the reserves from 20 to 24 December 2021 and 4 to 5 January 2022. Survey effort within each reserve was based on the area of the reserve, with approximately 2.75 hours of survey time per hectare. However, survey time was affected by the following factors:

- Reserves with complex vegetation mosaics required more time, while simple reserves were completed in less time.
- Very small reserves required a minimum of 0.5 hours to survey.

Surveys incorporated the following:

- a broad assessment of reserves, including observations of any major threats and weed incursions or other noteworthy ecological features and management recommendations
- visiting all vegetation community polygons mapped in previous surveys to update information and modify boundaries if required
- ground-truthing mapped TECs
- visiting all weed cover polygons mapped in previous surveys to update weed density and modify boundaries if required
- visiting all previous threatened species records to verify presence of threatened species and random meander searches to discover new threatened species populations
- collation of all flora species encountered during surveys of reserves
- Biodiversity Assessment Method vegetation plots in seven reserves.

Data was collected digitally using Fulcrum software on tablet devices loaded with GIS layers containing reserve boundaries and previous survey data. Data collection followed a modified method from Ecosure (2016).

Further details on flora survey methods are presented in Appendix 1.

3.2.1 Vegetation communities

For each reserve, vegetation community data was verified and updated where necessary using a modified method from Ecosure (2016). For each bushland reserve, vegetation community information has been described according to Benson and Howell, *Sydney Natural Vegetation, Cunninghamia* Vol 3 (4), 1994, and includes detailed descriptions of canopy species, major midstorey species and major ground layer species.

Threatened plant species and their locations have been documented and mapped using point data for individual plants, and polygons for populations. Every attempt was made to locate threatened plant species previously recorded, however in some cases these plants were not able to be found. At some sites, new occurrences were recorded and are outlined in the relevant bushland reserve in Section 4.2.

3.3 Native vegetation cover and weed density

Native vegetation cover and weed density were mapped at each bushland reserve and represented by colour-coding classes (Figure 1, Table 5 and Table 6). Weed density was calculated using the Bushland Weed Assessment Guidelines (Ku-ring-gai Municipal Council 1995) by evaluating the percentage of weeds occurring in the upper, middle and lower structural divisions (or stratum) within a vegetation community. A lower limit of 1% was necessary when calculating percent cover of individual species, and at some sites where weed density was particularly low, percentages were merged together to provide a more accurate estimation. This percentage estimation was then corresponded on a scale of 1-4. To calculate the weed class, a weighting factor was applied to each division or stratum to represent the

relative impact on the vegetation community.

Table 5 Colour coded mapping classification applied to native vegetation density

Colour	Condition class	% Indigenous vegetation density
Green	Very high indigenous vegetation density	90+
Blue	High indigenous vegetation density	70-89
Yellow	Moderate indigenous vegetation density	30-69
Red	Low indigenous vegetation density	<30
Orange	Open space/grass area	0

Table 6 Colour coded mapping classification applied to weed density

Colour	Condition class	% Weed density
Red	Very high weed density	>70
Yellow	High weed density	30-69
Blue	Moderate weed density	10-29
Green	Low weed density	<10
Orange	Open space/grass area	0

At each site and within each mapped weed density class, the top five species were determined according to their biology and potential threat. This information is presented for each bushland reserve in Section 4.4.

3.4 Fauna assessment

Two ecologists, Cameron Radford (Senior Ecologist) and Brad Pyne (Ecologist), carried out fauna surveys throughout the reserves on 8 and 20 to 24 December 2021 and 4 to 10 January 2022. Fauna surveys included:

- diurnal habitat assessments
- diurnal bird surveys
- diurnal active searches for reptiles, amphibians and fauna signs
- nocturnal spotlight surveys
- nocturnal amphibian surveys
- nocturnal microbat echolocation recordings
- nocturnal baited camera trap recordings.

3.4.1 Fauna habitat assessment

3.4.1.1 Bushland reserves

Bushland reserves were assessed for fauna habitat using a semi-quantitative survey method. The aim was to have a repeatable and objective assessment of fauna habitat within these areas. Primary habitat features of interest included the number of hollows, logs, termite

mounds and understorey/dense undergrowth. Full details of the criteria used, and the measurement of these criteria are provided in Table 7.

Table 7 Criteria for fauna assessment for bushland reserves

Criteria	Absent	Scattered	Common	Abundant	Notes
Large hollows (>20 cm)	0	1-5 hollows	6-10 hollows	Greater than 10	Notes were also made on any features that may be important to fauna. This includes, but is not limited to: Signs of fauna use and foraging and refuge resources
Small hollows (<20 cm)	0	1-5 hollows	6-10 hollows	Greater than 10	
Hollow status	N/A				These were reported as: mostly dead, mostly alive, mixture of both
Large logs (> 50 cm diameter)	0	1-5 logs	6-10 logs	Greater than 10	
Small logs (10-50 cm)	0	1-5 logs	6-10 logs	Greater than 10	
Cliffs/outcrops	0	1-10%	11-50%	>50%	
Large rocks (>30 cm)	0	1-10%	11-50%	>50%	
Small rocks (10-30 cm)	0	1-10%	11-50%	>50%	
Leaf litter	0	1-25%	26-50%	>50%	
Termite mounds	0	1-10	>10 (Frequent)		
Water bodies	N/A				Notes on creeks, drainage lines, damp areas, shorelines, tracks and pathways, freshwater
Threatened species habitat	N/A				Notes on suitability of habitat for locally occurring threatened species

3.4.1.2 Unmade road reserves

An evaluation of the value of fauna habitat within each unmade road reserve was made using the survey flora data, coupled with knowledge of fauna habitat within nearby bushland reserves, where applicable. Specifically, comment was made on the locality, connectivity, understorey cover, occurrence of foraging or breeding habitat, and any threats to fauna habitat.

3.4.2 Fauna survey

3.4.2.1 Bushland reserves

Diurnal bird surveys

In total, 31 standard bird surveys were undertaken in the 25 reserves (Table 8). Bushland reserves were surveyed at least once for birds, and seven of the larger reserves were surveyed twice. As recommended by DEC (2004), standard surveys of 20 minutes duration in an area of approximately 2 ha were undertaken by a single experienced observer actively searching for and identifying birds by sight and sound. Most surveys were undertaken in the morning (before 11:00), and some were undertaken in the late afternoon (after 15:00). All surveys were undertaken when winds were moderate or low and there was no precipitation (if conditions violated these conditions the survey and records were treated as opportunistic, not standardised surveys). Bird species were also recorded opportunistically during other activities, such as while entering or leaving sites, making habitat assessments and deploying and retrieving remote monitoring equipment.

Diurnal active searches

Diurnal active searches were undertaken during fauna habitat assessments, primarily to target reptiles and frogs, and to detect indirect signs of other fauna (e.g. scats, scratches, diggings etc.). Some rocks and logs were turned (and then replaced as close as possible to their original position), leaf litter around tree bases disturbed, and trees checked for nests and hollow use by inspecting for gnaw marks on the hollow rims. Potential den sites were checked for occupation and/or indirect evidence of use. Care was taken to avoid excessive habitat disturbance and damage.

Nocturnal fauna survey

Spotlighting was undertaken at all of the BR (Table 8). Spotlight surveys of each reserve involved two experienced personnel with a 300 lumen LED head torch and binoculars actively searching for, and identifying all tetrapod fauna types (birds, mammals, reptiles and frogs) by sight and sound. Surveys were standardised to 30 minutes (one person hour) per site. Care was taken to avoid spotlighting in the vicinity of homes and roads. Call playback for owls was not undertaken due to the proximity of residents' homes.

Remote devices

An echolocation recording device (Anabat Express) was deployed at seven sites for one night each. These included Balmoral Park, Bradley's Reserve, Lawrie Plunkett Reserve, Reid Park, Quaker's Hat Park, Clifton Gardens Reserve and Morella Road Reserve (Table 8).

Anabat survey data (a ZCA file) were downloaded from the detector and sent to Narrawan Williams (AMBS) for analysis.

Seven remote cameras were deployed for between two to fifteen nights at seven locations (81 trap nights) at Balmoral Park, Bradleys Reserve, Lawrie Plunkett Reserve, Reid Park,

Quaker's Hat Park, Parriwi Park, Clifton Gardens Reserve and Morella Road Reserve (Table 8). Cameras were attached arboreally to a tree or on the ground to capture arboreal and terrestrial species. Each camera was baited with both tinned sardines and universal bait (rolled oats, peanut butter and honey), which were pegged to the ground or wrapped around a tree in secure bait chambers. Camera data were analysed manually by Cameron Radford and Brad Pyne of Ecosure.

Table 8 Inventory of fauna survey effort in bushland reserves

Reserve No.	Reserve Name	Bird survey	2nd bird survey	Habitat assess.	Herpetofauna survey	Spotlight	Anabat	Camera traps
65	Quakers Hat South	4 Jan 2022		4 Jan 2022	4 Jan 2022	4 Jan 2022	N/A	N/A
63	Quakers Hat North	4 Jan 2022		4 Jan 2022	4 Jan 2022	4 Jan 2022	N/A	N/A
64	Quakers Hat Park	24 Dec 2021	7 Jan 2022	24 Dec 2021	24 Dec 2021	24 Dec 2021	12 Jan – 14 Jan	24 Dec – 7 Jan 2022
61	Parriwi Park	24 Dec 2021	7 Jan 2022	24 Dec 2021	24 Dec 2021	24 Dec 2021	10 Jan – 12 Jan	24 Dec 2021 – 7 Jan 2022
62	Parriwi Point Reserve	24 Dec 2021		24 Dec 2021	24 Dec 2021	24 Dec 2021	N/A	N/A
60	Parriwi Lighthouse Reserve	23 Dec 2021		23 Dec 2021	23 Dec 2021	23 Dec 2021	N/A	N/A
70	Wy-ar-gine Point Reserve	23 Dec 2021		23 Dec 2021	23 Dec 2021	23 Dec 2021	N/A	N/A
35	Lawry Plunkett Reserve	8 Dec 2021	6 Jan 2022	8 Dec 2021	8 Dec 2021	22 Dec 2021	4 Jan – 6 Jan	8 Dec – 20 Dec 2021
53	Balmoral Park	8 Dec 2021	6 Jan 2022	8 Dec 2021	8 Dec 2021	22 Dec 2021	24 Dec – 4 Jan	8 Dec – 20 Dec 2021
54	Bradley's Bushland Reserve	22 Dec 2021	6 Jan 2022	22 Dec 2021	22 Dec 2021	22 Dec 2021	6 Jan – 10 Jan	22 Dec – 24 Dec
39	Morella Road Reserve	22 Dec 2021	5 Jan 2022	22 Dec 2021	22 Dec 2021	22 Dec 2021	22 Dec – 24 Dec	7 Jan – 10 Jan 2022
37	Little Ashton Park	21 Dec 2021		21 Dec 2021	21 Dec 2021	21 Dec 2021	N/A	N/A
57	Curraghbeena Park	21 Dec 2021		21 Dec 2021	21 Dec 2021	21 Dec 2021	N/A	N/A
189	The Spit Reserve	24 Dec 2021		24 Dec 2021	24 Dec 2021	24 Dec 2021	N/A	N/A
69	Unnamed Reserve (Rosherville)	23 Dec 2021		23 Dec 2021	23 Dec 2021	23 Dec 2021	N/A	N/A
48	Rosherville Reserve	23 Dec 2021		23 Dec 2021	23 Dec 2021	23 Dec 2021	N/A	N/A
67	Sirius Park West	21 Dec 2021		21 Dec 2021	21 Dec 2021	21 Dec 2021	N/A	N/A
46	Reid Park	20 Dec 2021	5 Jan 2022	20 Dec 2021	20 Dec 2021	20 Dec 2021	20 Dec – 22 Dec	20 Dec – 22 Dec

Reserve No.	Reserve Name	Bird survey	2nd bird survey	Habitat assess.	Herpetofauna survey	Spotlight	Anabat	Camera traps
66	Sirius Park East	21 Dec 2021		21 Dec 2021	21 Dec 2021	21 Dec 2021	N/A	N/A
183	Harnett Park	20 Dec 2021	5 Jan 2022	20 Dec 2021	20 Dec 2021	20 Dec 2021	N/A	N/A
44	Rawson Park	22 Dec 2021		22 Dec 2021	22 Dec 2021	22 Dec 2021	N/A	N/A
27	Clifton Gardens	22 Dec 2021	5 Jan 2022	22 Dec 2021	22 Dec 2021	22 Dec 2021	22 Dec – 24 Dec	7 Jan – 10 Jan 2022
165	Mosman Bay Creek	20 Dec 2021		20 Dec 2021		20 Dec 2021	N/A	N/A
34	Joel's Reserve	4 Jan 2022		4 Jan 2022	4 Jan 2022	4 Jan 2022	N/A	N/A
55	Chinamans Sand Dunes	23 Dec 2021		23 Dec 2021	23 Dec 2021	23 Dec 2021	N/A	N/A
	Total	**25**	**9**	**25**	**25**	**25**	**25 trap nights**	**81 trap nights**

3.4.2.2 Unmade road reserves

Fauna were recorded opportunistically during diurnal flora surveys at each RR. One ecologist spotlight survey was also carried out at each RR.

3.5 Assessment of bushland management program

The BR and RR are currently managed under T-EP 11/11 Bushland Restoration Contract 2012 - 2022. Management measures identified in this program and recommended in previous reserve assessments (Oculus 2001, Total Earth Care 2007, 2011, Ecosure 2016, 2019) were reviewed. Management recommendations for specific reserves, based on this assessment are provided in Volumes 2 and 3.

3.6 Limitations and assumptions

3.6.1 Flora

The current flora survey was limited to a total of ten survey days during December 2021 and January 2022. The full spectrum of flora, fauna and vegetation cannot be fully quantified in a single rapid survey for a variety of reasons as described below:

- Some reserves could not be safely surveyed, due to extremely steep and treacherous terrain (e.g. Parrawi Point Reserve). The survey team assessed these sites from the closest accessible locations (e.g. pathways, shorelines).
- Some flora species could not be identified, due to lack of adequate diagnostic features (e.g. immature specimens, lack of reproductive material). Where possible, these specimens were classified to generic level. Other species may lack above-ground structures or be hidden by surrounding vegetation during the survey period.
- Vegetation cover and weed density was estimated as an average within each survey polygon. Subjective variation between individual observers may affect the accuracy of cover and density estimation and therefore influence trends observed across surveys.

3.6.2 Fauna

The current fauna survey was undertaken over a total of nine days and 23 nights during December 2021 and January 2022 (including remote devices being left out over extended periods). The full range of fauna species cannot be recorded in a single rapid survey for a variety of reasons. The primary reason is that animals can be hard to find and detect, and short surveys will always miss species, especially cryptic or skulking ones. Most animals also have seasonal cycles and may be absent from the area during the survey period, although they may be common and conspicuous in other seasons. For instance, closer to the coast, bird species tend to breed from early spring to early summer and many then depart. Other species may breed elsewhere over the summer (e.g. in the mountains or further south) and then migrate to or through coastal Sydney in the winter. Some frogs tend to call only on

summer nights during heavy rains, while others call in mid-winter. Some reptiles are diurnal, some are nocturnal and some are very cryptic and rarely seen.

Some reserves could not be safely surveyed, due to extremely steep and treacherous terrain (e.g. Parriwi Point Reserve). The survey team assessed these sites from the closest accessible locations.

Detailed fauna surveys targeted those areas considered to comprise the best quality fauna habitat. These concentrated on key bushland reserve areas, which were larger and generally better connected than other areas of council land, such as unmade road reserves. While it is likely that such areas will yield the maximum number of fauna species, there may still be cryptic species that are missed due to the restricted survey effort, and this method of targeted searches may overlook fauna found in smaller areas of less suitable habitat.

4 Results - Flora of Mosman LGA

4.1 Overview

The majority of the surveyed reserves occur on moderate to steep hillslopes and gullies. Soils are generally derived from sandstone, with small cliffs and outcrops often present. The most widespread vegetation is Sydney Sandstone Gully Forest, which is an open eucalypt forest community dominated by *Angophora costata* (Sydney red gum) and *Eucalyptus botryoides* (bangalay). Other associated variations include Regrowth Sydney Sandstone Gully Forest, Disturbed Sydney Sandstone Gully Forest, Established Planted Area, Recently Planted Area, and Cosmopolitan. The distribution of vegetation communities within the bushland reserves has generally remained stable or improved since the 2019 surveys. However, there were small areas that had declined, or had altered from open space to planted area, and these have been mapped accordingly.

Small areas in Lawry Plunkett Reserve, Morella Road Reserve, Rosherville Reserve and Sirius Park West support a more diverse canopy and mid-storey, including species that are characteristic of Coastal Sandstone Gallery Rainforest. This community generally occurs in more protected and fertile areas. It is listed as the following TECs:

- Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions, Endangered under the BC Act
- Littoral Rainforest and Coastal Vine Thickets of Eastern Australia, Critically Endangered under the EPBC Act.

Morella Road Reserve contains vegetation characteristic of Sandstone Gallery Rainforest which is also characteristic of Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions, under the BC Act.

The canopy species in Lawry Plunkett Reserve, Rosherville Reserve and Sirius Park West, however, are still dominated by eucalypt forest species typical of Sydney Sandstone Gully Forest.

Some reserves (e.g. Harnett Park, Quakers Hat Park, Reid Park, Sirius Park East and Wy- ar - gine Reserve) have narrow fringes of flatter topography with alluvial soils supporting an open forest containing *Casuarina glauca* (swamp oak) and sometimes paperbarks (*Melaleuca* spp.). These species are included in the species assemblage of Estuarine Complex – Low open-forest of *Casuarina glauca* and *Machearina juncea* (formerly *Baumea juncea*). This community is listed as the following TEC:

- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions, Endangered under the BC Act and EPBC Act.

Bradley's Reserve lies on a relatively flat sandstone plateau with skeletal sandy soil. The prevailing vegetation is Coastal Sandstone Heath, which is an open to closed shrubland containing a diverse range of heath species.

Chinamans Beach Reserve occurs on coastal dunes adjacent to Middle Harbour. It supports Coastal Foredune Wattle Scrub, which is a low dense scrub dominated by *Acacia longifolia* subsp. *sophorae* (coastal wattle) and *Leptospermum laevigatum* (coast tea-tree). Some areas have a canopy of taller trees, including *Casuarina glauca* (swamp oak) and *Allocasuarina littoralis* (black she-oak).

Current and previous surveys (Oculus 2001, Total Earth Care 2007, Ecosure 2016) have identified 739 flora species within the 25 bushland reserves and 11 unmade road reserves (Table 9 and Table 10), consisting of 499 indigenous species, 22 non-indigenous native species and 218 introduced species.

Table 9 Flora species recorded by surveys to date (2001-2022)

Species status	25 bushland reserves	11 road reserves	All 36 reserves
Indigenous	497	200	499
Non-indigenous native	16	14	22
Introduced	192	179	218
Total flora	705	393	739

Table 10 Flora species recorded during current 2021-2022 survey

Species status	25 bushland reserves	11 road reserves	All 36 reserves
Indigenous	295	157	295
Non-indigenous native	10	10	16
Introduced	123	104	152
Total flora	428	271	463

Appendix 2 provides a total flora species list for the 25 bushland reserves and 11 unmade road reserves, categorised by reserve and survey. The current survey identified 19 additional species that were previously unrecorded within the 25 bushland reserves and 11 unmade road reserves (Table 11). Future surveys are expected to further expand this species list. Of the 19 species:

- 9 species are indigenous
- 0 species are non-indigenous natives
- 10 species are introduced.

Another 276 flora species that were previously recorded within the 36 reserves were not observed during the current survey by Ecosure.

Table 11 New flora species recorded within the 25 bushland reserves and 11 unmade road reserves (2021-22)

Species name	Common name	Status	BR	RR
Calotis dentex			yes	
Crowea exalata subsp *exalata*			yes	
Howea forsteriana	kentia palm	*	yes	

Species name	Common name	Status	BR	RR
Ficus lyrate	fiddleleaf fern	*		yes
Livistona chinensis	Chinese fan palm	*	yes	yes
Lycopodiella cernua	scrambling clubmoss		yes	
Microscorum scandens	fragrant fern		yes	
Molineria capitulata	palm grass	*	yes	
Notogrammitis billardiera	finger fern		yes	
Opuntia sp	prickly pear	WoNS	yes	
Pelargonium sp	geranium	*	yes	
Phyllota phyicoides	heath phyllota		yes	
Prostanthera linearis	narrow-leaved mint bish		yes	
Pterostylis sp	greenhood orchid		yes	
Schefflera actinophylla	umbrella palm	*	yes	yes
Senecio madagascariensis	fireweed	WoNS	yes	yes
Tecoma stans	yellow binonia	*	yes	
Tetratheca thymifolia	thyme pink-bells		yes	
Ulmus parvifolia	Chinese elm	*	yes	

* denotes introduced species;

4.2 Vegetation communities of Mosman LGA

Sydney Sandstone Gully Forest is widespread within the broader Sydney Basin area and is the most commonly occurring vegetation community of bushland reserves in the Mosman LGA. It is described as a moist forest type occurring as open forest or woodland and is generally associated with sheltered hillsides and gullies (Benson and Howell 1994).

Dominant species associated with these forest types include *Eucalyptus piperita* (Sydney peppermint), *Angophora costata* (Sydney red gum), and *Corymbia gummifera* (red bloodwood). *Allocasuarina littoralis* (black she-oak) also frequently occurs along with a variety of shrubs belonging to the Proteacea, Fabaceae and Myrtaceae families (Benson and Howell 1994). Table 12 below provides a comprehensive species list.

At Bradley's Bushland Reserve in the east of the LGA, the vegetation is comprised of Coastal Sandstone Heath. This community is commonly associated with Hawkesbury Sandstone plateaus and ridges, containing gentle to moderately inclined slopes and wide rock benches with shallow soils. Vegetation type can vary between open heath to mallee or sedgeland, and is strongly influenced by environmental variables such as fire. Dominant species in this community include *A. littoralis* (black she-oak) and *Polyscias sambucifolia* (elderberry panax). Shrubs and understorey plants include *Banksia ericafolia* (*heath-leaved banksia*), *Kunzea ambigua* (tick bush), and *Epacris longiflora* (fuchsia heath). Coastal Sandstone Heath also occurs in a small area of Curraghbeena Park reserve.

In the east of the LGA, a small area of Coastal foredune wattle scrub exists at Chinaman's Beach Dunes bushland reserve. This vegetation community falls within the Coastal Dune

Heath category (Benson and Howell 1994), and is comprised of a low dense scrub dominated by *Leptospermum laevigatum* (coast tea-tree) and *Acacia longifolia* subsp. *sophorae* (coastal wattle). Some areas of this community may have a canopy of taller trees, including *Casuarina glauca* (swamp oak) and *A. littoralis* (black she-oak).

Table 12 Vegetation community descriptions and associated plant species in Mosman LGA (Benson and Howell 1994)

Sydney Sandstone Gully Forest	
Description	Occurs throughout Mosman LGA and wider Sydney Basin within sheltered hillsides and gullies. Open forest/woodland with variable midstorey and ground layer containing herbs, ferns, grasses and grass-like plants.
Canopy	*Eucalyptus piperita* (Sydney peppermint), *Angophora costata* (Sydney red gum), *Corymbia gummifera* (red bloodwood), *Eucalyptus botryoides* (bangalay)
Midstorey	*Allocasuarina littoralis* (black she-oak), *Banksia serrata* (old man banksia*), Glochidion ferdinandi var. ferdinandi* (cheese tree), *Pittosporum undulatum* (sweet pittosporum), *Polyscias sambucifolia* (elderberry panax), *Ficus rubiginosa* (Port Jackson fig), *Elaeocarpus reticulartus* (blueberry ash)
Understorey	*Banksia spinulosa* (hairpin banksia), *Persoonia pinifolia* (pine-leaved geebung), *Dodonaea triquetra* (large-leaf hopbush), *Crowea saligna, Homalanthus populifolius* (bleeding heart), *Pultenaea daphnoides* (large-leaf bush-pea), *Kunzea ambigua* (tick bush), *Smilax glyciphylla* (sweet sarsaparilla)
Ground layer	*Commelina cyanea* (scurvy weed), *Lomandra longifolia* (spiny-headed mat-rush), *Dianella caerulea* (blue flax-lily), *Pteridium esculentum* (common bracken), *Calochlaena dubia* (soft bracken), *Oplismenus aemulus* (basket grass), *Microlaena stipoides* (weeping grass), *Entolasia stricta* (wiry panic)
Coastal Sandstone Heath	
Description	Occurs on sandstone headlands, plateaus and ridges. Within the study area, is the dominant community at Bradley's Bushland Reserve, with a small patch occurring at Curraghbeena Park. Vegetation occurs as closed shrubland with scattered emergent trees and a sparse ground layer.
Canopy	*Allocasuarina littoralis* (black she-oak), *Pittosporum undulatum* (sweet pittosporum), *Polyscias sambucifolia* (elderberry panax)
Midstorey / understorey	*Banksia ericifolia (heath-leaved banksia), Kunzea ambigua (tick bush), Acacia longifolia subsp. longifolia (Sydney Golden wattle), Pittosporum undulatum (sweet pittosporum), Dodonaea triquetra (large-leaf hop-bush), Pomaderris lanigera (wooly pomaderris), Epacris longiflora (fuchsia heath), Grevillea linearifolia (linear-leaf grevillea), Platysace lanceolate (shrubby platysace)*
Ground layer	*Lomandra longifolia* (spiny-headed mat-rush), *Dianella caerulea* (blue flax-lily), *Microlaena stipoides* (weeping grass) and *Pomax umbellata*, *Oplismenus aemulus* (basket grass)
Coastal Foredune Wattle Scrub	
Description	Low dense scrub on coastal frontal dunes and beach ridges. The dominant community at Chinaman's Beach Dunes reserve. Dense low forest to shrubland with a sparse mid and ground layer.
Canopy	*Leptospermum laevigatum* (coast teatree), *Acacia longifolia* subsp. *sophorae* (coastal wattle), *Casuarina glauca* (swamp oak), *Allocasuarina littoralis* (black she-oak)
Midstorey/ understorey	*Myoporum boninense* (boobialla), *Banksia integrifolia* subsp. *integrifolia* (coast banksia), *Correa alba* var *alba* (white correa), *Westringia fruticosa* (coastal rosemary)
Ground layer	*Lomandra longifolia* (spiny-headed mat-rush), *Carpobrotus glaucescens* (pigface), *Zoysia macrantha* (prickly couch), *Sporobolus virginicus* (sand couch), *Stephania japonica* var *discolor* (snake vine)

A flora and fauna survey report provided to MMC by Total Earth Care in 2007 included an assessment of bushland reserves in the Mosman LGA. The report identified variations of Sydney Sandstone Gully Forest vegetation community that more accurately reflected the

condition state of the community during the survey period (Table 13). These vegetation community variations have been replicated at sites throughout this report, with edits made where required.

Table 13 Variations of Sydney Sandstone Gully Forest vegetation community (adapted from Total Earth Care 2007).

Variations of Sydney Sandstone Gully Forest	
Regrowth Sydney Sandstone Gully Forest	Sydney Sandstone Gully Forest that is characterised by some remnant native vegetation (mainly canopy), established or regenerating/planted midstorey, and groundcover stratums. Weed densities are variable but mainly weed infestation is limited to the groundcover and understorey stratums. Generally has a moderate to high resilience with variable weed densities.
Disturbed Sydney Sandstone Gully Forest	Sydney Sandstone Gully Forest that is characterised by little remnant native vegetation. Majority of all stratums have been disturbed and planted with native species. Weed densities are generally moderate to high and weed infestation may be in the groundcover through to midstorey stratums. Generally has a low to moderate resilience.

4.2.1 Threatened flora

The desktop assessment identified the potential presence of 11 flora species threatened under the BC Act and / or EPBC Act:

- *Acacia terminalis* subsp. *eastern Sydney* (sunshine wattle) (Endangered EPBC Act) (Endangered BC Act)
- *Allocasuarina portuensis* (Nielsen Park she-oak) (Endangered EPBC Act) (Endangered BC Act)
- *Callistemon linearifolius* (netted bottle brush) (Vulnerable BC Act)
- *Epacris purpurascens* var. *purpurascens* (Vulnerable BC Act)
- *Eucalyptus camfieldii* (Camfield's stringybark) (Vulnerable EPBC Act) (Vulnerable BC Act)
- *Eucalyptus nicholii* (narrow-leaved black peppermint) (Vulnerable EPBC Act) (Vulnerable BC Act)
- *Lasiopetalum joyceae* (Vulnerable EPBC Act) (Vulnerable BC Act)
- *Pimelea curviflora* var. *curviflora* (Vulnerable EPBC Act) (Vulnerable BC Act)
- *Prostanthera junonius* (somersby mintbush) (Endangered EPBC Act) (Endangered BC Act)
- *Prostanthera marifolia* (seaforth mintbush) (Critically Endangered EPBC Act) (Critically Endangered BC Act)
- *Syzygium paniculatum* (magenta lily pilly) (Vulnerable EPBC Act) (Endangered BC Act).

Two threatened flora species have been consistently recorded in bushland reserves within Mosman LGA, including during this survey:

- *Acacia terminalis* subsp. *eastern Sydney* (sunshine wattle)
- *Syzygium paniculatum* (magenta lilly pilly).

4.2.1.1 Sunshine wattle (Acacia terminalis subsp. Eastern Sydney)

Sunshine Wattle is an erect or spreading shrub, 1 - 5 m tall with bipinnate leaves and pale yellow ball-shaped flowers (OEH 2014b). It differs from other more widespread subspecies by being hairier and having thicker flower stalks and wider seed pods. It has a very limited distribution from Botany Bay to the northern foreshore of Sydney Harbour and occurs in dry sclerophyll forests and coastal heath on sandy soils. Areas of potential habitat for the species are generally sparse, scattered, small and isolated. Most known sites are highly modified or disturbed due to surrounding urban development. Natural pollinators are small birds and bees and seeds are dispersed by ants. Seed viability is high and recruitment occurs mainly after fire. Threats to the species include urban development, weed invasion, inappropriate fire regimes and the potential for the subspecies to hybridise with horticultural cultivars (DECCW 2010).

The current survey recorded populations of sunshine wattle in six bushland reserves (Table 14). Parriwi Park and Quakers Hat Park had populations containing juvenile and adult plants. The current survey did not detect some populations recorded during previous surveys, possibly due to lack of fire or other disturbance to promote recruitment. Sunshine wattle seeds may still be present in the soil seed bank in these areas, so may regenerate after a suitable disturbance.

Table 14 Areas and/or population estimates for sunshine wattle within the Mosman LGA

Reserve	Area (m^2)	Number
Curraghbeena Park	<1	1
Balmoral Park	<1	1
Parriwi Lighthouse	<1	1
Parriwi Park	101-1,000	11-100
Quakers Hat Park	>1,000	11-100
Quakers Hat South	<1	1
Sirius Park East	<1	1

4.2.1.2 Magenta lily pilly (*Syzygium paniculatum*)

Magenta lily pilly is a small to medium sized rainforest tree that grows to 8 m tall (OEH 2014a). It has a flaky bark and leaves that are shiny, dark-green above and paler underneath. The deep magenta fruits are spherical to egg-shaped and range from 15 to 25 mm in diameter. The species is restricted to a narrow, linear coastal strip from Upper Lansdowne in the north to Conjola State Forest in the south. In the Central Coast region (including Sydney) the species occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities. Threats to the species include loss of habitat through clearing for residential development, weed invasion, myrtle rust and vulnerability to fire (OEH 2014a).

The current survey recorded magenta lily pilly in three bushland reserves, generally as one or two plants (Table 15). Some individuals were large remnant trees, while other records were smaller plants that may be natural or planted specimens.

Table 15 Areas and/or population estimates for magenta lily pilly within the Mosman LGA

Reserve	Area (m^2)	Number
Lawry Plunkett Reserve	<1	1
Parrawi Lighthouse Reserve	<1	1
Quakers Hat South	1-10	2-10

4.3 Rare or threatened Australian plants

The current survey recorded two indigenous ROTAP species, *Acacia terminalis* subsp. *terminalis* (sunshine wattle) and *Syzygium paniculatum* (magenta lily pilly).

Oculus (2001) recorded one other ROTAP species, *Blechnum gregsonii*. This species was not recorded during the current survey and is typically known to occur in the Blue Mountains in the west of Sydney (NSW Atlas of Living Australia).

4.4 Weeds

At least three weed species were identified during the survey that are listed as Weeds of National Significance (WoNS) under the National Weeds Strategy (Australian Government 2018), including *Anredera cordifolia* (Madeira vine), *Asparagus aethiopicus* (ground asparagus) and *Rubus fruiticosus* (blackberry). Plant species listed under WoNS are regarded as the worst weeds in Australia due to their invasiveness, potential for spread, and economic and environmental impacts (NSW Government). *Anredera cordifolia* (Madeira vine) and *Asparagus aethiopicus* (ground asparagus) were two of the most frequently recorded species across all sites.

4.4.1 Bushland reserves

Approximately 28.14 ha (78% of the surveyed bushland reserves) had an overall weed cover of less than 10% in 2021-2022 which was more than the 72.6% in 2016 (Ecosure 2016) (Table 16). Only three reserves (Harnett Park, Little Ashton Park, and Parriwi Point) contained areas with an overall weed cover over 70%.

Table 16 Overall weed cover in bushland reserves in Mosman LGA

Reserve name	Area in weed cover class (ha)					Total area (ha)
	> 70%	30-70%	10-29%	< 10%	Open space	
Balmoral Park		0.14	0.27	2.36		2.77
Bradley's Bushland Reserve				1.24	0.03	1.27
Chinamans Beach Dunes				0.89		0.89
Clifton Gardens Reserve			0.14	0.71		0.85
Curraghbeena Park		0.17	0.04	0.93		1.14
Harnett Park	0.02	0.60	0.42	0.34		1.38
Joel's Reserve			0.11	0.25	0.02	0.38
Lawry Plunkett Reserve			0.26	3.21	0.15	3.62

Reserve name	Area in weed cover class (ha)					Total area (ha)
	> 70%	30-70%	10-29%	< 10%	Open space	
Little Ashton Park	0.16	0.23	0.10		0.06	0.55
Morella Road Reserve		0.13		0.74		0.87
Mosman Bay Creek		0.03	0.17			0.20
Parriwi Lighthouse				0.12	0.02	0.14
Parriwi Park				3.47	0.05	3.52
Parriwi Point	0.40	0.18		0.41	0.01	1.00
Quakers Hat North		0.18	0.23	0.49	0.27	1.17
Quakers Hat Park		0.26		3.58	0.22	4.06
Quakers Hat South			0.06	0.69	0.04	0.79
Rawson Park			0.11	0.20		0.31
Reid Park			0.62	1.43	0.11	2.16
Rosherville Reserve				0.40		0.40
Sirius Park East			0.25	0.74		0.99
Sirius Park West			0.06	0.40	0.02	0.48
The Spit Reserve		0.53	0.48	3.97		4.98
Unnamed Reserve (Rosherville)		0.14	0.34	0.89	0.08	1.45
Wy-ar-gine Point			0.03	0.67		0.70
Total area	**0.58**	**2.59**	**3.69**	**28.13**	**1.08**	**36.07**

4.4.2 Road reserves

Approximately 0.14 ha (10% of the surveyed road reserves) had an overall weed cover of less than 10% (Table 17). Six road reserves contained areas with an overall weed cover over 70%.

Table 17 Overall weed cover in road reserves in Mosman LGA

Reserve name	Area in weed cover class (ha)					Total area (ha)
	> 70 %	**30-70%**	**10-29%**	**< 10%**	**Open space**	
Unmade Bullecourt Ave Reserve (North)	0.07		0.03	0.01		0.11
Unmade Bullecourt Ave Reserve (South)	0.05	0.04			0.01	0.10
Unmade Carrington Ave Reserve				0.07		0.07
Unmade Cobbittee St Reserve	0.02	0.02		0.03	0.00	0.07
Unmade Crown Road Reserve	0.02	0.41				0.43
Unmade Government Rd Reserve			0.14			0.14
Unmade Grecia Ln Reserve (West)	0.17					0.17
Unmade Grove Ave Reserve		0.01	0.06			0.07
Unmade Harston Ave Reserve	0.02	0.02	0.01	0.03	0.01	0.09
Unmade Inkerman St Reserve (South)		0.06			0.03	0.09
Unmade Kahiba Rd Reserve (South)			0.05		0.01	0.06
Total area	**0.35**	**0.56**	**0.29**	**0.14**	**0.06**	**1.40**

5 Results -Fauna of Mosman LGA

5.1 Fauna habitat

5.1.1 Overview

The Mosman LGA contains only a few broad habitats, due to its small size and the homogeneity of the vegetation. The following broad habitat types were recognised during surveys:

- moist gully forests
- dry ridgeland forests and woodlands
- heaths
- foreshores
- exotic vegetation
- grassy open areas.

These habitats are defined below. However, it should be noted that they grade into one another, and some sites transition from one habitat to another, or could be classified as more than habitat. Furthermore, the history of disturbance at the site can have a significant bearing on the state of the habitat.

5.1.2 Moist gully forests

A few moist gullies in the LGA support tall forests with emergent eucalypts over dense mid storeys of Port Jackson figs, pittosporum and the like. In the ground story the soil remains moist, leaf litter is mouldy and decaying, and ferns can be frequent. Within the LGA there are no major water courses (except for Port Jackson), so no significant development of riparian vegetation. Hollow development in the old growth trees is important nesting habitat for many species, including microbats, possums, cockatoos, parrots and the powerful owl (*Ninox strenua*). Fallen timber on the ground provides potential shelter for the long-nosed bandicoot, but unfortunately also for feral species like black rats and feral cats. Figs are an important seasonal food source that attracts birds like the channel-billed cuckoo *(Scythrops novaehollandiae)* and eastern koel (*Eudynamys orientalis*), as well as large numbers of the grey-headed flying-fox *(Pteropus poliocephalus).* The understory provides dense habitat for skulking birds like the eastern whipbird (*Psophodes olivaceus*) and the white-browed scrubwren (*Sericornis frontalis*).

5.1.3 Dry ridgeland woodlands

Up slope from the gullies to the ridges, the escarpments dry out, the canopy thins out, and trees diminish in height and girth. Hollows may still form, but larger ones become rarer. More light penetrates the canopy and the ground dries out faster, so the leaf litter is dryer. Mid and

ground covers may still be dense, but tend to be dryer and healthier than in the gullies. In some circumstances gully forests can transition quickly into ridge woodlands, whereas elsewhere the change may be slight and barely perceptible. Most fauna species move easily between the two habitats and recognise no major boundary.

5.1.4 Heathlands

Pure heathlands that stand alone are very limited in occurrence, and the only example included in this study is at Bradley's Bushland Reserve. However, heathlands also occur underneath many of the woodlands (especially on escarpments) where they typically enhance the biodiversity of the woodland. Heathlands typically occur on shallow, infertile soils over sandstone which can support a high diversity and density of shrub species. This in turn can provide plentiful shelter for small fauna species, as well as a variety of food resources (flowers, fruits and insects). Heathlands are limited in their ability to provide shelter resources in the form of hollows and fallen logs. Depending on the topography, they may contain significant rock features that provide microhabitat for reptiles. The variegated fairywren (*Malurus lamberti*) is associated with sandstone heaths in the Sydney Basin (Hindwood & McGill 1958). In the Mosman LGA, it occurs in woodland and forest habitats where there is some development of a heathy understory.

5.1.5 Foreshores

Mosman LGA has an extensive coastline with Port Jackson (Sydney Harbour and Middle Harbour). Forests, woodlands and heaths run right to the high tide mark in many reserves. Between the vegetation and the water's edge there is a thin strip of tidal and supralittoral land. Due to the steep slopes and (sometimes) high energy of the waves there are no major silt deposits, mudbanks or sandbanks, so no development of mangroves or saltmarsh. Natural shorelines consist of bare weathered sandstone, sandy or gravel beaches, or a combination of the two. In some instances, artificial shorelines of stone walls allow lawns to extend virtually to the high tide line.

5.1.6 Exotic vegetation

Exotic plants are a feature of cities the world over. Some exotic plants are bad for biodiversity, but some can enhance it. Environmental weeds, spread by natural agents (birds, water, wind, etc.) occur in most bushland in the Sydney Basin, including the Mosman LGA. Alongside these, there are garden plants that escape into bushland but do not thrive, and planted gardens (parklands) alongside bushland reserves. A continuum of examples can be found between almost pure native bushland and pure exotic vegetation. Whilst native vegetation is far superior habitat for native fauna, many fauna species can however thrive in exotic vegetation habitats.

5.1.7 Grassy open areas

The nature of Council reserves is that they include both bushland for conservation and parkland for recreation. Alongside many bushland reserves are areas of mowed lawn. Whilst

artificial, these grassy open areas provide habitat for species that do not favour bushland, for example masked lapwing, Australian wood-duck and magpie-lark.

5.1.8 Microhabitats

Tree hollows are an essential habitat feature required for nesting, roosting and/or denning by many arboreal, bird and microbat species in Australia (Gibbons & Lindenmayer 1992; DEC 2004). Hollow-bearing trees are generally old trees, alive or dead, and can contain one or more hollows (cavities within the trunk or branches) suitable for the occupation of hollow-dependent fauna. As a result, regrowth habitats generally have few hollows and consequently they support few hollow-dependant fauna species. Within the Mosman LGA, all recorded species of parrots, owls, kingfishers, and possums require hollows for nesting. Furthermore, most microbat species require hollows or loose bark and crevices for refuge and sometimes breeding purposes. Large hollows (> 50 cm diameter) were recorded as common in Balmoral Park and scattered (present but not common) in six other reserves: Parriwi Lighthouse Reserve, Parriwi Park, Quakers Hat Park, Reid Park and The Spit Reserve. Small hollows were recorded as scattered to common in 17 of the 25 bushland reserves. Most hollows were in live trees, and very few large dead stags were recorded.

Fallen logs provide shelter and sometimes foraging habitat for terrestrial fauna species, especially reptiles and small to medium-sized mammals. In the LGA, large fallen logs (> 50 cm diameter) are likely important as shelter for long-nosed bandicoots. Large fallen logs were recorded as common in three bushland reserves: Balmoral Park, Little Ashton Park and The Spit Reserve. Small fallen logs were present in all reserves. The presence of small logs indicates that regular disturbance of the ground layer (mowing, people traffic) is not occurring.

Rocky outcrops, cliffs, escarpments and boulders provide habitat for many reptile species. They provide heat sinks that help cold-blooded animals maintain body temperature. They also provide shelter in the form of caves, crevices and cavities under rocks. Rocky habitats are abundant in the reserves of the LGA. The abundance of the southern leaf-tailed gecko reflects this.

Leaf litter is an important foraging and shelter site for many species of frogs and small reptiles. It also provides important foraging habitat for some mammals (e.g. bandicoots) and birds (e.g. brush turkeys and lyrebirds). Leaf litter was recorded as abundant or common in most of the bushland reserves.

Dense shrubs and grass provide shelter for an array of small fauna species including small frogs, reptiles, mammals and birds. By definition, heathland sites contain a high frequency of dense understorey shelter. There is ample evidence that Bushcare revegetation has restored dense understorey shelter in many sites. Dense weeds also contribute understorey shelter.

Termite mounds provide nesting habitat for kingfishers, and shelter for many reptile species. Termites provide food for echidnas, reptiles, and sometimes birds. Termites are also very important for speeding up the development of hollows. Termites play an important role in recycling nutrients and increasing the productivity of the environment. Termite mounds were recorded in six of the bushland reserves: Balmoral Park, Clifton Gardens, Morella Road,

Parriwi Park, Quakers Hat Park and The Spit Reserve.

5.1.9 Connectivity

Connectivity is very important to maintaining and or regaining populations of wildlife in a given area. The concept is quite simple: connectivity is merely the absence of barriers to movement. However, in land management it can become quite a complex issue. This is not helped by the appearance of narrow unrealistic definitions or goals, for instance the notion that connectivity is a line of trees with an unbroken canopy and dense undergrowth. This might aid movement of a fairywren, but it is irrelevant to a sea-eagle. Different species are impacted by different barriers. For some species roads are a barrier but for others, deserts and oceans are no barrier. Many species use chains of habitat as stepping stones and don't need corridors at all. The specifications of connectivity therefore differ from species to species.

Connectivity also varies in scale. Rivers and mountain chains can provide regional connectivity that facilitates the mass migrations of large animals over long distances. Narrow corridors of trees can help woodland birds disperse locally after breeding or exploit seasonal food resources. Assessments of connectivity should consider at least two scales, regional and local.

From the perspective of less mobile fauna species, the Mosman LGA is very isolated and effectively an island. Being a peninsula in Port Jackson, it is surrounded on three sides (north east and south) by salt water and on the fourth side by unbroken urban development. For species that do not cross water and urban landscapes, Mosman no longer has regional connectivity. Rebuilding regional connectivity to Mosman (for less mobile species) would be very difficult, and would require cooperation with neighbouring LGAs around Middle Harbour.

Local connectivity varies between reserves in the LGA. Lawry Plunkett Reserve is connected by virtually unbroken tree canopy to Curraghbeena Park, via a narrow, convoluted and sometimes tenuous chain of reserves, including Balmoral Park, the Middle Head section of Sydney Harbour National Park (SHNP), Bradley's Bushland Reserve, Rawson Park, Clifton Gardens, Taronga Zoo and Sirius Cove. Other reserves, such as Joel's Reserve, are fairly isolated.

Despite the connectivity issues, some species of wildlife have managed to colonise Mosman LGA in recent years. Australian brush turkey is a prime example of a species that has colonised recently by walking overland, probably down the western shore of Middle Harbour. Channel-billed cuckoo has colonised in recent decades, but this species is a strong flyer that migrates to New Guinea in the winter. It is attracted to the fruiting Port Jackson figs and relatively recent nesting populations of pied currawong, its favoured brood host. It is not clear how the long-nosed bandicoot has colonised the LGA, but there seem to be three possible explanations: 1) colonisation along the western shore of Middle Harbour; 2) colonisation over the Spit Bridge; or 3) through expansion of a tiny remnant population that survived unnoticed in the LGA.

5.1.10 Previous habitat assessment comparisons

In previous biodiversity surveys for Mosman LGA, Oculus (2001) and Total Earth Care (2007) identified three broad habitat types (Table 18).

Table 18 Definitions of landscape habitats used in previous reports

Habitat name	Definition Oculus (2001)	Definition Total Earth Care (2007)
Core Habitat	Bushland and areas of native plants on public land including community land, crown land, National Park and Military land	Remnant, regrowth and disturbed native plant communities generally with statuary protection for conservation
Cosmopolitan Habitat	Land with a mixture of exotic and native plants and can involve native and exotic weeds and garden plants as well as very degraded remnant vegetation	Reconstructed native plant communities or Cosmopolitan plant communities generally with some statuary protection
Street Tree Habitat Links	Proposed habitat links including public open space, street tree planting and gardens on private land	Road verges with native or exotic shrubs and trees.

This classification distinguishes between healthy bushland, parkland that is not bushland, and habitat that is neither but does or can contribute to connectivity. Thus they are based mostly on a notion of ‘condition’. The classifications used in this report and in Ecosure 2016 are based on both ‘condition’ and ‘ecology’. However, to facilitate consistency and comparison, the two schemes are compared in Table 19 for each of the 25 bushland reserves surveyed in this report. It should be noted that the classifications can be subjective and are not absolute.

Table 19 Comparison of different descriptions of fauna habitat between surveys for each bushland reserve

Reserve number	Reserve name	Moist gully forest	Dry ridgeland woodland	Heath	Foreshore	Exotic veg	Grassy open area	Core	Cosmopolitan
63	Balmoral Park	Mostly	Some	Little		Some	Abutting	Yes	
64	Bradley's Bushland Reserve			Mostly		Some	Abutting	Yes	
65	Chinaman's Beach Dunes	*	*	*	Yes		Yes	Yes	
61	Clifton Gardens	Some	Mostly		Yes	Some	Yes		Yes
62	Curraghbeena Park		Some		Yes	Some			Yes
60	Harnett Park	Some	Some		Yes				Yes
70	Joel's Reserve	Mostly			Yes	Some	Yes		Yes
35	Lawry Plunkett Reserve	Mostly	Some			Some	Yes	Yes	
53	Little Ashton Park					Mostly			Yes
54	Morella Road	Mostly				Some		Yes	
39	Mosman Bay Creek	Mostly				Some			Yes
37	Parriwiri Lighthouse Reserve		Some		Yes	Some			Yes
57	Parriwiri Park		Mostly	Much				Yes	
189	Parriwiri Point Reserve		Some		Yes	Mostly			Yes
69	Quakers Hat North		Mostly	Some	Yes			Yes	
48	Quakers Hat Park		Mostly	Some	Yes			Yes	
67	Quakers Hat South		Some		Yes	Mostly			Yes
46	Rawson Park			Some		Mostly	Yes		Yes
46	Reid Park	Mostly			Yes	Some	Yes	Yes	
66	Reid Park East	Mostly			Yes	Some	Yes	Yes	
183	Rosherville Park	Some				Mostly	Yes		Yes
44	Rosherville South	Some			Small	Mostly	Yes		Yes
27	Sirius Park East	Some	Some		Yes		Yes	Yes	

Reserve number	Reserve name	Moist gully forest	Dry ridgeland woodland	Heath	Foreshore	Exotic veg	Grassy open area	Core	Cosmopolitan
165	Sirius Park West	Some	Some		Yes		Yes		Yes
34	The Spit Reserve		Mostly	Some	Yes		Yes	Yes	
55	Wy-Ar-Gine Pt Reserve		Mostly	Some	Yes		Abutting	Yes	

* Chinaman's Beach Dunes Reserve is a unique example (within this study) of Coastal Foredune Wattle Scrub, which does not fit within the habitat definitions, this was its second year of survey.

5.2 Fauna species

5.2.1 Overview

Overall, 64 native fauna species were recorded during formal surveys in the 25 targeted bushland reserves. This total included three species of frog, nine species of reptile, nine species of mammal and 43 species of bird. Furthermore, nine introduced species (four birds and five mammals) were recorded.

The three species of frogs recorded in the current survey were:

- common eastern froglet (*Crinia signifera*)
- Peron's tree frog (*Litoria peronii*)
- striped marsh frog (*Limnodynastes peronii*).

These were recorded calling at night during spotlight surveys. Common eastern froglet and striped marsh frog were recorded in previous surveys (Oculus 2001; Total Earth Care 2007; Ecosure 2016), and Peron's tree frog has not previously been recorded. These species are tolerant of urbanisation and remain common and widespread within the Sydney metropolitan area (Griffiths 2006).

The nine reptile species recorded in the current survey were:

- elegant snake-eyed skink (*Cryptoblepharus pulcher*)
- wall lizard (*Cryptoblepharus virgatus*)
- copper-tailed skink (*Ctenotus taeniolatus*)
- eastern water-skink (*Eulamprus quoyii*)
- dark-flecked garden sunskink (*Lampropholis delicata*)
- pale-flecked garden sunskink (*Lampropholis guichenoti*)
- southern leaf-tailed gecko (*Phyllurus platurus*)
- eastern water dragon (*Intellagama lesueurii lesueurii*)
- weasel skink (*Saproscincus mustelinus*).

All species were recorded during direct searches, spotlighting or as opportunistic records during bird surveys and/or device deployment. All of these species were recorded in previous fauna surveys commissioned by MMC (Oculus 2001; Total Earth Care 2007; Ecosure 2016) except elegant snake-eyed skink which had not previously been recorded. Each is relatively tolerant of urbanisation and remains common and widespread in the Sydney metropolitan area (Griffiths 2006). The nocturnal southern leaf-tailed gecko was also recorded. This species is confined to sandstone galleries within about a 160 km radius of Sydney. It remains common in the Mosman LGA and probably occurs in all reserves where sandstone outcropping is common. It also inhabits the cave-like environments under buildings adjacent to or within bushland. The eastern water dragon and eastern water skink, as their names suggest, are

usually associated with streams or seepages, although they can be found away from water. At Chinaman's Beach Dunes the eastern water skinks have an unusual habit of making burrows in the sand dune, often at the interface between the dune scrub and the mowed grassland.

The fourteen species of mammals recorded during the surveys were:

- dog (*Canis lupus familiaris*)
- cat (*Felis catus*) (feral)
- large-eared pied bat (*Chalinolobus dwyeri*)
- Gould's wattled bat (*Chalinolobus gouldi*)
- eastern bentwing-bat (*Miniopterus schreibersii oceanensis*)
- rabbit (*Oryctolagus cuniculus*) (feral)
- long-nosed bandicoot (*Perameles nasuta*)
- common ringtail possum (*Pseudocheirus peregrinus*)
- grey-headed flying-fox (*Pteropus poliocephalus*)
- bush rat (*Rattus fuscipes*)
- black rat (*Rattus rattus*) (feral)
- yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*)
- common brushtail possum (*Trichosurus vulpecula*)
- European fox (*Vulpes vulpes*).

Long-nosed bandicoot was observed at four reserves, during spotlighting at Balmoral Park and on camera traps at Bradley's Bushland Reserve, Quakers Hat Park and Clifton Gardens. The population at North Head is listed as an endangered population under the BC Act, but animals in Mosman LGA fall outside the defined distribution of the listed population. Balmoral Park, Bradley's Bushland Reserve and Clifton Gardens are connected through SHNP. Quakers Hat Park has some connectivity with other foreshore reserves such as Quakers Hat North and Quakers Hat South to the south-west, and The Spit Reserve and possibly Parrawi Park and Parrawi Point to the east. Therefore, it is likely that two populations of long-nosed bandicoot are occurring in the Mosman LGA. Targeted surveys for this species in all reserves would confirm this. Long-nosed bandicoot is relatively tolerant of urbanisation, making use of lawns for foraging and underneath buildings for refuge (OEH 2017). However, road mortalities and dog and cat attacks are known threats to this species (OEH 2017).

Grey-headed flying-fox (listed as vulnerable under both the BC Act and EPBC Act) was recorded at nine reserves during spotlight surveys. They were mostly found in fig trees (*Ficus spp*.). This species also forages on *Eucalypt* spp. blossoms.

Common ringtail possum and common brushtail possum were each recorded in several reserves during spotlighting. Ringtail possum was recorded in nine reserves and brushtail was recorded in two reserves. Both species are likely to inhabit all or most reserves as well as

built-up areas in the LGA.

Several species of insectivorous bats were recorded at several reserves. Gould's wattled bat was recorded at all reserves where anabat recording occurred (Balmoral Park, Bradley's Bushland Reserve, Reid Park, Quakers Hat Park, Parriwi Park, Clifton Gardens and Morella Road Reserve). These recordings may have included some calls of Ride's free-tailed bat (*Ozimops ridei*) or yellow-bellied sheathtail-bat as well, although this cannot be confirmed. One definite call was recorded of yellow-bellied sheathtail-bat, which has not previously been recorded in the LGA according to the OEH Wildlife Atlas, and previous fauna surveys (Total Earth Care 2007, Ecosure 2016). This species is listed as vulnerable under the BC Act. Four definite calls were recorded of large-eared pied bat, which has also not previously been recorded in the LGA according to the OEH Wildlife Atlas, and previous fauna surveys (Total Earth Care 2007, Ecosure 2016). This species is listed as vulnerable under both the BC Act and the EPBC Act.

Bush rat was recorded in Bradley's Bushland Reserve during the current surveys on camera trap. This species was reintroduced into SHNP at Bradley's Head in 2011 and it is possible that the species migrated to Bradley's Bushland Reserve where it has remained.

Several introduced mammal species were recorded during the current surveys. A single feral cat was recorded at Reid Park on a camera trap, as was a single European fox. Black rat was recorded in several reserves through spotlight surveys and camera traps. Only one individual rabbit was recorded at Sirius Park East and it was white and appeared to be an escapee. Dogs were common in most reserves with walking tracks and open space.

Fourty-seven species of bird were recorded across the 25 targeted bushland reserves during the current surveys (Appendix 3). Most species recorded were medium to large species that are tolerant of urban habitats. There are a few species of small 'bush birds', however these have declined since previous surveys (Oculus 2001, Total Earth Care 2007). Variegated fairywren is present in reserves with any heath understory, and superb fairywren is present in locations with good ground cover. White-browed scrubwren and eastern whipbird inhabit the understorey of moist to dry forests and woodlands where the understory and mid story are well-developed. Nevertheless, an absence of other bushland species was noted during the surveys. Species such as eastern spinebill, grey shrike-thrush, eastern yellow robin, white-browed tree-creeper and red-browed finch remain common in similar habitats upstream in Middle Harbour (e.g. Ku-ring-gai). Whilst they likely still occur in the LGA, they were not common, at least during this survey period. It is likely that small bushland patches and low regional connectivity affect persistence of these species.

One adult powerful owl (*Ninox strenua*) (listed as vulnerable under the BC Act) was recorded during a spotlight survey at Balmoral Park. It has been recorded breeding at Balmoral Park in recent years (Steven Smith, MMC, pers. com.).

Australian brush turkey (*Alectura lathami*) has colonised Mosman LGA (and northern Sydney generally) in the last decade. From the time of European settlement until about 2000, they had never been recorded in Greater Sydney (with the exception of an isolated population in the Illawarra – Hindwood & McGill 1958; Cooper et al. 2014). This was probably due initially to

Aboriginal hunting pressure, followed by settler clearing and hunting pressure, followed by fox predation. The widespread control of foxes by National Parks and Wildlife Services and local governments between the Hawkesbury River and Port Jackson in recent decades has likely facilitated the widespread colonisation by this species.

Coastal fauna were not targeted in this survey, however some species of note such as crested tern (*Sterna bergii*), little black cormorant (*Phalacrocorax sulcirostris*) and Australian pelican (*Pelecanus conspicillatus*) were recorded. Further effort in coastal areas would likely see the bird species list increased by several shorebirds, other terns and marine birds. In addition, several marine mammals commonly occur in Sydney harbour and may occur within close proximity of the LGA. These species are:

- southern right whale (*Eubalaena australis*)
- humpback whale (*Megaptera novaeangliae*)
- bottlenose dolphin (*Tursiops truncatus*)
- common dolphin (*Delphinus delphis*)
- Australian fur seal (*Arctocephalus pusillus*)
- New Zealand fur seal (*Arctocephalus forsteri*).

5.2.2 Threatened fauna

Four threatened fauna species were recorded during the current survey. These include:

- large-eared pied bat (*Chalinolobus dwyeri*)
- powerful owl (*Ninox strenua*)
- grey-headed flying fox (*Pteropus poliocephalus*)
- yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*).

5.2.2.1 Large-eared Pied Bat

The large-eared pied bat (*Chalinolobus dwyeri*) is listed as vulnerable under both the BC Act and the EPBC Act. It is endemic to eastern Australia, ranging from Shoalwater Bay in Queensland to Ulladulla in New South Wales. This species uses caves, overhangs, abandoned mine tunnels and disused fairy martin nests for roosting. It is found mainly in areas with extensive cliffs and caves and forages in forest and woodland nearby, preferring well timbered areas with gullies (OEH 2017a). Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years, however exact breeding periods are unknown (OEH 2017a).

The large-eared pied bat (*Chalinolobus dwyeri*) has not been recorded in the Mosman LGA previously. Four definite echolocation calls for this species were recorded in Reid Park on 19 December 2021 using an Anabat Express echolocation call detector. This species is likely using a sea cave or sandstone cliff roost nearby to Reid Park.

5.2.2.2 Powerful Owl

The powerful owl (*Ninox strenua*) is listed as vulnerable under the BC Act and not listed under the EPBC Act. It is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range. It occurs continuously from Mackay, Queensland to south-western Victoria at low densities (OEH 2014c). In NSW, it is widely distributed throughout the eastern forests from the coast inland to the tablelands, with scattered (and mostly historical) records on the western slopes and plains (OEH 2014c).

The powerful owl roosts in dense mid-canopy trees or tall shrubs (e.g. turpentine *Syncarpia glomulifera*, black she-oak *Allocasuarina littoralis*, blackwood *Acacia melanoxylon*, rough-barked apple *Angophora floribunda*, cherry ballart *Exocarpos cupressiformis* and rainforest trees). These are usually located in sheltered gullies, typically on wide creek flats and at the heads of minor drainage lines (DECC 2006). Nesting occurs in large hollows (greater than 450 mm wide and greater than 1 m deep) in eucalypts in unlogged, unburnt gullies and lower slopes within 100 m of streams or minor drainage lines (DECC 2006). Nest trees are typically emergent, and are often the largest and oldest in a stand (Debus and Chafer 1994). The powerful owl is faithful to traditional nesting hollows but can also use other hollows within the nesting gully.

Pairs occupy large home ranges of approximately 300-1500 ha (Higgins 1999; DECC 2006), utilising various portions of this area at different times, depending on the local abundance of food (Debus and Chafer 1994). *N. strenua* preys predominantly on arboreal mammals, particularly the greater glider (*Petauroides volans*), common ringtail possum (*Pseudocheirus peregrinus*), sugar glider (*Petaurus breviceps*), brushtail possum (*Trichosurus vulpecula*) and flying-foxes (*Pteropus* spp). However, virtually all mammals up to the size of small macropods can be taken, including insectivorous bats, rodents, feral cat (*Felis catus*) and European rabbit (*Oryctolagus cuniculus)*, as well as birds and insects (Debus and Chafer 1994; Higgins 1999; DECC 2006).

Powerful owls can breed within urban areas, but the degree of urbanisation that it can tolerate is not known (Cooke et. al. 2002). Habitat fragments less than 200 ha are generally not large enough to provide significant habitat for *N. strenua* in south-eastern NSW (Higgins 1999).

This species was sighted flying in the eastern area of Balmoral Park during nocturnal surveys. It was sighted roosting in Balmoral Park in the 2016 survey as well (Ecosure 2016). This species has been recorded across the Mosman LGA and it has been regularly recorded within Balmoral Park (Steven Smith, MMC pers. comm. March 2016, January 2021).

5.2.2.3 Grey-headed flying-fox

The grey-headed flying-fox (*Pteropus poliocephalus*) is listed as vulnerable under the BC Act and the EPBC Act. It primarily occurs in the coastal belt from central Queensland to Victoria, however, it occasionally ranges into South Australia and is frequently observed west of the Great Dividing Range (Tidemann 1998). The relative abundance of this species in any area varies widely within its distribution between seasons and from year to year (Eby and Lunney 2002).

There are 221 previous records for this species within a 5 km radius of the LGA, with several records including many thousands of individual flying foxes. This is primarily within the Botanic Gardens roost, prior to dispersal. Within the Mosman LGA records exist for Taronga Zoo and Sirius Cove as well as Julian and Belmont Streets. The current survey recorded this species in 12 bushland reserves, but only while flying over or foraging. No roosts or camps were detected.

5.2.2.4 Yellow-bellied Sheathtail-bat

The yellow-bellied sheathtail-bat (*Saccolaimus flaviventris*) is listed as vulnerable under the BC Act. It is a wide-ranging species found across northern and eastern Australia. It occurs in forests and woodlands, and uses tree hollows and buildings to roost singularly or in groups of up to six. This species forages in most habitats, including open spaces. It uses mammal burrows in treeless areas for roosting. An aerial territory appears to be defended by this species (OEH 2017). Breeding occurs between December and mid-March after which a single young is born. There is speculation this species migrates to southern Australia in late summer and autumn, however seasonal movement are generally unknown (OEH 2017).

The yellow-bellied sheathtail-bat has not been recorded during previous flora and fauna surveys, and indeed in the Mosman LGA. A definite echolocation call for this species was recorded in Bradley's Bushland Reserve on 20 December 2021 using an Anabat Express echolocation call detector. Likely calls were also recorded in Balmoral Park and Lawrie Plunkett Reserve, both of which are in close proximity to Bradley's Bushland Reserve.

5.2.3 Unlikely fauna species

Some of the previous records of fauna species recorded by Oculus (2001) seem unlikely to occur regularly within Mosman LGA. Whilst it is not possible to rule out a one-off (or vagrant) occurrence of a particular species (especially birds), multiple records of these species are unlikely to be a regular occurrence in Mosman LGA. Some of the unlikely species are listed below.

5.2.3.1 Black-tailed gull (*Larus crassirostris*)

This species is a Japanese sea gull that has been recorded in Australia only three times, and never in NSW (BirdLife Australia Rarities Committee 2016). It was reported from six bushland reserves by Oculus (2001 in Total Earth Care 2007 Vol. 2).

5.2.3.2 Pied butcherbird

This species is rare in Sydney, breeding only along the Hawkesbury River, and rarely reported elsewhere in the metropolitan area. It was reported from three bushland reserves by Oculus (2001 in Total Earth Care 2007 Vol. 2).

5.2.3.3 Bar-shouldered dove

This species has patchy distribution in Sydney, and therefore likely rare in the Mosman LGA.

It was reported from eight bushland reserves and five road reserves by Oculus (2001 in Total Earth Care 2007 Vol. 2).

5.2.3.4 White-throated gerygone

This species is patchy in Sydney and rare along the coast, and unlikely to occur regularly in the Mosman LGA. It was reported from three bushland reserves by Oculus (2001 in Total Earth Care 2007 Vol. 2).

5.2.3.5 Lewin's honeyeater

This is a conspicuous and resident species in the Sydney district, but with a patchy distribution. It was reported from ten bushland reserves and one road reserve by Oculus (2001 in Total Earth Care 2007 Vol. 2). It has not been recorded in other surveys.

5.2.3.6 Common bronzewing

This species is generally found only in the western districts of Sydney or around large areas of bushland such as Royal and Ku-ring-gai Chase National Parks. It was reported from four bushland reserves and one road reserve by Oculus (2001 in TEC 2007 Vol. 2).

5.2.3.7 Other rare species

Other species which plausibly occur in the Mosman LGA, but nevertheless have only been recorded so far by Oculus (2001) include brown gerygone, and common scaly-foot (*Pygopus lepidopodus*). Caution is recommended when considering these records.

6 Bushland management program within Mosman LGA

6.1 Overview

Management of bushland within remnant vegetation in the Mosman LGA commenced in the 1980s, in response to community concern about the condition of these areas. Since this time, bushland regeneration has been undertaken and further amendments have been developed based on the Bushland Management Strategy prepared by Oculus (2001).

Bushland reserves and unmade road reserves are managed by contract bush regenerators and volunteers, primarily under the current specification Bushland Restoration Contract 2012 – 2022 (MMC 2012). This document outlines areas to be restored, which are divided into three catchments (Port Jackson, Middle Harbour East and Middle Harbour West). Management methods depend on the level of Indigenous Vegetation Cover determined for the reserve during a 2011 audit (Total Earth Care 2011) and are briefly summarised in Table 20. There are two areas that require special attention – Wy-ar-gine Point Bushland is a non-chemical spray area and the area for Parriwi Point is restricted to sections of the reserve, not the reserve in its entirety. Volunteer groups assist in the management of 13 bushland sites.

Table 20 Techniques and key performance indicators for bushland management, depending on Indigenous Vegetation Cover

Indigenous Vegetation Cover	Management methods/considerations
>90+% Indigenous Vegetation Cover	Specific techniques for this condition type are generally prescribed by the Bradley Method. The focus weed species (noxious weeds of the Mosman LGA and several other potentially invasive environmental weeds such as cassia, ochna, African olive, camphor laurel, Canary Island date palm, cotoneaster, Chinese elm, turkey rhubarb, moth vine and tradescantia) will be continuously targeted and removed from these areas. By the end of the first year of the contract, the aims are to have focus weed species free from flowers and fruits, and vine weeds to be absent from shrub and canopy species. Focus weed species should be completely removed by the start of the fifth year and remain absent until the end of the contract (MMC 2012).
70-89% Vegetation Cover	Specific techniques for this condition type are generally prescribed by the Bradley Method. Focus weeds will be continuously targeted and removed from these areas. By the end of the first year of the contract, the aims are to have focus weed species free from flowers and fruits, and vine weeds to be absent from shrub and canopy species. Small areas within this vegetation condition type (edges and other disturbed areas) are likely to contain annual and perennial weeds such as *Ehrharta erecta* and *Bidens pilosa* and will require spraying, mulching and planting. Mulching will also occur on an annual basis where required (MMC 2012). It is expected by implementing these management measures that this category will increase to the next level (>90% Indigenous Vegetation Cover) from the start of the fifth year until the end of the contract.
30-69% Indigenous Vegetation Cover	This condition type will require large scale revegetation works and constant weed control activities. Focus weeds will be continuously targeted and removed from these areas. By the end of the fourth year of the contract, the aims are to have focus weed species free from flowers and fruits, and vine weeds to be absent from shrub and canopy species. Focus weed species are required to be completely removed before the start of the eighth year of the contract and continue to be absent until the end of the contract period. It is expected by implementing these management measures that this category will increase to the next level (70-89% Indigenous Vegetation Cover) from the start of the eighth year until the end of the contract.

Indigenous Vegetation Cover	Management methods/considerations
<30% Indigenous Vegetation Cover	This condition type must be assessed by the bushland contractor with the Contract Supervisor. This condition type will require large scale revegetation works and constant weed control activities. Focus weeds will be continuously targeted and removed from these areas. By the end of the fourth year of the contract, the aims are to have focus weed species free from flowers and fruits, and vine weeds to be absent from shrub and canopy species. Focus weed species are required to be completely removed before the start of the eighth year of the contract and continue to be absent until the end of the contract period. Where areas are completely cleared of weeds they will be programmed for planting and continually controlled for weeds. All areas identified for revegetation in this condition type will be cleared and planted no later than the start of the sixth year of the contract period. It is expected by implementing the above works guideline that this vegetation category will increase to 30-69% indigenous vegetation cover condition from the start of the eighth year until the end of the contract.

The previous Bushland Restoration Contract 2001-2011 resulted in the management of 17 bushland sites (over two contracts on a catchment basis) and was extended until the end of March 2012. From 2001 to 2011, the proportion of bushland reserves with greater than 90% indigenous vegetation cover increased from <25% to 58%. This improvement demonstrates the effectiveness of the bushland restoration program over this period. The ten-year contract allowed:

- a consistent work methodology (with flexibility to use new technologies and adapt to changes on sites)
- contractors to experience a sense of ownership and pride in improving the biodiversity, health and long-term sustainability of bushland areas
- effective interaction between the parties that was underpinned by good and regular communication strategies.

The aims of the current bushland restoration works are to:

- increase the biodiversity of Mosman through effective bushland restoration methods
- restore indigenous vegetation cover through bushland restoration
- increase habitat for native fauna in Mosman
- control and reduce weed cover, especially noxious and environmental weed cover, in bushland areas and replace with indigenous vegetation cover
- improve amenity and passive use of these areas.

The methods used to obtain these aims are as follows:

- bush regeneration activities as per the Bradley Method
- weed removal and control (noxious weeds, environmental weeds and aquatic weeds)
- on-going site maintenance and management
- mulching or weed matting of selected areas using materials provided by Council
- revegetation with indigenous plants provided by Council
- seed collection and on-site dispersal

- track clearance works involving minor pruning works (up to 50 mm diameter)
- clearance of bushland drainage lines of debris and weeds
- general rubbish removal from site
- Bushcare volunteer group supervision.

6.2 Conservation priority

6.2.1 Bushland reserves

Reserve conservation priority was analysed using a combination of ecological measures including diversity and abundance of flora, fauna and weed species (if available), fauna habitat, connectivity to surrounding bushland and bushland resilience scores. Based on the current survey, 12 reserves have a high conservation priority, four reserves have medium to high conservation priority and nine reserves have a medium conservation priority. These results were very similar to those obtained in 2006 and 2016, however with some variation (Table 21).

Table 21 Conservation priority of Mosman bushland reserves and comparison with the 2006 and 2016 surveys. Changes in conservation priority are highlighted in bold.

Reserve name	Conservation priority		
	2006 survey	2016 survey	2022 survey
Quakers Hat South	High	Medium to High	Medium to High
Quakers Hat North	Medium to High	Medium to High	Medium to High
Quakers Hat Park	High	Medium	**High**
Parriwi Park	High	Medium	**Medium to High**
Parriwi Point Reserve	High	High	**Medium to High**
Rosherville/Parriwi Lighthouse Reserve	Medium	Medium	Medium
Wy-ar-gine Point Reserve	High	High	High
Lawry Plunkett Reserve	High	High	High
Balmoral Park	High	High	High
Bradley's Bushland Reserve	High	High	High
Morella Road	High	High	High
Little Ashton Park	Medium	Medium	Medium
Curraghbeena Park	High	High	High
The Spit Reserve	High	High	High
Unnamed Reserve (Rosherville)	Medium to High	Medium	Medium
Rosherville Reserve	Medium to High	Medium to High	Medium to High
Sirius Park West	High	Medium	Medium
Reid Park	High	High	High
Sirius Park East	High	High	High
Harnett Park	High	Medium to High	**High**
Rawson Park	High	High	**Medium to High**

Reserve name	Conservation priority		
	2006 survey	2016 survey	2022 survey
Clifton Gardens	High	High	High
Mosman Bay Creek	ns	Medium	**Medium to High**
Joel's Reserve	ns	Medium	Medium
Chinamans Beach Dunes	ns	Medium	**High**

6.2.2 Unmade road reserves

Reserve conservation priority was analysed using a combination of ecological measures including diversity and abundance of flora, fauna and weed species (if available), fauna habitat, connectivity to surrounding bushland, and bushland resilience scores. Based on the current survey, one road reserve has a high conservation priority, five road reserves have a medium conservation priority, and five reserves have a low conservation priority (Table 22).

Table 22 Conservation priority of Mosman unmade road reserves and comparison with 2006 and 2016 survey. Changes in conservation priority are highlighted in bold.

Reserve name	Conservation priority		
	2006 survey	2016 survey	2021 survey
Unmade Boyle St	High	Medium	ns
Unmade Millett Rd	Medium	Medium	ns
Unmade Spit Rd	Medium to High	Medium	ns
Unmade Mcleod St (West)	Medium	Medium	ns
Unmade Mcleod St (Lower)	High	Medium	ns
Unmade Kallaroo St	High	Medium	ns
Unmade Mosman St	High	Medium	ns
Unmade Cobbittee St	Low to Medium	Medium	**High**
Unmade Glen Rd	High	Medium	ns
Unmade Inkerman St north	Medium to High	Medium	ns
Unmade Bay St	High	Medium	ns
Unmade Warringah Rd	High	High	ns
Unmade Wallington Rd	High	High	ns
Unmade Armitage Ln	High	High	ns
Unmade Edwards bay Rd	Medium	Low to Medium	ns
Unmade Koowong Avenue (West)	Medium to High	Medium	ns
Unmade Almora St	Medium to High	Medium to High	ns
Unmade Grecia Ln (East)	Medium	Low	ns
Unmade Grecia Lane (West)	ns	ns	Low
Unmade Harnett Ave	Medium to High	Medium	ns
Unmade Lower sverge St	Medium to High	Medium	ns
Unmade Burrawong Ave (South)	Medium	Medium	ns
Unmade Morella Rd (South)	Medium to High	Medium to High	ns
Unmade Morella Rd (North)	Medium	Low	ns

Reserve name	Conservation priority		
	2006 survey	2016 survey	2021 survey
Unmade Amaroo Cres	High	High	ns
Unmade Kahibah Rd North	High	Medium	ns
Unmade Quakers Rd (West)	Medium to High	High	ns
Unmade Pulpit Ln	Medium to High	Medium	ns
Unmade Stanton Rd	Medium to High	Medium to high	ns
Unmade Mulbring St	High	Medium to high	ns
Unmade Gordon St	Low	Medium	ns
Unmade Bullecourt Ave Reserve (South)	ns	ns	Low
Unmade Bullecourt Ave Reserve (North)	ns	ns	Low
Unmade Carrington Ave Reserve	ns	ns	Medium
Unmade Crown Rd	ns	ns	Low
Unmade Government Rd	ns	ns	Medium
Unmade Grove Ave Reserve	ns	ns	Medium
Unmade Harston Ave Reserve	ns	ns	Low
Unmade Inkerman St South	ns	ns	Medium
Unmade Kahibah Rd South	ns	ns	Low

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Appendix 1 Detailed methods for flora survey

Survey effort

A team of two ecologists surveyed the reserves over 11 days (8 and 20 to 24 December 2021, and 4 to 7 and 10 January 2022). Remote devices were left in the field between 8 Dec 2021 to Survey effort within each reserve was based on the area of the reserve, with approximately 2.75 hours of survey time per hectare. However, survey time was affected by the following factors:

- Reserves with very complex vegetation mosaics required more time, while very simple reserves were completed in less time.
- Very small reserves required a minimum of 0.25 hours to survey.

Surveys incorporated:

- a broad assessment of reserves, including observations of any major threats or other noteworthy ecological features and management recommendations
- visiting all vegetation community polygons mapped in previous surveys to update information and modify boundaries if required
- identifying and mapping any TECs detected during vegetation surveys
- visiting all weed cover polygons mapped in previous surveys to update weed information and modify boundaries if required
- visiting all previous threatened species records to verify presence of threatened species and random meander searches to discover new threatened species populations
- collation of all flora species encountered during surveys of reserves
- collection of weed and bare soil cover data for assessment of resilience
- Biodiversity Assessment Method vegetation plots in four reserves.

These survey components generally required a minimum of two full traverses through each reserve.

Data collection

The survey team used tablet devices for navigation and data collection. Prior to the survey, GIS layers containing reserve boundaries and previous survey data were loaded onto tablets. Data forms were created to allow electronic entry of vegetation community, weed, threatened species and threatened ecological community information.

General reserve information

Table 23 summarises general information collected electronically for each reserve.

Table 23 General reserve information recorded during survey

Field	Description	Notes
Record ID	Record identification	Created automatically
Site ID	Site identification	Created automatically
Location	Location in latitude / longitude	Created automatically
Date	Survey date	Created automatically
Time	Time that survey commenced	Created automatically
Observer	Initials of survey observer	
BR/RR number	Bushland / road reserve number	Provided by MMC
Address	Reserve address	Provided by MMC
Area of BR/RR (ha)	Area of reserve (ha)	Provided by MMC
Photo	Photo	Image recorded with tablet
Point Location	Location of survey point within reserve	Boundary or internal
Bare soil	% cover of bare soil within reserve (excluding areas of rock, leaf litter and vegetation)	<1%, 1-5%, 6-10%, >10%
Description	Any ecological observations of reserve	
Major threats to BR/RR	Any observed major threats to reserve	
Management Recommendations	Any recommendations for management	

Vegetation communities

Each vegetation community polygon mapped during previous surveys was visited to:

- identify up to five dominant / common species in the over storey, mid storey, under storey and ground strata (refer to Table 24)
- verify community classification and extent identified in previous surveys (refer to Table 25)
- update vegetation community polygon boundaries if significant discrepancies were observed
- classify communities according to other NSW vegetation mapping systems
- record any noteworthy ecological observations regarding the community.

Table 24 Vegetation community information recorded during survey

Field	Description	Notes
Veg com type	Vegetation community	Dropdown list (refer to Table 25)
Veg com comments	Any ecological observations of community	
Community structure notes	Any notes regarding community structure	
Boundary points	Used to update community boundaries	
Tree over storey (Canopy)		
TOS Dominant species1	Name of dominant species 1	Dominant / common species only
TOS Dominant species2	Name of dominant species 2	
TOS Dominant species3	Name of dominant species 3	
TOS dominant species 4	Name of dominant species 4	
TOS dominant species 5	Name of dominant species 5	
Mid storey layer		
Mid Dominant species1	Name of dominant species 1	Dominant / common species only
Mid Dominant species2	Name of dominant species 2	
Mid Dominant species3	Name of dominant species 3	
Mid dominant species4	Name of dominant species 4	
Mid dominant species5	Name of dominant species 5	
Under storey layer		
Under dominant species1	Name of dominant species 1	Dominant / common species only
Under dominant species2	Name of dominant species 2	
Under dominant species3	Name of dominant species 3	
Under dominant species4	Name of dominant species 4	
Under dominant species5	Name of dominant species 5	
Ground storey layer		
Ground dominant species1	Name of dominant species 1	Dominant / common species only
Ground dominant species2	Name of dominant species 2	
Ground dominant species3	Name of dominant species 3	
Ground dominant species4	Name of dominant species 4	
Ground dominant species5	Name of dominant species 5	

Table 25 Vegetation community classification system (modified from Total Earth Care 2007)

Present map unit	2007 map unit	Description
Intact vegetation communities		
Coastal Sandstone Heath	Coastal Sandstone Heath	Coastal Sandstone Heath as described by Benson and Howell (1994). Fully structured native plant community generally with high resilience.
Sydney Sandstone Gully Forest	Sydney Sandstone Gully Forest	Sydney Sandstone Gully Forest as described by Benson and Howell (1994). Fully structured native plant community generally with high resilience.
Coastal Foredune Wattle Scrub	Not recorded	Coastal Foredune Wattle Scrub as described by OEH (2013). Component of Coastal Dune Heath as described by Benson and Howell (1994). Fully

Present map unit	2007 map unit	Description
		structured native plant community generally with moderate to high resilience, as community is susceptible to invasion by bitou bush.
Modified vegetation communities		
Regrowth Sydney Sandstone Gully Forest	Regrowth Sydney Sandstone Gully Forest	Sydney Sandstone Gully Forest with some remnant native vegetation (mainly canopy). Established or regenerating / planted midstorey and groundcover strata. Weed densities are variable but mainly weed infestation is limited to the groundcover and understorey strata. Generally has a moderate to high resilience with variable weed densities.
Disturbed Sydney Sandstone Gully Forest	Disturbed Sydney Sandstone Gully Forest	Sydney Sandstone Gully Forest with little remnant native vegetation. Majority of all strata have been disturbed and often planted with native species. Weed densities are generally moderate to high and weed infestation may be in the groundcover through to midstorey strata. Generally has a low to moderate resilience.
Other map units		
Established Planted Area	Shrubland	Established planted areas with occasional remnant or regrowth native trees and shrubs. Generally consisting of established (>2 years) planted native trees, shrubs and groundcovers that are flowering and setting seed and some regeneration of groundcovers and shrubs. Low to moderate resilience.
Recently Planted Area	Open Shrubland	Planted areas with occasional remnant or regrowth native trees. Generally consisting of recently planted native trees, shrubs and groundcovers and some regeneration of mainly groundcovers. Low to moderate resilience. Generally low resilience.
Cosmopolitan	Cosmopolitan	Similar to that described from previous survey. Generally a mix of weed infestations, native and exotic plantings, and regrowth native vegetation including occasional native trees.
Cleared and Disturbed	Cleared and Disturbed	Recently cleared of exotic and / or native vegetation; or un-worked portions of a reserve totally dominated by woody weed thickets and / or herbaceous weeds.
Open Space	Open Space	Areas with no definable vegetation community including mown areas and parkland; or with no vegetative cover such as carparks, roads and rocky foreshore. Generally areas of lawn with landscaped garden beds and occasional native and exotic trees.
Private Property	Private Property	Areas that appear to be now under freehold title which may or may not have disposed of by Council as surplus land. Includes areas that have been fenced but which fall within the current cadastre.

Threatened ecological communities

Desktop studies identified the potential presence of four TECs listed under the BC Act and/or EPBC Act within the Mosman LGA:

- Coastal Upland Swamp (BC Act)
- Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions (BC Act)
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (BC Act)

- Littoral Rainforest in the NSW North Coast, Sydney Basin and South East Corner Bioregions (BC Act, also listed as Littoral Rainforest and Coastal Vine Thickets of Eastern Australia under EPBC Act).

Previous surveys mapped reserves with vegetation communities that could potentially contain these TECs. Where feasible, the survey team visited these communities to assess the presence and extent of TECs. Table 26 summarises TEC information recorded for each identified occurrence within a reserve.

Table 26 TEC information recorded during survey

Field	Description	Notes
TEC present?	Yes if Threatened Ecological Community (TEC) present	
TEC name	Name of TEC	
TEC %	% of broad vegetation community that comprises TEC	
TEC size	Approximate size of TEC	< 100 m^2, 101-1,000 m^2, > 1,000 m^2
Boundary points	Used to record TEC boundaries	
TEC notes	Any ecological notes on TEC	

Weeds

Overview

Weeds were classified into exotic weeds (species not native to Australia) and non-indigenous weeds (native species from other areas within Australia). Each weed cover polygon mapped during previous surveys was visited to:

- classify weed cover into four classes
- classify indigenous cover as the inverse of weed cover
- identify up to five of the most important weed species in the polygon
- update weed cover polygon boundaries if significant discrepancies were observed
- identify the stratum most affected by weeds
- record any noteworthy ecological observations regarding weeds within the polygon.

Overall weed cover class

Overall weed cover was calculated using a modified version of the method described in Bushland Weed Assessment (Ku-ring-gai Council 1995). Table 27 summarises the method and scales used in the survey. This method is equivalent to previous surveys, so results are directly comparable (aside from subjective variation between individual observers).

Table 27 Classification of overall weed cover class and indigenous cover class (modified from Ku-ring-gai Council 1995)

Step	Stratum		
Determine vegetation strata	Upper	Middle	Lower
Estimate weed cover class in each stratum using 4 level scale	1 = < 10%, 2 = 10-29%, 3 = 30-70%, 4 = > 70%	1 = < 10%, 2 = 10-29%, 3 = 30-70%, 4 = > 70%	1 = < 10%, 2 = 10-29%, 3 = 30-70%, 4 = > 70%
Calculate overall weed cover class using 4 level scale (rounded to nearest integer)	= 0.5 x Upper class	+ 0.2 x Middle class	+ 0.3 x Lower class
Calculate indigenous cover class (inverse of overall weed cover class)	= 5 - weed class		

Table 28 describes weed density labels used to describe the four weed cover classes and colours used to map weed cover classes throughout the report. Note that weed cover was not estimated for areas classified as “open area”. These areas were assigned a class of zero.

Table 28 Weed density labels and mapping colours for overall weed cover classes

Overall weed cover class	Weed density	% cover	Mapping colour
1	Low	< 10	Green
2	Moderate	10–29	Blue
3	High	30-70	Yellow
4	Very high	>70	Red
0	Open space area	Not assessed	Orange

Cover of important weed species

Weed cover was estimated for up to five important weed species. These were defined as the species considered to constitute the greatest potential threat to native biodiversity and ecosystem function (not necessarily the species with greatest cover).

Based on discussions with MMC, cover of an important weed species was calculated as the % that the species contributed to the overall weed cover within its vegetation stratum. For example, the % cover of a grass weed species was calculated as the % that the species contributed to the overall ground weed cover. The cover of all ground weed species would therefore total 100%. If weeds were present within all three vegetation strata, the cover of all weed species would total 300%.

This measure differs from previous surveys, which estimated the cover of an individual species as the % contribution to all strata. Total weed cover in previous reports would total 100%, regardless of which stratum was occupied by each weed species. This measure was considered less accurate, as weed densities within each stratum could vary substantially and therefore bias cover estimates of species in different strata.

Table 29 summarises weed information recorded for each weed cover polygon.

Table 29 Weed information recorded during survey

Field	Description	Notes
Overall weed cover		
Weed cover %	% cover of weeds modified from Bushland Weed Assessment (Ku-ring-gai Council 1995)	0 = open space (no density recorded), 1 = < 10%, 2 = 10-29%, 3 = 30-70%, 4 = > 70%
Dominant weed stratum	Dominant weed stratum	Canopy, mid, ground
Weeds difficult to manage?	Are the weeds difficult to manage?	
Weed tree species present?	Yes if weed tree species > 5 m present	
Notes regarding weeds	Any notes regarding weeds	
Individual major weed cover		
Major weed 1 - name	Name of most important weed	
Major W1 dominance	% contribution of species to weed cover in that stratum	1%, 2%, 5%, 10%, 20% 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%
Major weed 2 - name	Name of second most important weed	
Major W2 dominance	% contribution of species to weed cover in that stratum	1%, 2%, 5%, 10%, 20% 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%
Major weed 3 - name	Name of third most important weed	
Major W3 dominance	% contribution of species to weed cover in that stratum	1%, 2%, 5%, 10%, 20% 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%
Major weed 4 - name	Name of fourth most important weed	
Major W4 dominance	% contribution of species to weed cover in that stratum	1%, 2%, 5%, 10%, 20% 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%
Major weed 5 - name	Name of fifth most important weed	
Major W5 dominance	% contribution of species to weed cover in that stratum	1%, 2%, 5%, 10%, 20% 30%, 40%, 50%, 60%, 70%, 80%, 90%, 100%
Indigenous vegetation cover		
Indigenous Veg density %	Indigenous vegetation density class	Inverse of overall weed density

Threatened species

Threatened species surveys included:

- thorough searches in the vicinity of sites where previous surveys recorded threatened species
- random meander searches for threatened species in each reserve (conducted concurrently with weed community and weed surveys).

Information collected for each threatened species population included the approximate number of plants, approximate area of population, boundaries of large populations and any noteworthy ecological features of the population. Table 30 summarises threatened species information recorded for each population.

Table 30 Threatened species information recorded during survey

Field	Description	Notes
Threatened flora present?	Yes if threatened flora present	
Threatened flora name	Name of threatened flora species	
Threatened flora number	Approximate number of plants	1, 2-10, 11-100, 101-1,000, >1,000
Threatened flora area	Approximate area of population	< 1 m^2, 1-10 m^2, 11-100 m^2, 101-1,000 m^2, > 1,000 m^2
Boundary points	Used to record population boundaries	
Threatened flora notes	Any ecological notes on species	

Flora inventory

A list of all observed flora species was compiled while other surveys were conducted within the reserve. Species were classified into:

- native to the Sydney area (including species listed as threatened under the BC Act or EPBC Act or ROTAP species [Briggs and Leigh 1996])
- native to Australia, but not indigenous to the Sydney area
- exotic (including species declared as noxious under the NW Act).

Specimens of plants that could not be identified in the field were collected for further analysis in the Ecosure office or sent to the NSW Herbarium for identification.

Biodiversity Assessment Method (BAM) Plots

Vegetation condition within four reserves was assessed using the BAM methodology (OEH 2021). This system provides a consistent and transparent method to measure biodiversity and condition of vegetation and is used by the NSW government to assess and manage biodiversity offsets.

BAM surveys were undertaken in 50 m by 20 m plots, following methods detailed in OEH (2021). Table 31 summarises data collected in each plot.

Table 31 BioBanking information recorded during survey

Parameter	Sample area	Method
Location		GPS coordinate of the bottom left corner of the plot
Photo		Four photos taken to the north, east, south and west from the bottom left corner of the plot
Native over-storey cover (%)	50 m transect	Estimate foliage cover of over-storey at 10 points (i.e. every 5 m) along transect. Cover may include native indigenous and non-indigenous species.
Native mid-storey cover (%)	50 m transect	Estimate foliage cover of mid-storey at 10 points (i.e. every 5 m) along transect. Mid-storey includes all native plants between over-storey and 1 m in height. Cover may include native indigenous and non-indigenous species.

Parameter	Sample area	Method
Native ground cover (grasses)	50 m transect	Record number of hits (where plant is present at point) at 50 points (i.e. every 1 m) along transect. Divide number of hits by total number of points. Ground-storey (grasses) include all native grasses less than 1 m in height. Cover may include native indigenous and non-indigenous species.
Native ground cover (shrubs)	50 m transect	Record number of hits (where plant is present at point) at 50 points (i.e. every 1 m) along transect. Divide number of hits by total number of points. Ground-storey (shrubs) include all native woody vegetation less than 1 m in height. Cover may include native indigenous and non-indigenous species.
Native ground cover (other)	50 m transect	Record number of hits (where plant is present at point) at 50 points (i.e. every 1 m) along transect. Divide number of hits by total number of points. Ground-storey (other) includes all native non-woody vegetation that is not a grass (e.g. forbs, sedges, ferns) less than 1 m in height. Cover may include native indigenous and non-indigenous species.
Exotic plant cover	50 m transect	Record number of hits (where plant is present at point) at 50 points (i.e. every 1 m) along transect. Divide number of hits by total number of points. Exotic plants include all non-native vascular plants in any stratum.
Native plant species richness	20 m x 20 m plot	Systematic search of plot to count the number of all native indigenous vascular species.
Number of trees with hollows	50 m x 20 m plot	Count the number of living and dead trees with at least one hollow. Hollows must: · have a minimum entrance width of 5 cm · appear to have depth · be at least 1 m above ground · be on a tree whose trunk is within the plot.
Over-storey regeneration	50 m x 20 m plot	Record proportion of over-storey species that have regenerating individuals within the plot
Total length of fallen logs (m)	50 m x 20 m plot	Measure total length of logs within plot. Logs must be at least 10 cm diameter and at least 0.5 m long. Only record sections of log within the plot.

Appendix 2 Bushland and road reserves flora species list

General status	
*	Exotic (not native to Australia)
N	Noxious weeds as listed on the *NSW Noxious Weeds Act 1993* for the Mosman LGA
ni	Non - indigenous native species (does not naturally occur at this locality)
Conservation status	
CE	Critically Endangered - listed under Schedule 1A of the BC Act
E	Endangered - listed under Schedule 1 of the BC Act
V	Vulnerable - listed under Schedule 2 of the BC Act
ROTAP	Rare or Threatened Australian Plants (Briggs and Leigh 1996)
Other	
BR (number)	Bushland Reserve number
a	Recorded by Oculus 2001 and Total Earth Care 2007
b	Recorded by Oculus 2001
c	Recorded by Total Earth Care 2007
d	Recorded by Ecosure 2016
e	Recorded by Total Earth Care 2007 and Ecosure 2016
f	Recorded by Oculus 2001 and Ecosure 2016
g	Recorded by Oculus 2001, Total Earth Care 2007 and Ecosure 2016
h	Recorded by Ecosure 2022 and in previous surveys
i	Recorded by Ecosure 2022
?	Uncertain identification

This report is accompanied by a spreadsheet in Microsoft Excel format, summarising:

- All flora species recorded by the current survey and / or previous surveys (Oculus 2001, Total Earth Care 2007, Ecosure 2016), within each of the 25 bushland reserves and 30 unmade road reserves
- all flora species recorded by the current survey, either within bushland reserves or road reserves
- flora species newly recorded by the current survey.

Appendix 3 Overall fauna species list

Terms and abbreviations

BL	Records by Barry Lancaster include counts.
TZ	Records by Taronga Zoo Veterinary & Quarantine Centre and Wildlife Clinic include counts.
DEC	Records from Department of Environment and Conservation Wildlife Atlas include presence only.
O&TEC	Records from the 2001 Flora and Fauna Survey (Oculus, 2001) and the 2006/7 field survey (Total Earth Care 2007) include presence only.
Ecosure 2016	Records from the 2016 Flora and Fauna Survey (Ecosure 2016) include presence only.
Ecosure 2022	Records from the current survey (Ecosure 2022)

Status

*	Exotic (not native to Australia)
P	Protected
V	Vulnerable

Group	Family	Scientific name	Common name	Status	BL	TZ	DEC	O&TEC	Ecosure 2016	Ecosure 2022
Amphibians	Myobatrachidae	*Crinia signifera*	common Eastern froglet	P			#	#	#	#
Amphibians	Myobatrachidae	*Limnodynastes peronii*	striped marsh frog	P			#	#	#	#
Amphibians	Hylidae	*Litoria caerulea*	green tree frog	P			#			
Amphibians	Myobatrachidae	*Pseudophryne australis*	red-crowned toadlet	V	2					
Birds	Acanthizidae	*Acanthiza nana*	yellow thornbill	P				#		
Birds	Acanthizidae	*Acanthiza pusilla*	brown thornbill	P	>116					
Birds	Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern spinebill	P	9			#		
Birds	Accipitridae	*Accipiter fasciatus*	brown goshawk	P			#			
Birds	Sturnidae	*Acridotheres tristis*	common myna	*	>185	2		#	#	#
Birds	Megapodiidae	*Alectura lathami*	Australian brush turkey	P					#	#
Birds	Psittacidae	*Alisterus scapularis*	Australian king parrot	P	5		#	#	#	
Birds	Anatidae	*Anas castanea*	chestnut teal	P	1					
Birds	Anatidae	*Anas superciliosa*	Pacific black duck	P	8	4	#			
Birds	Anhingidae	*Anhinga (melanogaster) novaehollandiae*	Australian darter	P	5				#	
Birds	Meliphagidae	*Anthochaera carunculata*	red wattlebird	P	>34	3	#		#	#
Birds	Meliphagidae	*Anthochaera chrysoptera*	little wattlebird	P	5			#	#	#
Birds	Apodidae	*Apus pacificus*	fork-tailed swift	P				#		#
Birds	Cacatuidae	*Cacatua galerita*	sulphur crested cockatoo	P	>63	5	#	#	#	
Birds	Cacatuidae	*Cacatua sanguinea*	little corella	P	>53			#		
Birds	Cacatuidae	*Calyptorhynchus funereus*	yellow-tailed black-cockatoo	P	>240		#			
Birds	Anatidae	*Chenonetta jubata*	Australian wood duck	P	4	1			#	
Birds	Pachycephalidae	*Colluricincla harmonica*	grey shrike-thrush	P	1					
Birds	Columbidae	*Columba livia*	rock dove	*	>74	7	#	#	#	#
Birds	Campephagidae	*Coracina novaehollandiae*	black-faced cuckoo-shrike	P	16	1	#	#	#	

Group	Family	Scientific name	Common name	Status	BL	TZ	DEC	O&TEC	Ecosure 2016	Ecosure 2022
Birds	Corvidae	*Corvus coronoides*	Australian raven	P	>46	3	#	#	#	#
Birds	Artamidae	*Cracticus nigrogularis*	pied butcherbird	P		3		#		
Birds	Artamidae	*Cracticus torquatus*	grey butcherbird	P	16	1	#	#	#	#
Birds	Cuculidae	*Cacomantis flabelliformis*	fan-tailed cuckoo	P	3	1				
Birds	Cuculidae	*Cuculus pallidus*	pallid cuckoo	P		1				
Birds	Halcyonidae	*Dacelo novaeguineae*	laughing kookaburra	P	>42	23	#	#	#	#
Birds	Dicaeidae	*Dicaeum hirundinaceum*	mistletoebird	P	3					
Birds	Ardeidae	*Egretta novaehollandiae*	white-faced heron	P	4		#	#	#	#
Birds	Accipitridae	*Elanus axillaris*	black-shouldered kite	P		1				
Birds	Cacatuidae	*Eolophus roseicapilla*	galah	P	3					
Birds	Eopsaltriidae	*Eopsaltria australis*	Eastern yellow robin	P	15			#		
Birds	Cuculidae	*Eudynamys cyanocephala*	Pacific koel	P	9	3	#	#	#	
Birds	Spheniscidae	*Eudyptula minor*	little penguin	P			#			
Birds	Coraciidae	*Eurystomus orientalis*	dollarbird	P	5					
Birds	Falconidae	*Falco cenchroides*	nankeen kestrel	P	1					
Birds	Falconidae	*Falco peregrinus*	peregrine falcon	P	1				0	
Birds	Columbidae	*Geopelia humeralis*	bar-shouldered dove	P				#		
Birds	Acanthizidae	*Gerygone mouki*	brown gerygone	P				#		
Birds	Acanthizidae	*Gerygone olivacea*	white-throated gerygone	P				#		
Birds	Dicruridae	*Grallina cyanoleuca*	magpie-lark	P	35		#	#	#	#
Birds	Artamidae	*Gymnorhina tibicen*	Australian magpie	P	>60	23	#	#	#	#
Birds	Accipitridae	*Haliaeetus leucogaster*	white-bellied sea-eagle	P	1				0	
Birds	Accipitridae	*Haliastur sphenurus*	whistling kite	P	1					
Birds	Apodidae	*Hirundapus caudacutus*	white-throated needletail	P	8				#	
Birds	Hirundinidae	*Hirundo neoxena*	welcome swallow	P	>238		#	#	#	#

Group	Family	Scientific name	Common name	Status	BL	TZ	DEC	O&TEC	Ecosure 2016	Ecosure 2022
Birds	Hirundinidae	*Hirundo nigricans*	tree martin	P	>5					
Birds	Campephagidae	*Lalage tricolor*	white-winged triller	P	1					
Birds	Laridae	*Larus crassirostris*	blacked-tailed gull	P				#		
Birds	Laridae	*Larus novaehollandiae*	silver gull	P	>432	8	#	#	#	#
Birds	Meliphagidae	*Lichenostomus chrysops*	yellow faced honeyeater	P	>11			#		
Birds	Columbidae	*Macropygia amboinensis*	brown cuckoo-dove	P	1					
Birds	Maluridae	*Malurus cyaneus*	superb fairy wren	P	6		#	#	#	#
Birds	Maluridae	*Malurus lamberti*	variegated fairy wren	P	>177		#	#	#	#
Birds	Meliphagidae	*Manorina melanocephala*	noisy miner	P	>256	30	#	#	#	#
Birds	Meliphagidae	*Meliphaga lewinii*	Lewin's honeyeater	P				#		
Birds	Dicruridae	*Monarcha melanopsis*	black-faced monarch	P	8	2				
Birds	Sulidae	*Morus serrator*	Australian gannet	P	>31					
Birds	Estrildidae	*Neochmia temporalis*	red-browed finch	P				#		
Birds	Strigidae	*Ninox boobook*	Southern boobook	P		1		#	#	#
Birds	Strigidae	*Ninox strenua*	powerful owl	V			#	#	#	#
Birds	Columbidae	*Ocyphaps (Geophaps) lophotes*	crested pigeon	P	>58	3		#	#	#
Birds	Pachycephalidae	*Pachycephala pectoralis*	golden whistler	P	4			#		
Birds	Pardalotidae	*Pardalotus punctatus*	spotted pardalote	P	>118	1		#		
Birds	Passeridae	*Passer domesticus*	house sparrow	*	>3			#		
Birds	Pelecanidae	*Pelecanus conspicillatus*	Australian pelican	P	32	#				#
Birds	Petroicidae	*Petroica rosea*	rose robin	P	1					
Birds	Phalacrocoracidae	*Phalacrocorax melanoleucos*	little pied cormorant	P	6				#	
Birds	Phalacrocoracidae	*Phalacrocorax carbo*	great cormorant	P	10			#	#	
Birds	Phalacrocoracidae	*Phalacrocorax sulcirostris*	little black cormorant	P	>47	3		#	0	#

Group	Family	Scientific name	Common name	Status	BL	TZ	DEC	O&TEC	Ecosure 2016	Ecosure 2022
Birds	Phalacrocoracidae	*Phalacrocorax varius*	pied cormorant	P	42			#	0	#
Birds	Columbidae	*Phaps chalcoptera*	common bronzewing	P				#		
Birds	Meliphagidae	*Philemon corniculatus*	noisy friarbird	P	>62					
Birds	Meliphagidae	*Phylidonyris nigra*	white-cheeked honeyeater	P			#	#		
Birds	Meliphagidae	*Phylidonyris novaehollandiae*	New Holland honeyeater	P		1		#	#	
Birds	Psittacidae	*Platycercus adscitus eximius*	Eastern rosella	P	7	1	#	#		
Birds	Psittacidae	*Platycercus elegans*	crimson rosella	P	2			#		
Birds	Podargidae	*Podargus strigoides*	tawny frogmouth	P	2	56	#	#	#	#
Birds	Psittacidae	*Psephotus haematonotus*	red-rumped parrot	P				#		
Birds	Eupetidae	*Psophodes olivaceus*	Eastern whipbird	P	10		#		#	#
Birds	Columbidae	*Ptilinopus superbus*	superb fruit dove	P		1			0	
Birds	Procellariidae	*Puffinus tenuirostris*	short-tailed shearwater	P		6				
Birds	Pycnonotidae	*Pycnonotus jocosus*	red-whiskered bulbul	*	>39			#	#	
Birds	Dicruridae	*Rhipidura albiscapa (fuliginosa)*	grey fantail	P	5			#		
Birds	Dicruridae	*Rhipidura leucophrys*	Willie wagtail	P	9			#		#
Birds	Dicruridae	*Rhipidura rufifrons*	rufous fantail	P	3					
Birds	Cuculidae	*Scythrops novaehollandiae*	channel-billed cuckoo	P	13			#	#	#
Birds	Acanthizidae	*Sericornis frontalis*	white-browed scrubwren	P	>225	1		#	#	#
Birds	Oriolidae	*Sphecotheres vieilloti*	Australasian figbird	P	1		#	#		
Birds	Laridae	*Sterna bergii*	crested tern	P	>35		#			#
Birds	Artamidae	*Sterna hirundo*	common tern	P	3					
Birds	Artamidae	*Strepera graculina*	pied currawong	P	>259	21	#	#	#	#
Birds	Columbidae	*Streptopelia chinensis*	spotted turtle dove	*	>137	2	#	#		
Birds	Sturnidae	*Sturnus vulgaris*	common starling	P	>138			#		

Group	Family	Scientific name	Common name	Status	BL	TZ	DEC	O&TEC	Ecosure 2016	Ecosure 2022
Birds	Threskiornithidae	*Threskiornis molucca*	Australian white ibis	P	11	1	#			#
Birds	Halcyonidae	*Todirhamphus sanctus*	sacred kingfisher	P		3				
Birds	Psittacidae	*Trichoglossus chlorolepidotus*	scaly-breasted lorikeet	P		1				#
Birds	Psittacidae	*Trichoglossus haematodus*	rainbow lorikeet	P	>326	95	#	#	#	#
Birds	Tytonidae	*Tyto alba*	barn owl	P	1			#		
Birds	Charadridae	*Vanellus miles*	masked lapwing	P	20	9		#	#	
Birds	Zosteropidae	*Zosterops lateralis*	silvereye	P	>211	1	#	#	#	#
Mammals	Canidae	*Canis familiaris*	dog	*				#		#
Mammals	Felidae	*Felis catus*	cat	*			#		#	#
Mammals	Muridae	*Hydromys chrysogaster*	water rat	P				#		
Mammals	Undetermined	*Microbat* sp.	microbat sp.	P				#	#	#
Mammals	Vespertilionidae	*Chalinolobus gouldi*	Gould's wattled bat	P				#	#	#
Mammals	Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern bentwing-bat	V			#		#	
Mammals	Vespertilionidae	*Scoteanax/Scotorepens* sp.	broad-nosed bat sp.	V					#	
Mammals	Muridae	*Mus musculus*	house mouse	*		1	#			
Mammals	Leporidae	*Oryctolagus cuniculus*	rabbit	*		3		#	#	#
Mammals	Peramelidae	*Perameles nasuta*	long-nosed bandicoot	P				#	#	#
Mammals	Pseudocheiridae	*Pseudocheirus peregrinus*	common ringtail possum	P		252	#	#	#	#
Mammals	Pteropodidae	*Pteropus poliocephalus*	grey-headed flying-fox	V		4	#	#	#	#
Mammals	Muridae	*Rattus fuscipes*	bush rat	P				#		#
Mammals	Muridae	*Rattus rattus*	black rat	P		3	#	#	#	#
Mammals	Tachyglossidae	*Tachyglossus aculeatus aculeatus*	short-beaked echidna	P		1				
Mammals	Phalangeridae	*Trichosurus vulpecula*	common brushtail possum	P		44	#	#	#	#

Group	Family	Scientific name	Common name	Status	BL	TZ	DEC	O&TEC	Ecosure 2016	Ecosure 2022
Mammals	Canidae	*Vulpes vulpes*	fox	*				#		#
Reptiles	Elapidae	*Cacophis squamulosus*	golden-crowned snake	P		15				
Reptiles	Chelidae	*Chelodina longicollis*	long-necked turtle	P		5				
Reptiles	Scincidae	*Cryptoblepharus virgatus*	wall lizard	P				#	#	#
Reptiles	Scincidae	*Ctenotus taeniolatus*	copper-tailed skink	P				#		#
Reptiles	Colubridae	*Dendrelaphis punctulata*	green tree snake	P		1				
Reptiles	Scincidae	*Eulamprus quoyii*	Eastern water-skink	P			#	#	#	#
Reptiles	Scincidae	*Lampropholis delicata*	dark-flecked garden sunskink	P			#	#	#	#
Reptiles	Scincidae	*Lampropholis guichenoti*	pale-flecked garden sunskink	P			#	#	#	#
Reptiles	Scincidae	*Lygisaurus foliorum*		P				#		
Reptiles	Gekkonidae	*Phyllurus platurus*	Southern leaf-tailed gecko	P		2	#	#	#	#
Reptiles	Agamidae	*Physignathus lesueurii*	Eastern water dragon	P	1	4		#	#	#
Reptiles	Agamidae	*Pogona barbata*	bearded dragon (coastal)	P		1				
Reptiles	Elapidae	*Pseudechis porphyriacus*	red-bellied black snake	P			#			
Reptiles	Elapidae	*Pseudonaja textilis*	Eastern brown snake	P				#		
Reptiles	Pygopodidae	*Pygopus lepidopodus*	common scaly-foot	P				#		
Reptiles	Scincidae	*Saproscincus mustelinus*	weasel skink	P				#	#	#
Reptiles	Scincidae	*Tiliqua scincoides scincoides*	blue-tongued Skink (Eastern)	P	2	39		#		

Revision History

Revision No.	Revision date	Details	Prepared by	Reviewed & approved by
00	04/02/2022	Mosman Flora and Fauna Survey Volume 1	Cameron Radford, Senior Ecologist	Heather Richards, Senior Environmental Scientist
01	21/02/2022	Mosman Flora and Fauna Survey 2022 V2 FINAL	Cameron Radford, Senior Ecologist	Heather Richards, Senior Environmental Scientist

Distribution List

Copy #	Date	Type	Issued to	Name
1	04/02/2022	Electronic	Mosman Municipal Council	Stephen Wall
2	04/02/2022	Electronic	Ecosure	Administration
3	22/02/2022	Electronic	Mosman Municipal Council	Stephen Wall
4	22/02/2022	Electronic	Ecosure	Administration

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PR6939-RE.Mosman Flora and Fauna Survey 2021 Volume 1 FINAL

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