Canada Bay Biodiversity Framework and Action Plan - Draft

City of Canada Bay Council

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Abbreviations

Abbreviation	Description
BC Act	Biodiversity Conservation Act
CEEC	Critically Endangered Ecological Community
CoCB	City of Canada Bay
CBEAC	Canada Bay Environment Advisory Committee
DCP	Development Control Plan
DPI - Water	NSW Department of Primary Industries – Water
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW Environment Planning and Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESD	Ecologically Sustainable Development
FM Act	Fisheries Management Act 1995
GANSW	Government Architect NSW
GSLLS	Greater Sydney Local Land Services
LEP	Local Environmental Plan
LGA	Local Government Area
OEH	NSW Office of Environment and Heritage
PRCG	Parramatta River Catchment Group
SMCMA	Sydney Metropolitan Catchment Management Authority
TEC	Threatened Ecological Community
VMP	Vegetation Management Plan
WM Act	Water Management Act 2000
WoNS	Weeds of National Significance

Executive Summary

Biodiversity is the variety of life, from vegetation communities to individual species and the genes they contain. Our quality of life depends on maintaining biodiversity so that ecosystem services such as the availability of fresh water, food, and fuel sources remain. The key is to make our use of biodiversity sustainable, so that the social, economic, environmental and health services provided by healthy ecosystems can continue to provide their benefits for current and future generations.

At the local level, City of Canada Bay has developed this Biodiversity Framework and Action Plan to help to ensure that local ecosystem health including species and their genetic diversity survive in their natural habitat. The plan's vision is that "Canada Bay is a community that values, protects, conserves and enhances natural areas and biodiversity in an urban and river foreshore environment". This Biodiversity Plan is designed to act as an overarching framework that sits within the City of Canada Bay's Community Strategic Plan. It is designed to allow future action plans to be created and implemented and help inform Plans of Management for Parks and Reserves. The structure of the document will allow this flexibility and provides the capacity to measure improvement to better target spending need based on conservation priority and feasibility.

The Biodiversity Framework and Action Plan supports the Local Strategic Planning Statement which sets out the 20-year vision for land-use in the local area. To implement the action items, the Biodiversity Plan will link with Council's four-year Delivery Plan, one-year Operational Plan. Council will have the ability to prioritise budget allocations based on conservation priorities that have been identified.

The plan is based upon six interconnected themes: native vegetation, urban waterways and foreshores, corridors and connectivity, public spaces, urban habitat and green infrastructure. This plan is supported by international, national, state and local policy that drive the development of a biodiversity plan at the local level. This Biodiversity Plan provides capacity to reinforce regional connections and enhance local corridors. It will allow for regional partnerships and is flexible enough to embrace any future infrastructure and development.

Canada Bay is located within the Sydney basin bioregion and occurs along the Parramatta River foreshore. A highly urbanised area characterised by plateaus of Wianamatta Shales in the west, Hawkesbury Sandstone and estuarine foreshores and bays along the Parramatta River. Canada Bay has endangered ecological communities and habitats for threatened migratory and wading birds being located near Bicentennial Park.

City of Canada Bay manages 245 hectares of public open space in 169 parks and has 47 hectares zoned environmental conservation. This plan has identified the values and threats to biodiversity values within Canada Bay and has identified wildlife corridors on a local and regional scale. These corridors currently provide a degree of connectivity between bushland reserves and priority areas were identified that require revegetation to link reserves and improve the degree of connectivity.

A priority ranking of Canada Bay's reserves was undertaken to prioritise the conservation significance of each. The threats facing these reserves reserve was also determined and ranked. When considered together, the priority ranking and threats at each reserve has determined the management priority for

each reserve. The management priority lists which reserves contain the highest values and threats and are thus a priority for management funding and on ground works.

Biodiversity measures have been listed, so that the actions in this plan can be implemented and monitored for successful completion. Each action has been developed based on the literature review, vision and themes of this plan. The actions provide City of Canada Bay with a well-informed basis for undertaking works to improve, maintain and ultimately enhance the biodiversity values of Canada Bay.

1. Purpose of the Biodiversity Framework and Action Plan

The Canada Bay Biodiversity Framework and Action Plan will provide the overarching framework to assist management, enhancement and protection of natural areas and biodiversity in the City of Canada Bay (CoCB) LGA (Local Government Area) for the next 10 years. The document addresses the need for consideration of biodiversity within the context of Council's management and operations by identifying values and issues and presenting strategies and actions that can be undertaken.

The Plan has been developed within the context of wider frameworks including neighbouring local government areas, the broader catchment areas of the Parramatta River and the Eastern City District Plan. As such, it is also a tool to guide Council in its own activities and in its dealings with organisations that may have an impact on biodiversity in Canada Bay.

1.1 Vision

The City of Canada Bay 2030 Community Strategic Plan outlines five themes for the city as a response to the clear and consistent priorities from the community. One of the key themes is to be environmentally responsible and its vision is outlined as:

"Our community shares a collective responsibility to protect our environment and actively participates in innovative programs to mitigate climate change. These programs, along with our well cared for and cherished, active and passive open spaces and waterways, are sustaining our future."

This Biodiversity Framework is consistent with the communities' vision and outcomes for the city. The vision for this Biodiversity Framework is:

"Canada Bay is a community that values, protects, conserves and enhances natural areas and biodiversity in an urban and river foreshore environment"

1.2 Themes

The vision for the Canada Bay Biodiversity Plan is supported by the following six themes, which are all interconnected:

Native Vegetation: protecting, managing and restoring native vegetation and biodiversity for current and future generations

Native vegetation provides habitat for plants and animals and is the cornerstone of biodiversity and ecosystem processes across the City of Canada Bay. This includes remnant forests, foreshores and vegetation that provides structurally complex habitat elements.

Urban Waterways: restoring the river foreshore environment, waterways and their surrounds

The Parramatta River foreshore and tributaries provide a unique environment and supports a range of species within pockets of native vegetation and forms a basis for connectivity across the LGA. Opportunities exist to enhance foreshore protection, riparian habitat and water quality.

Corridors and Connectivity: enhancing landscape linkages

Corridors connect larger habitat patches allowing movement of species and/or genetic interchange among native flora and fauna thereby maintaining biodiversity across the landscape.

Public Spaces: managing our reserves to promote biodiversity and community interaction

Public reserves are a focal point for biodiversity management, places of rest and recreation for the community and support areas of vegetation in the LGA. They provide opportunities for enhancing habitat for native flora and fauna.

Urban Habitat: protecting, conserving and managing biodiversity with the community in the urban landscape

Biodiversity in an urban environment connects people with nature. As city dwellers, Council and its current and future residents have a responsibility for stewardship of biodiversity, its management and protection. Increased tree canopy and understorey in the urban areas supports habitat linkages and improves liveability for residents.

Green Infrastructure: providing opportunities for green infrastructure, innovation, enhancements and demonstration of excellence in biodiversity, and fostering partnerships and education opportunities in Canada Bay

Green infrastructure is the network of green spaces, natural systems and semi-natural systems that are strategically planned, designed and managed to support a good quality of life in an urban environment. Elements include roof gardens, residential gardens, local parks, streetscapes, service corridors, waterways, water sensitive urban design features and recreation areas. This theme overlaps with corridors, public spaces and urban habitat.

1.3 Values

Biodiversity is the variety of living things at several scales - from vegetation communities, to the species they contain, to the genetic information contained within each individual. The value of biodiversity includes its intrinsic value as well as economic value, based its contribution towards social, economic, and health measures that equate to a greater quality of life.

The World Health Organization has acknowledged that human health ultimately depends upon ecosystem products and services (such as availability of fresh water, food, and fuel sources). It is recognised that biodiversity loss can have significant direct human health impacts if ecosystem services are no longer adequate to meet social needs (WHO, 2012).

A Biodiversity Plan for Canada Bay aims to ensure that local ecosystem health, including species and their genetic diversity, survive in their natural habitat. This will ensure that the social, economic, environmental and health services provided by healthy ecosystems can continue to provide their benefits for current and future generations. This is further outlined in Biodiversity Values, Concepts and Design Principles (Appendix A).

2. Plan Framework

The CoCB has obligations and opportunities under international, national and regional planning and policy framework (Figure 1). These agreements, legislation and policies assist in the protection of environmental values and the direction of future conservation and sustainable development.

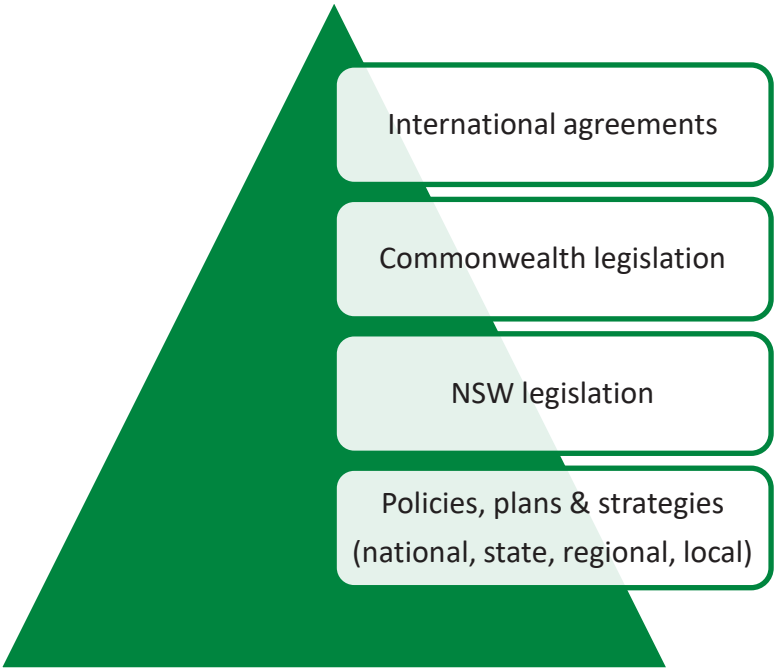

Figure 1: Legislative and planning hierarchy

2.1 International conventions and treaties

The need for biodiversity planning has its origins in a number of international conventions and treaties that Australia signed in the 1990s. These include:

- *1992 Rio Summit* (United Nations Conference on Environment and Development - UNCED) which resulted in the following documents:
  - Rio Declaration on Environment and Development
    - highlighted the importance of Ecologically Sustainable Development (ESD)
  - Agenda 21
    - the global blueprint for sustainability
    - Chapter 28 of Agenda 21 identifies local authorities as the sphere of governance closest to the people, and calls upon all local authorities to consult with their communities to develop and implement a local plan for sustainability - a 'Local Agenda 21'
  - Convention on Biological Diversity
    - a legally binding agreement ratified by Australia in 1993. As a signatory nation, Australia is bound to develop and implement strategies that will ensure the conservation and sustainable use of its biological resources
  - Forest Principles

    - a set of guidelines for development of forest policy that form the basis of all later policy developments
  - Framework Convention on Climate Change
    - is an intergovernmental treaty developed to address the problem of climate change
- *China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA), Republic of Korea-Australia Migratory Bird Agreement ROKAMBA),* and the *Bonn Convention:*
  - provide for co-operation between the Governments of Australia, China, Japan and South Korea to protect waterbirds that migrate between these countries.

2.2 National Framework

As a result of being a signatory to international treaties and conventions, Australia has taken some significant steps to meet its obligations under these treaties, including the following agreements and strategies:

- *Intergovernmental Agreement on the Environment*
- *Draft National Biodiversity Conservation Strategy 2010-2020*
- *Australia's Biodiversity Conservation Strategy 2010-2030*
- *Australian Weeds Strategy*
- *Australian Pest Animal Strategy*
- *Commonwealth Wetlands Policy*
- *National Water Quality Management Strategy*
- *National Forest Policy Statement*

2.3 NSW Framework

At the state level, the most significant initiative relating to biodiversity protection has been the preparation of the *Biodiversity Conservation (BC) Act 2016.* This legislation guides conservation and sustainable development in NSW, with strategies to minimise and offset impacts to natural resources. It provides guidance to Councils to prepare and implement biodiversity plans.

Under the BC Act, development is required to consider whether clearing triggers the Biodiversity Offsets Scheme. One of the main triggers for this is the Biodiversity Values Map that has been updated in 2019 to include wetlands and TECs within Canada Bay (Figure 2).

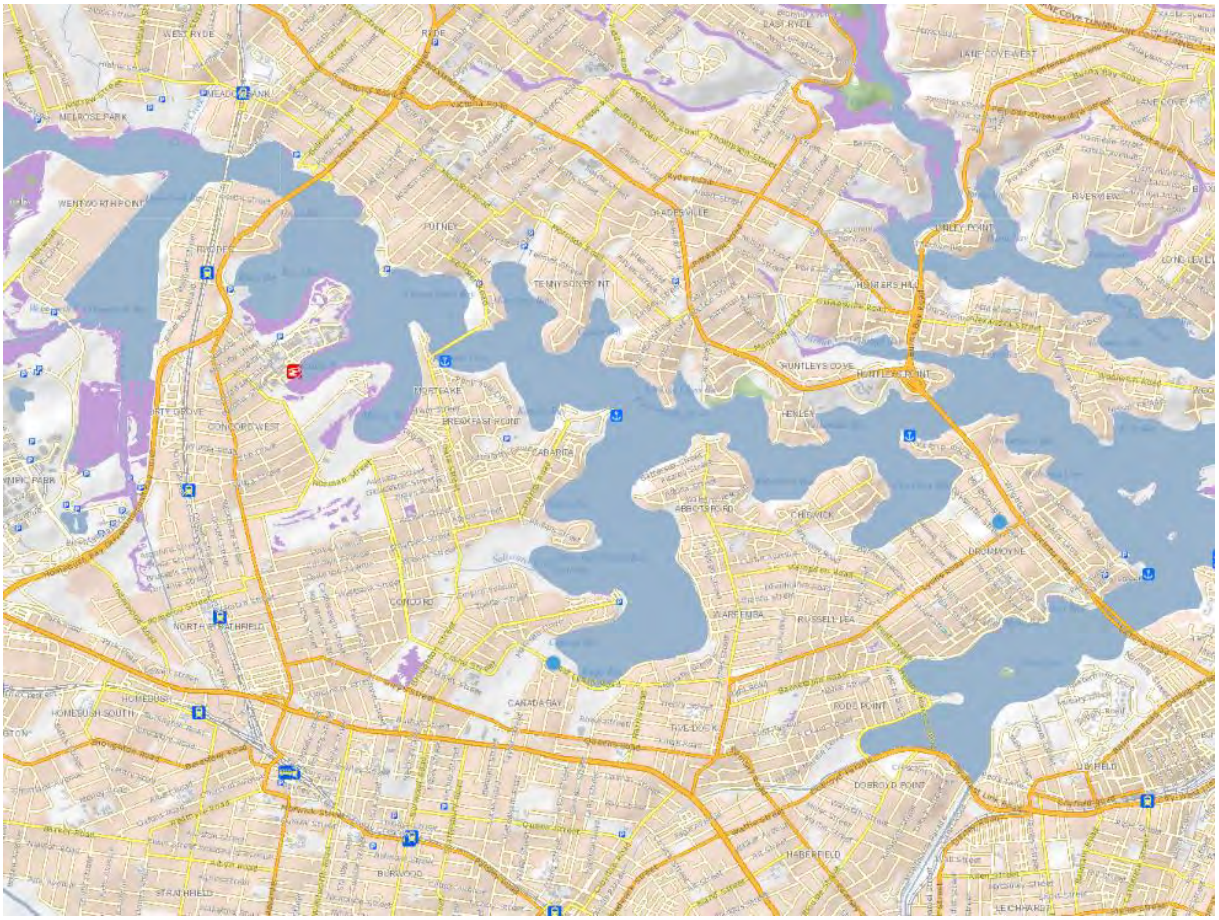

Figure 2: Biodiversity Values Map 2019

Other important documents and frameworks at the state level includes:

- *NSW Biodiversity and Climate Change Adaptation Framework 2007-2008*
- *NSW 2021 – NSW State Plan*
- *Draft Greener Places Discussion Paper – Establishing an Urban Green Infrastructure policy for NSW 2017*

2.4 Legislative Obligations

The following **table** summarises the key National and State biodiversity legislation and their implications for City of Canada Bay.

Table 1: Key Legislation

Act	Summary	Implications for Canada Bay
Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) (EPBC Act)	Provides a national scheme for environmental protection and biodiversity conservation. Incorporates referral mechanisms and environmental impact assessment processes for projects of national significance.	Endangered Ecological Communities (EECs) and Critically Endangered Ecological Communities (CEECs) such as Sydney Turpentine Ironbark Forest, endangered species and JAMBA/CAMBA/ROKAMBA species.

Act	Summary	Implications for Canada Bay
	Triggers for referral to the Commonwealth include significant impacts to listed communities and species.	
Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act).	The principal planning legislation for the State providing a framework for the overall environmental planning and assessment of development proposals.	Drives the planning and development processes in Canada Bay. The Act provides for the preparation of a number of environmental planning instruments (including SEPPs and LEPs).
Biodiversity Conservation Act 2016 (NSW)	This requires that Councils consider the impact on threatened species and ecological communities before approving developments. Key components of the reform include: • A new framework for managing native vegetation clearing • An enhanced and strategic approach to private land conservation and threatened species conservation • An expanded biodiversity offsetting scheme	Management of threatened species and communities on Council owned lands. Development approvals. Fulfil the actions required under priority action statements and recovery plans.
Biodiversity Conservation (Savings and Transitional) Regulation 2017)	BioBanking was a voluntary market-based scheme administered by OEH that provided a streamlined biodiversity assessment process for development, a rigorous and credible biodiversity offsetting scheme, as well as an opportunity for landowners to generate income by managing land for conservation. This regulation explains the transitional arrangement for licences under the *Threatened Species Conservation Act 1995.*	Any established BioBank sites can be used to generate biodiversity credits to help manage land for biodiversity. This can assist with the ongoing costs for conservation management of the land.
Protection of the Environment Operations Act 1997 (NSW) (POEO Act)	The POEO Act enables the Government to set out explicit protection of the environment policies (PEPs) and adopt more innovative approaches to reducing pollution through licences and approvals relating to air pollution, water pollution, noise pollution and waste management.	Integration of licensing with the development approval procedures in CoCB under the EP&A Act in environmental assessment of activities.
Local Government Act 1993 (NSW)	Now incorporates Ecologically Sustainable Development (ESD) considerations (including biodiversity conservation) as a key aspect of Council operations. Require the preparation of Plans of Management (POMs) for all Council owned land, and provides for the classification of land into, amongst other things, natural areas and various sub-categories. Additionally, this Act has a range of other provisions that allow for appropriate management of operational land and infrastructure, provide educational services, set	The Local Government Act was reviewed by the State Government under the Fit for the Future reforms. The first phase of developing new local government legislation is now in place.

Act	Summary	Implications for Canada Bay
	rates and charges, issue orders and have a range of enforcement powers.	
Local Land Services Act 2013 (NSW) and *Local Land Services Amendment Bill 2017* (NSW)	The Act Provides a framework to ensure the proper management of natural resources in the social, economic and environmental interests of the State	CoCB is part of the Greater Sydney Local Land Services (GSLLS). The Greater Sydney LLS State Strategic Plan 2016-2026 sets the vision and goals for Local Land Services for the next ten years and outlines the strategies through which these goals will be achieved. Catchment based targets will be incorporated into this Biodiversity Plan.
National Parks and Wildlife Act 1974 (NSW):	Provides for establishment/management of National Parks and other conservation reserves (for example, through Voluntary Conservation Agreements) and the protection of flora and fauna species	CoCB contains no national parks but it is adjacent to Parramatta River Regional Park, Newington Nature Reserve and Rodd Island (Sydney Harbour National Park).
Crown Lands Management Act 2016 (NSW)	The Crown Lands Management Act 2016 governs the planning, management and use of Crown land, including provisions to reserve or dedicate lands for a prescribed public purpose and for leasing and licensing.	The Department of Primary Industries, together with reserve trusts appointed by the Minister, are responsible for the administration and management of the Crown reserve system. City of Canada Bay is the reserve trust manager appointed by the Minister to care, control and manage crown lands within the LGA.
Biosecurity Act 2015 (NSW)	Provides a streamlined, clear framework for safeguarding primary industries, natural environments and communities from a range of pests, diseases and weeds across NSW.	The Greater Sydney Regional Strategic Weed Management Plan lists weeds that are State Priority, Regional Priority and Other Regional Priority. CoCB is a Local Control Authority responsible for enforcing weed legislation. This includes: • Inspect weeds on public and private property • inspect and control weeds in high risk pathways and sites • education, training and resources for the public and staff on weed management • administer compliance weed regulations • respond to breaches of the Act, and • notify and report weed activities to the Biosecurity Information System (BIS).

Act	Summary	Implications for Canada Bay
Fisheries Management Act 1994 (NSW)	This Act aims to preserve fish stocks, habitats and species and to maintain and promote ecologically sustainable development whilst ensuring the commercial viability of fisheries. It allows for listing of threatened species, habitat, communities, and processes in a similar manner to the BC Act.	Mangroves, saltmarsh and key fish habitat areas that occur in CoCB are protected under this Act.
Water Management Act 2000 (NSW)	This Act controls the extraction of water, how water can be used, the construction of works such as dams and weirs, and the carrying out of activities on or near water sources in NSW	Any works within 40m from the top of bank of a waterway is a controlled activity that requires integrated development approval. Council are exempt from requiring integrated approval.

2.4.1 Planning Strategies and Policies

Canada Bay is subject to several regional and state-wide planning strategies and policies, particularly through the State Environmental Planning Policies (SEPPs) and the Sydney Regional Environmental Plan (SREP) which maps Wetlands Protection Areas (sheets 2, 3 and 4) and has planning controls for the protection of wetlands. The SEPPs and sections of the SREP that are relevant to Canada Bay are detailed in the Canada Bay Local Planning Strategy (2010).

The Greater Sydney Region Plan (2018a) is a broad scale coordinated plan for the infrastructure, liveability, productivity and sustainability of Greater Sydney. The City of Canada Bay is within the Eastern City District of the Greater Sydney Region Plan and is included in the Eastern City District Plan (2018). This will guide the future housing, infrastructure and environmental planning in the City of Canada Bay.

The City of Canada Bay is in the Inner West region of the Sydney Metropolitan Region (SMR), and is affected by several regional planning strategies which include:

- *Greater Sydney Regional Plan - A Metropolis of Three Cities*
- *Eastern City District Plan*
- *Parramatta Road Urban Transformation Strategy*
- *Sydney Olympic Park –Masterplan 2030 and Parklands Plan of Management 2010*
- *Homebush Bay Circuit Wayfinding Strategy and Masterplan;*
- *Sharing Sydney Harbour Program and Draft Environmental State Environmental Planning Policy (incorporating Sydney Harbour Catchment Regional Environmental Plan)*
- *Ten Steps to a living river – the Parramatta River Master plan*
- *Greener Places / Bushland and Waterway Guide/Manual, and*
- *Green Grid.*

2.5 Local framework

The main policies that control biodiversity protection and management within the CoCB are the Canada Bay Local Environment Plan 2013 (Canada Bay LEP 2013) and the Development Control Plan (City of Canada Bay DCP 2017). These documents determine what land use is permissible in particular locations

within the LGA and list what requirements must be met to allow a development to be approved. The sections of the LEP and DCP that address biodiversity protection include the following:

- Clause 3.3 LEP defines an environmentally sensitive area for exempt or complying development
- Clause 6.3 LEP defines the terrestrial biodiversity considerations that the consent authority must make when considering a development application
- Part C5 of the DCP defines the policies for the preservation of trees and vegetation

Several Council plans and other documents that relate to biodiversity were reviewed in preparation of the Biodiversity Plan and are outlined in **Appendix B**. Also important to the future environmental management of Canada Bay are the Council programs that encourage biodiversity protection and community involvement).

Table 2: Council programs that encourage biodiversity protection and community involvement.

Name	Location/Involvement	Summary
Bayside Bushcare – Bushcare Volunteer Program	Reserves and parks in CoCB, especially Queen Elizabeth II Park (Concord), Lovedale Place (Concord West), Quarantine Reserve (Abbotsford), Prince Edward Park (Cabarita), Drummoyne, Russell Lea and Yaralla (Concord West). Four main Bushcare groups.	Volunteer program that enables community members to "participate in the restoration, enhancement and maintenance of natural areas within the CoCB."
Sustainable City Committee	Meets bi-monthly, on the last Thursday of the month from 7-9pm	Environmental advisory committee of community members "interested in contributing to the ongoing improvement of CoCB's natural environment."
Love Your Place Volunteer Program	Entire CoCB	"Love Your Place participants: • act as ambassadors at their nominated park or street • organise at least two community litter clean-ups a year • report illegal dumping, graffiti, damaged facilities and anti-social behaviour • regularly visit their nominated site to monitor its upkeep and report maintenance requirements to Council."
Sustainable Schools Network	14 active member schools	Aims is to "assist, advise and inspire schools to incorporate sustainability education within the curriculum and run projects within the school community."
Sustainable Childcare Network	Various childcare centres - 20 active service members who participate in network meetings and free workshop opportunities	Expansion of the Sustainable Schools Network following its success.
Our Energy Future	Southern Sydney Regional Organisation of Councils	Provides "up-to-date and impartial energy efficiency and renewable energy advice and support for the households, businesses and Council staff."
Litter Strategy – *Let's put litter in its place*	Entire CoCB	Broad strategy involving infrastructure, education, enforcement, partnerships, evaluation and management to reduce litter by 50% by 2021.
Community education, including	Entire CoCB	Additional programs targeting food sustainability, dog faeces litter, business impacts etc.

Name	Location/Involvement	Summary
sustainability workshops		
Our Living River Project - as a partner in the Parramatta River Catchment Group	CoCB Council; foreshore areas of CoCB	Aims to “expand, restore and manage the extent of native habitats in the fragmented landscapes of the Parramatta River catchment”.

3. Existing Environmental Values

3.1 Physical features

3.1.1 Landscape and infrastructure

The Canada Bay LGA is situated 6 km west of the Sydney central business district and covers 20 km^2. It stretches 8 km from Birkenhead Point in the east to Sydney Olympic Park in the west, and Rhodes in the north to Five Dock in the south. The LGA is a highly urbanised landscape with residential, commercial and industrial areas dissected by road and rail infrastructure (Figure 3).

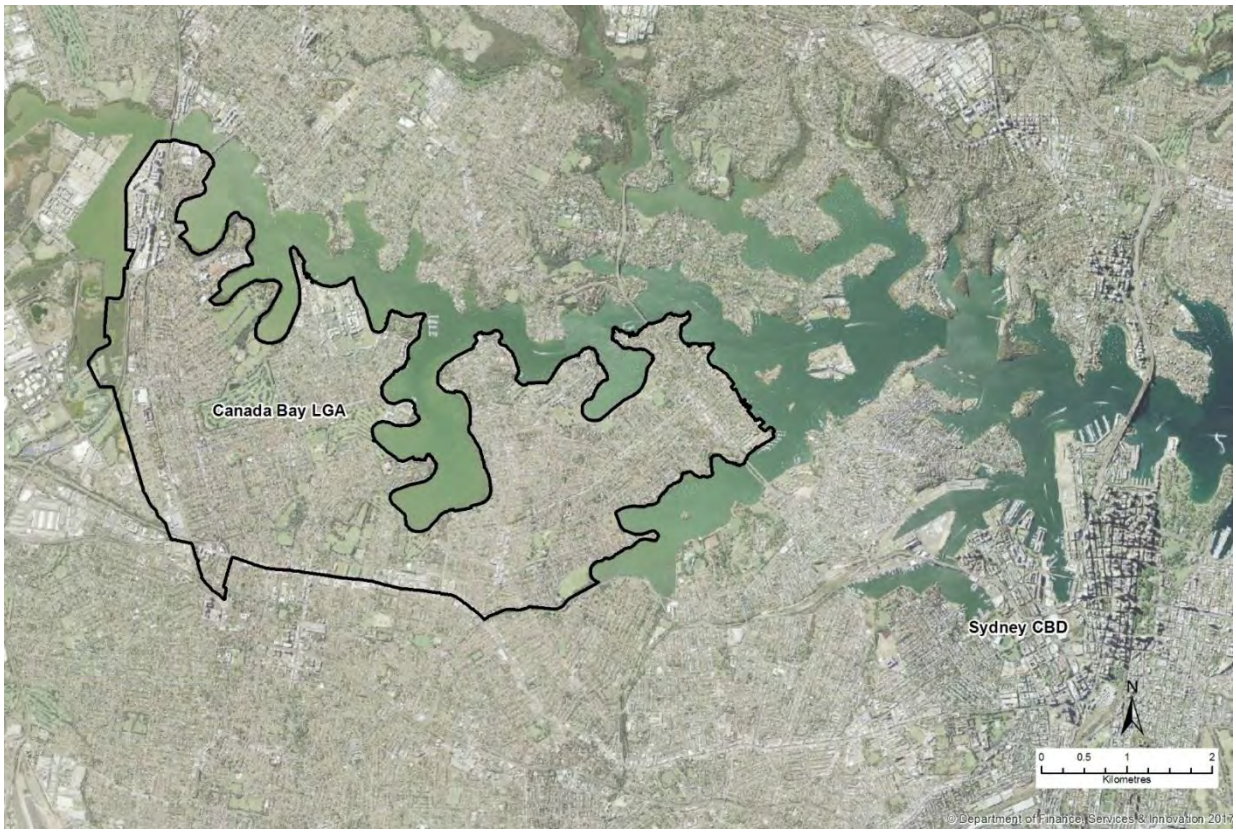

Figure 3: Location of Canada Bay LGA in relation to Sydney CBD

3.1.2 Geology, soils and topography

The LGA lies within the Harbour Foreshores region of the Sydney Basin in a drowned river valley of the Parramatta River (Figure 22, **Appendix C**). It features underlying geology of Hawkesbury Sandstone in the east, Wianamatta Group shales and Quaternary Alluvium in floodplains and bays along the Parramatta River foreshore (Figure 23, **Appendix C**). Terrain features rugged to undulating valley sides of the foreshores with a broad dissected plateau capped in the west part of the LGA with shale. As indicated in Figure 24, **Appendix C,** the Blacktown soil landscape dominates the LGA. It is characterised by soils that are typically sodic, highly erodible and have poor fertility and drainage.

Soil landscapes present in Abbotsford and Drummoyne include Gymea and Hawkesbury, from Mortlake to Cabarita features Oxford Falls, Sydney Olympic Park is characterised by Birrong, and many foreshore areas are disturbed terrain.

3.1.2.1 Historical Landscape

Pre 1750 vegetation has been mapped by Benson and Howell (1990) in Figure 4 and is based on broad landscapes across the LGA dominated by the underlying geology and soils of the area. It shows mainly sandstone influenced vegetation towards the north eastern parts of the LGA and a clay influence in the south western parts of the LGA as well as estuarine influences.

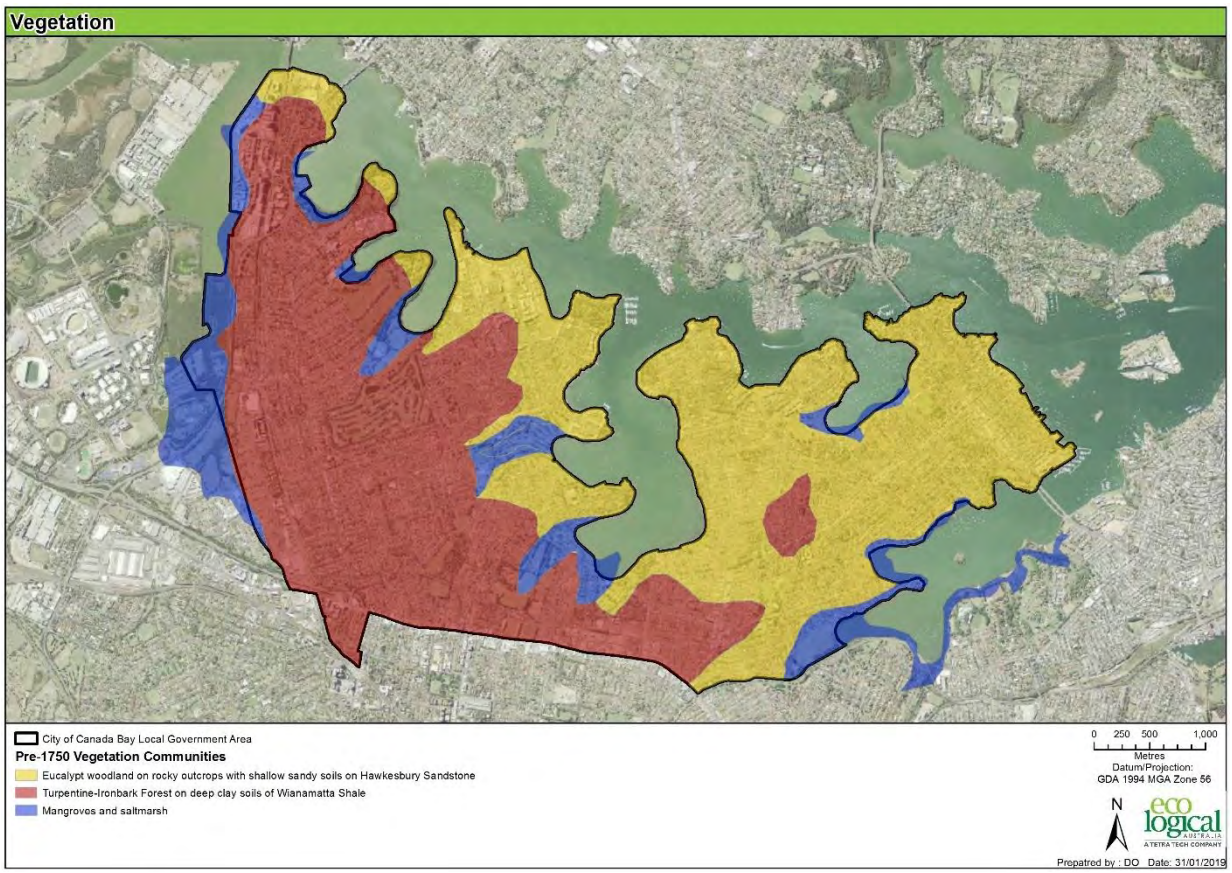

Figure 4: Pre-1750 Vegetation

3.1.3 Drainage and water quality

Canada Bay LGA lies within the Parramatta River Catchment. Waterways within these catchments drain to the Parramatta River to the north and north-east (Figure 25, **Appendix C**):

- Iron Cove Creek (Dobroyd Canal),
- Several unnamed creeks that flow through St Lukes Canal and a canal in Barnwell Golf Course into Canada Bay and Kings Bay,
- Saltwater Creek that flows through Massey Park Canal into Exile Bay, and
- Powells Creek that flows to through the Badu Mangroves in Sydney Olympic Park to the Parramatta River – a previous canal being naturalised.

The morphology of waterways in the LGA has changed since European settlement, either by natural processes, accelerated sedimentation and erosion, or by filling, reconfiguration, seawall construction and concrete lining of creeks that once served as sewerage channels. Channels and catchments have increased the peak runoff velocity and volumes and decreased low flow volumes. Waterways in the LGA experience poor water quality, loss of mangroves, saltmarsh and seagrasses with smothering by sediments, bed erosion and damage from RiverCat wash and boat propellers and moorings, illegal clearing, dinghy storage and trampling (AECOM, 2010), invasion of aquatic weeds and pest species (e.g. *Gambusia holbrooki*), rubbish dumping and loss of riparian vegetation. This adversely impacts aquatic species (e.g. fish kills) and reduces the amenity and values of surrounding properties and public spaces. Poor waterway health decreases public amenity and swimmability.

3.2 Current Biodiversity

Compared with the pre-1750 vegetation, there are small but important areas of native vegetation remaining in the Canada Bay LGA. The main habitats in the LGA are in the north west at Sydney Olympic Park, Brays Bay to Yaralla Bay (Figure 6) and stretch along the Parramatta River foreshore, and throughout the LGA's parks, golf courses schools and street and garden trees. Other waterways and larger patches of vegetation have the potential to create corridors and/or act a 'stepping stones' in the landscape.

A summary of the key biodiversity features across the LGA include:

- Approximately 35km of foreshore along the Parramatta River and Iron Cove including important mangrove habitats protected under the *Fisheries Management Act 1994 (NSW;* EPBC Act Protected Matter Report).
- Threatened Ecological Communities, habitat for threatened species and listed migratory birds, Figure 6, **Table 16**, **Appendix D**).
    - Threatened Species
        - 13 threatened species of fauna listed in NSW, 3 of which are also threatened in Australia
        - 1 species of threatened flora listed in NSW
    - 13 migratory birds protected under international agreements
    - Threatened Ecological Communities (NSW)
        - Coastal Saltmarsh
        - Swamp Oak Floodplain Forest
        - Swamp Sclerophyll Forest on Coastal Floodplains
        - Sydney Turpentine Ironbark Forest
    - 1 nationally important wetland at Bicentennial Park, Sydney Olympic Park.

3.2.1 Vegetation

The total area of vegetation currently mapped by OEH in 2016 is 175.9 ha (**Table 3,** Figure 6).The remnant native vegetation is predominantly concentrated in the west of the LGA, in Concord West, Liberty Grove and Majors Bay. Approximately 24 ha of the remnant native vegetation consists of Threatened Ecological Communities listed under BC Act, and about 23 ha potentially meets the criteria for listing under the EPBC Act, particularly Sydney Turpentine-Ironbark Forest (Lembit 2009).

The City of Canada Bay also contains about 39 ha of area protected under the *Fisheries Management Act 1994*, consisting of mangroves, saltmarshes and seagrass meadows. This vegetation occurs along the Parramatta River foreshores and in the intertidal zone and nearshore areas.

Urban native and exotic vegetation occurs throughout the LGA and provides habitat for fauna.

Table 3: Vegetation communities in Canada Bay mapped by OEH 2016

Vegetation Community (PCT)	NSW TEC	NSW FMA	Potential EPBC TEC	Area (ha)
Estuarine Mangrove Forest (920)		√		33.76
Coastal Saltmarsh (1126)	√	√	√	0.90
Swamp Oak Floodplain Forest (1234)	√		√	2.55
Coastal Enriched Sandstone Dry Forest (1776)				0.04
Swamp Sclerophyll Forest on Coastal Floodplains (1798)	√			0.49
Sydney Turpentine Ironbark Forest (1281)	√		√	20.39
Seagrass Meadows (1913)		√		4.10
Urban Exotic/Native				113.00
Weeds and Exotics				0.67
Total				175.90

Figure 5: Sydney Turpentine - Ironbark Forest and Coastal Saltmarsh at Dame Eadith Estate

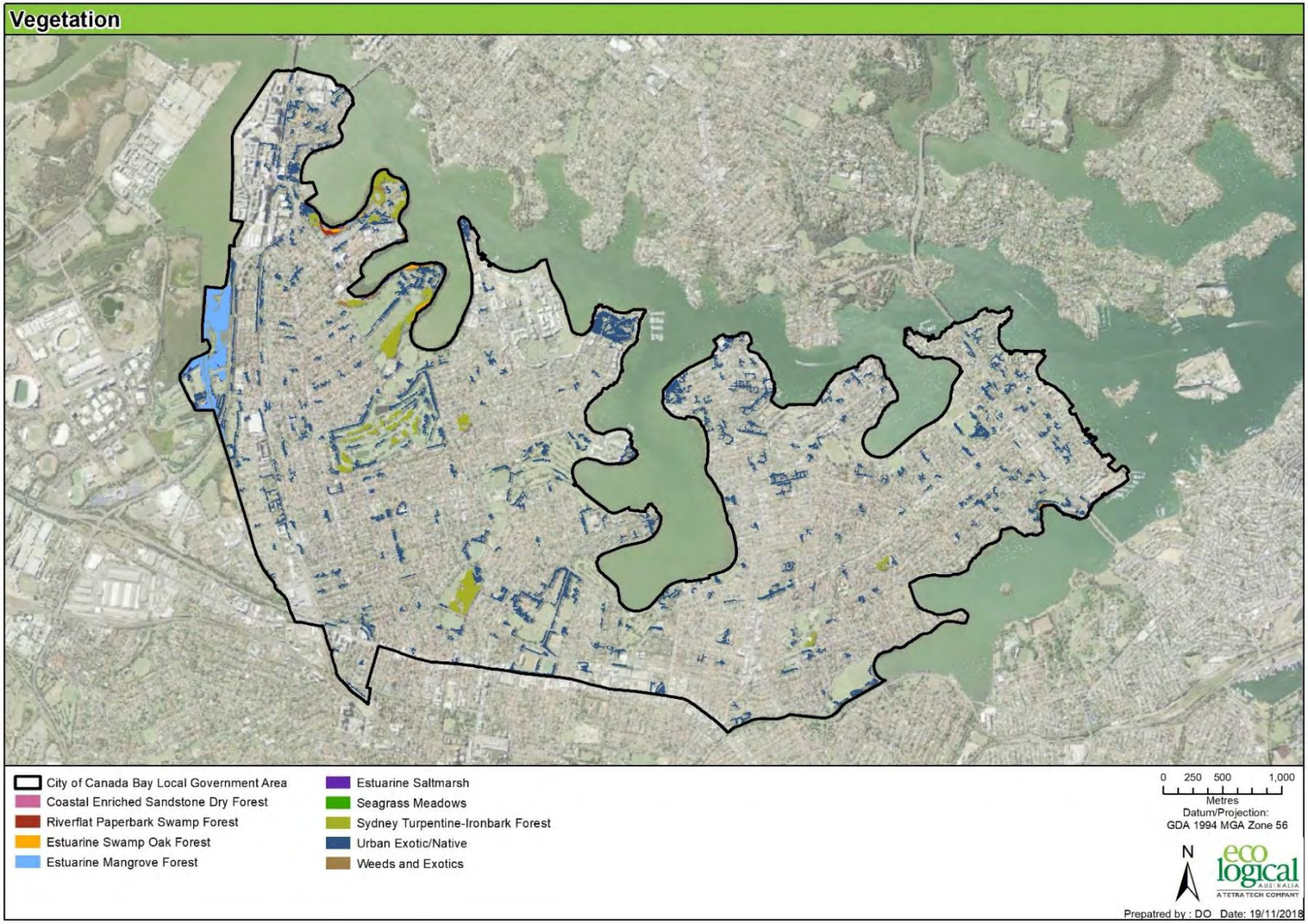

Figure 6: Mapped vegetation in the City of Canada Bay by OEH, 2016

3.2.2 Fauna

In summary, the fauna of Canada Bay includes:

- 13 threatened species of bird, mammal and amphibian listed under the NSW Biodiversity Conservation (BC) Act 2016; these include:
  - 3 threatened species listed under the federal Environment Protection and Biodiversity Conservation Act 1999:
    - Swift Parrot (Endangered Cth, NSW)
    - Green and Golden Bell Frog (Vulnerable Cth, Endangered NSW)
    - Grey-headed Flying-fox (Vulnerable Cth, NSW)
  - 8 other NSW threatened fauna species:
    - Bush Stone-curlew
    - Curlew Sandpiper
    - Sanderling
    - White-fronted Chat
    - Little Lorikeet
    - Sooty Oystercatcher
    - Australian Pied Oystercatcher
    - Powerful Owl
  - 2 endangered fauna populations listed under the TSC Act occur near the study area or have been recorded in the LGA:
    - White-fronted Chat and
    - Long-nosed Bandicoot
- 13 migratory and marine bird species listed under the CAMBA, JAMBA and/or ROKAMBA agreements and the EPBC Act 1999 (also includes some of the above):
  - CAMBA, JAMBA and ROKAMBA -
    - Bar-tailed Godwit
    - Common Greenshank
    - Grey-tailed Tattler
    - Sharp-tailed Sandpiper
    - Curlew Sandpiper
    - Sanderling,
    - Common Tern
    - White-throated Needletail
    - Pacific Golden Plover
  - JAMBA and CAMBA -
    - Eastern Great Egret
    - CAMBA and ROKAMBA
    - White-bellied Sea-Eagle
    - Latham's Snipe
  - JAMBA
    - Crested Tern

The BioNet search recorded 80 threatened or migratory fauna species, 73 of which have been recorded since 1990. The search included an 5km area from the LGA (Figure 8, **Table 7, Appendix D**). The high number of fauna species recorded in the BioNet Search indicates that many mobile species occur within Canada Bay and the surrounding area. Canada Bay is recognised as being a feeder/ overflow for Bicentennial Park which is a biodiversity hotspot.

Previous studies (Hobcroft, 2003, Insight, 2014) have undertaken a more detailed analysis of fauna recorded within the Canada Bay LGA and documented the change over time (**Table 4**).

Table 4 Fauna recorded in Canada Bay 2003-2014

Class	Key Species	Number of species 2003	Number of species 2014
Birds	Migratory birds and waders: Bar-tailed Godwit, Sharp-tailed Sandpiper, Black-winged Stilt and White-throated Needletail, Other water birds: Little Black Cormorant, Little Pied Cormorant, Great Cormorant, Pelican, White-faced Heron, Silver Gull, White Ibis, Chestnut Teal, Pacific Black Duck, Grey Teal, Crested Tern, Larger birds: Pied Currawong, Australian Raven, Australian Magpie, Grey Butcherbird, Little Corella, Galah, Masked Lapwing, Crested Pigeon, Noisy Miner, Rainbow Lorikeet, Eastern Rosella, Kookaburra, Smaller birds: Superb Fairy Wren, Silvereye and Welcome Swallow	86	84 (79 native, 5 exotic)
Reptiles	Eastern Blue-tongue, skinks and Eastern Snake-necked Turtle	10	10
Mammals	Common Brushtail Possum, Common Ringtail Possum, Rakali, Long-nosed Bandicoot and microbats	7	6
Amphibians	Bleating Tree Frog, Common Eastern Froglet, Eastern Dwarf Tree Frog, Peron's Tree Frog	5	4

Figure 7: Bar-tailed Godwit and Powerful Owl

3.2.3 Flora

A previous flora survey by Lembit (2009), indicates that 159 native plant species have been identified across the city area. Of these, one species was listed as threatened under the BC Act (*Wilsonia backhousei* known from Canada Bay in Lovedale Place Park). This species was last recorded 15 years ago being outcompeted by Casuarinas due to shading and nutrients (Rob Stevenson, pers. comm.). It has also been recorded in Liberty Grove near Sydney Olympic Park (BioNet Search).

The BioNet Atlas search (2018) however indicated that 26 threatened flora species have been recorded within 5km of the LGA, 17 of which have been recorded since 1990 and one of which is now listed as Extinct (Figure 8, **Table 17, Appendix D**). Of the 26 species recorded, 17 are listed under both the EPBC Act (Commonwealth) and the BC Act (NSW); and 9 are listed only under the BC Act. This demonstrates that the locality, although highly urbanised, is however a biodiversity hotspot.

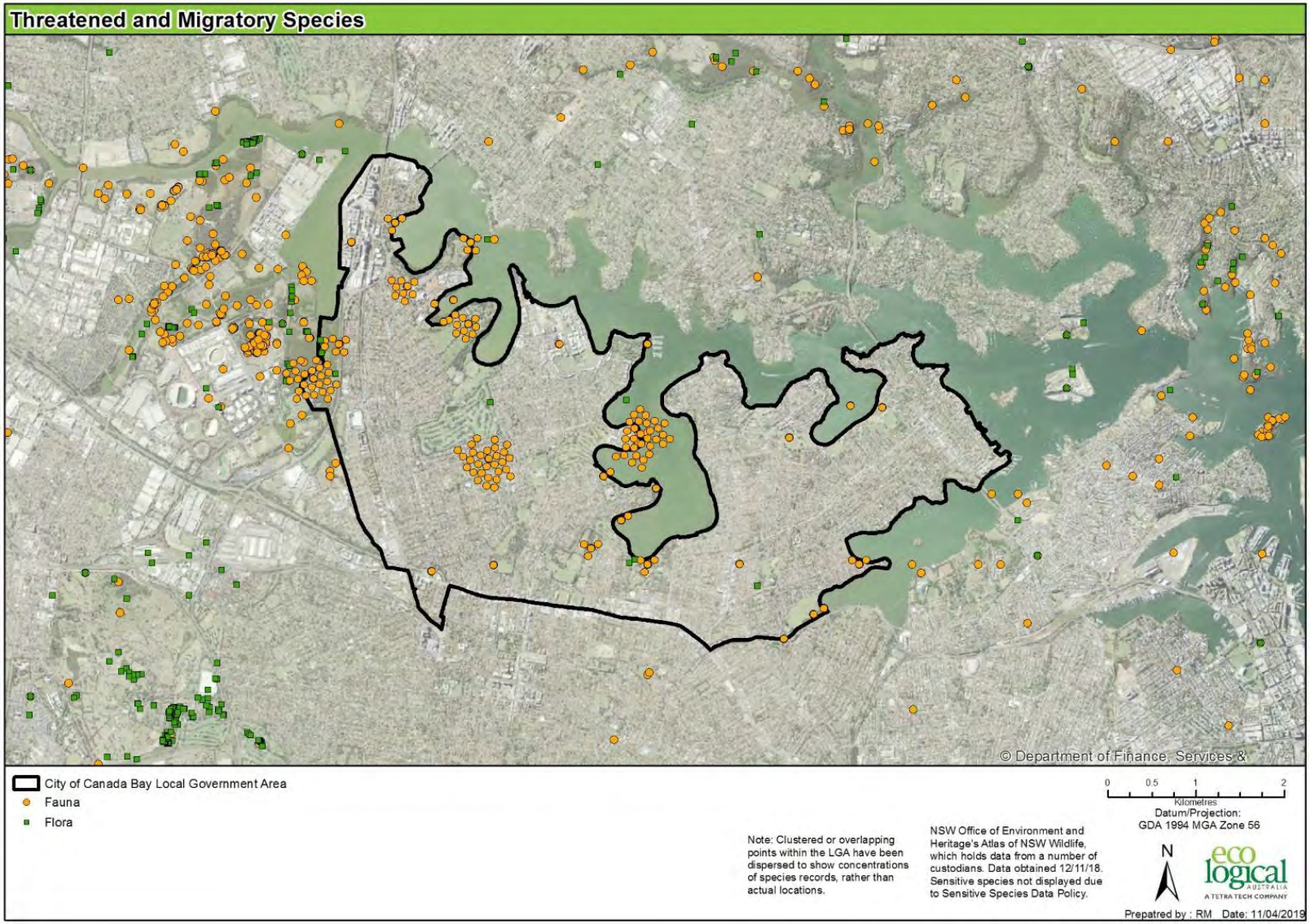

Figure 8: Threatened and migratory species within 5km of Canada Bay (BioNet search 2018)

3.3 Habitat Ranking

Existing habitats across Canada Bay have been ranked according to mapped vegetation communities, with three levels being broadly defined as:

- ***Critical habitat*** – primarily remnant native vegetation communities – threatened ecological communities, this includes areas mapped on the Biodiversity Values Map
- ***Significant habitat*** – native vegetation community remnants – not threatened ecological communities
- ***Supporting habitat*** – other vegetation, including street trees and mix of native and exotic species

Figure 9: Habitat types within the City of Canada Bay shows this classification of habitat across the LGA which maps the extant vegetation as either critical or supporting habitat (including street trees) across the LGA. These are small but important areas, with critical habitat is the most important, but all habitat supports an element of 'natural' function within the landscape. The key reserves and locations broken down by the ranked habitat types are detailed in Appendix E.

Table 5: Areas of mapped vegetation in City of Canada Bay LGA

Habitat Type	Area (ha)	Percent of LGA
Critical Habitat (Endangered Ecological Communities and other protected communities)	42.05	2.12
Significant Habitat (Native vegetation)	0.04	<0.01
Supporting Habitat (Non-native vegetation and planted native species)	113.18	5.72

Note that GANSW (2018a) defines ***corridor habitat*** as the following:

- Core areas - Core areas of bushland and waterways are the least disturbed and the most biodiverse, representative of the structure, function, and composition known to exist before European settlement. Protection and management of these areas are important to protect biodiversity and ensure long-term stability of ecosystem functions.
- Transition areas - Transition or buffer areas are located at the interface between a natural area and an adjoining urban environment and represent the transition from one ecosystem to another. These areas function as a buffer to core zones, protecting their condition, promoting regeneration and improving their resilience to threats. Transition areas vary in extent and composition and may require ongoing maintenance. They can provide wildlife habitat, are often more suited to recreation uses such as cycleways, walkways, and picnic areas, and may offer benefits such as an asset protection zone for bushfire protection or buffer to core zones from invasive species.

In Canada Bay habitat also occurs outside corridors. 'Critical habitat' mapped in this report equates to a broader definition of core habitat, being a larger patch of native vegetation. 'Supporting habitat'

mapped in this report functions as a transitional area. This report has mapped opportunities for corridor enhancement which connects critical habitat in Appendix H.

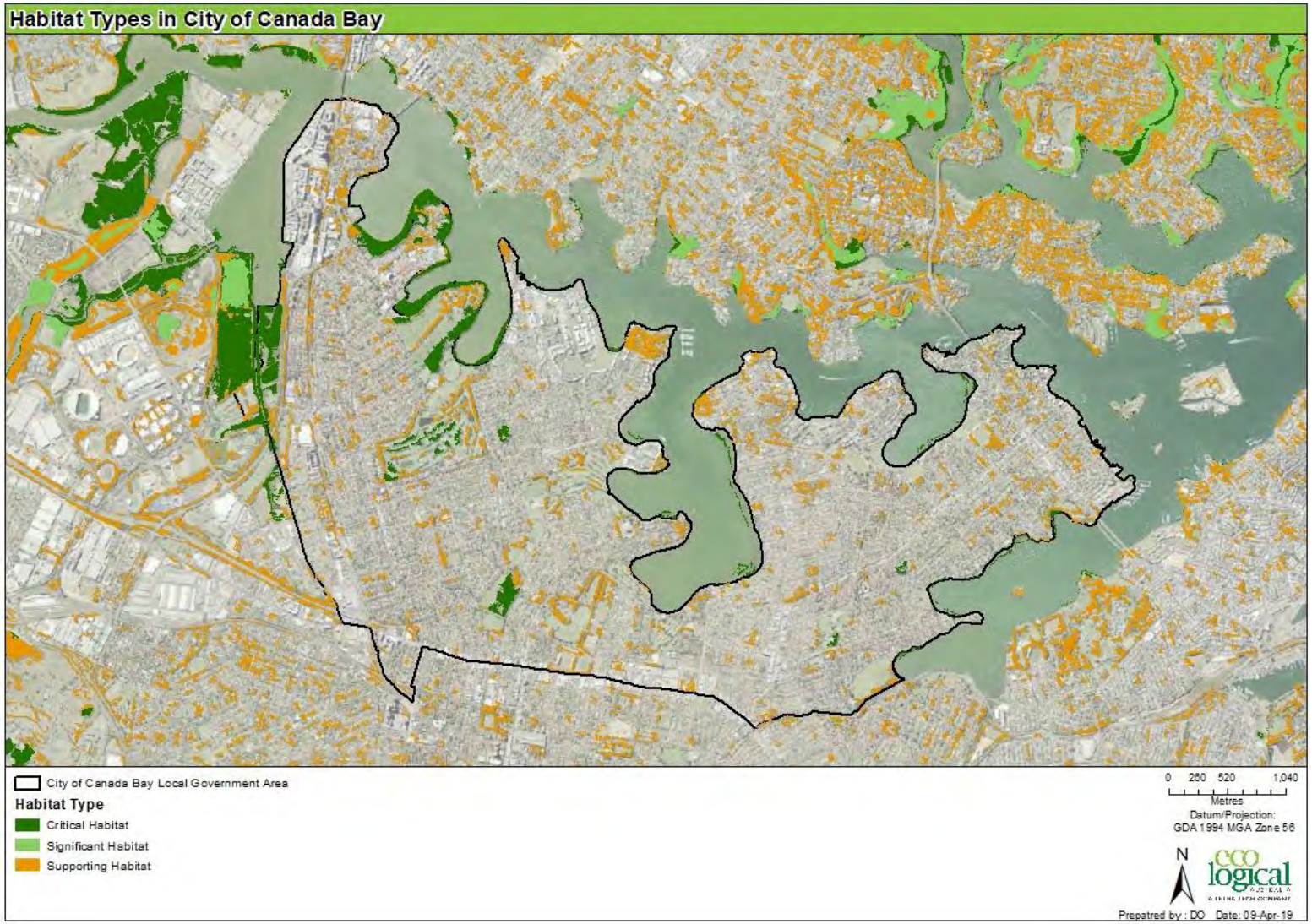

Figure 9: Habitat types within the City of Canada Bay

3.4 Green spaces and planning

The City of Canada Bay has 150 parks, open spaces and reserves which cover an area of approximately 353 ha and range in size from less than 1 ha to 53 ha. The current land zoning for each area is shown in **Table 5** and Figure 10. Many of the areas zoned as Public Recreation or Environmental Conservation include areas of key habitat. The majority of critical habitat occurs within these zones.

Areas of public land zoned Public Recreation include Massey Park Golf Club, Edwards Park, Saltwater Creek, Greenlees Park, Jessie Stewart Reserve, Rothwell Park, Queen Elizabeth Park and Goddard Park.

Table 6: Green spaces in the City of Canada Bay

Zoning Type	Area (ha) in LGA	% of LGA
Environmental Conservation	47.32	2.4
Environmental Management	0.38	<0.1
Private Recreation	59.66	3.0
Public Recreation	245.22	12.4
Total	**352.58**	**17.8**

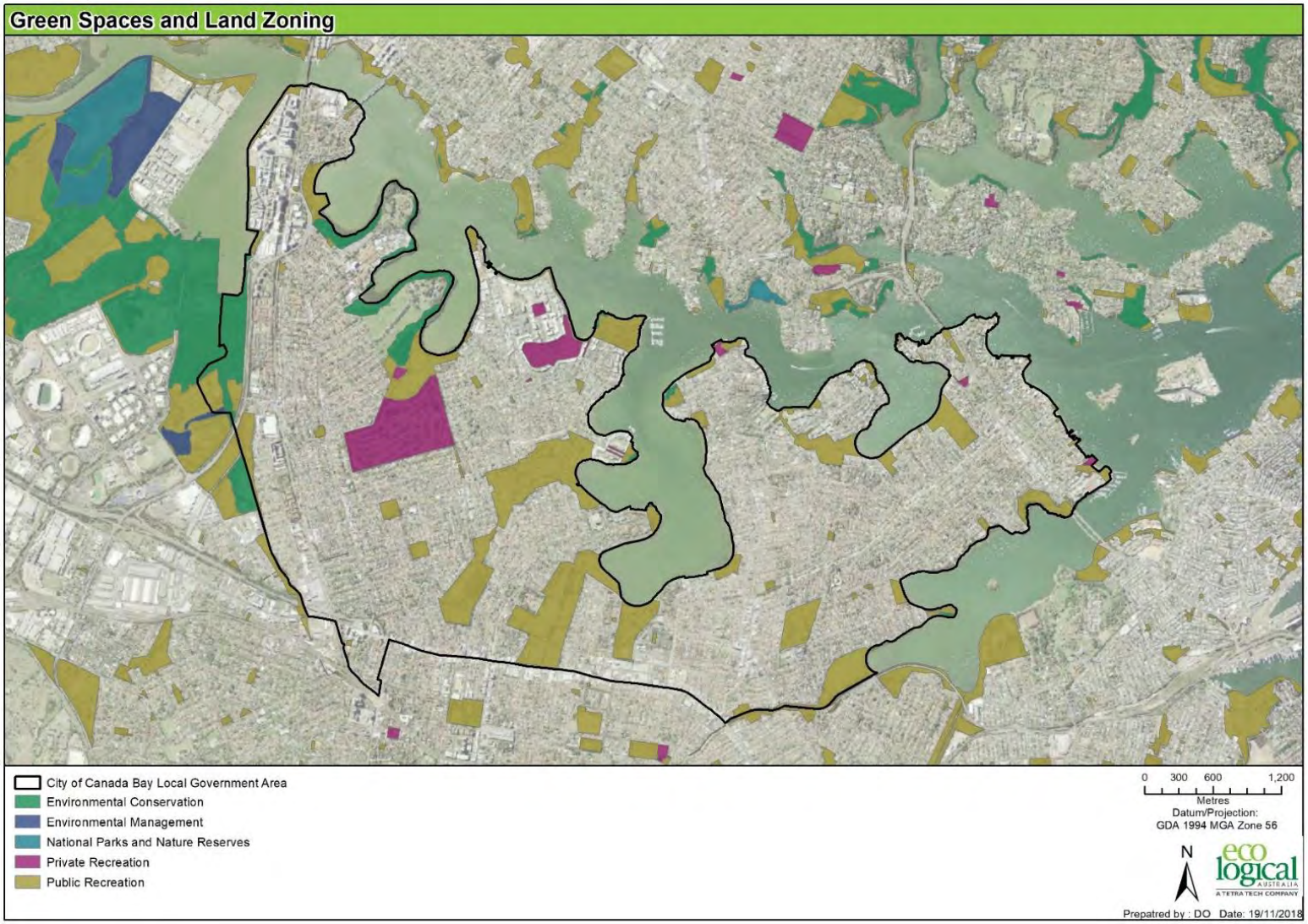

Figure 10: Green Spaces and environmental land zoning within the City of Canada Bay

3.5 Connectivity and ecological corridors

Canada Bay has areas of regional connectivity particularly along Parramatta River and through Sydney Olympic Park, linking to habitat outside of the LGA. This is supported by several locally connecting habitat pathways for small bird and mammal species. There is local connectivity for more localised species, as well as local connections made up of stepping stones made up of small patches of vegetation to individual street trees and gardens for more mobile species (Figure 11). This figure includes Green Grid mapping, and opportunities for its further enhancement is discussed in Sections 6 and 8.

Several studies have recommendations for corridors throughout the LGA (**Table 7**).

Table 7: Previous biodiversity studies with corridor recommendations

Study	Overview	Corridor Recommendations
City of Canada Bay Fauna Survey 2002-2003 D Hobcroft for Canada Bay Council	Valuable migratory shorebird habitat in the Parramatta River estuary. A diversity of native animals present in fragmented pockets with greatest diversity in foreshore wetlands, golf courses and recreation reserves.	Key Biodiversity Areas and corridors at: Rodd Point to Timbrell Park Quarantine Reserve, Halliday Park, Cintra Park, Barnwell Park Golf Course, Massey Park, Queen Elizabeth Park and Prince Edward Park Concord Golf Course, Arthur Walker Reserve, Yaralla, Dame Eadith Walker, Majors Bay, Rivendell Adolescent Unit, Lovedale Place, Bray's Bay Reserve Powells Creek Reserve, Mason Park and Homebush Bay Walker Street Rhodes
The Fauna of City of Canada Bay LGA 2013-2014, Insight Ecology 2014 for Canada Bay Council	One of the oldest urban landscapes in Australia, biodiversity survives in some of the last stands of remnant native vegetation, with diverse suite of indigenous fauna and migratory species	Recommended 5 priority connectivity target zones: Iron Cove Creek and Timbrell Park to Rodd Point including Henley Marine Drive mudflats and mangroves Nield Park to Five Dock Bay and Abbotsford Bay Kings Bay to Exile Bay and France Bay including Queen Elizabeth Park to Massey Park Golf Course Strathfield North Public School to Brays Bay including Concord Golf Course, Yaralla and Rivendell peninsulas Mill Park to Bicentennial Park east and Powells Creek Reserve; and Coonong Road urban neighbourhood site - home gardens and street verges east-west along Coonong, Bangalla and Wunda Roads.
Our Living Catchment – Native Habitats and Fauna, Parramatta River Catchment Group (PRCG), 2014	A number of migratory, threatened and rare species occur on foreshores and native species remain in the highly urbanized bushland. Need to identify and establish key linkages and stepping	Iron Cove to Hen and Chicken Bay: • Parramatta to Rodd Point/ Nield Park via Five Dock Park • Five Dock Park to Nield Park • Taplin Park and The Esplanade

Study	Overview	Corridor Recommendations
	stones between important areas of native habitat for dispersing fauna.	• Hen and Chicken to Abbotsford Bay Kings Bay to Powells Creek • Kings Bay to Canada Bay • Exile Bay and Massey Park Golf Course • Kings Bay to Queen Elizabeth Park • Majors Bay to Massey Park Golf Course • Majors Bay to Bicentennial Park • Rhodes Park to Porters Creek
Parramatta River Catchment Ecological Health Project, CT Environmental 2017 for PRC Group	Five iconic species (river mascots) identified from the catchment that are valued by community. Habitat requirements link to the goal to make the river swimmable by 2025.	Recommendations for habitat management and creation of linkages for each of the five species. Create habitat through the Sydney Green Grid to support movement within and between catchments
Connected Corridors for Biodiversity, last updated 2019, Southern Sydney Regional Organisation of Councils' (SSROC) and Sydney Coastal Councils Groups (SCCG) for Local Land Services (LLS)	Web-based interactive habitat corridor map based on desktop review of vegetation. Guide to regulatory tools, financial incentives and other mechanisms for promoting biodiversity conservation on private property	Supporting areas are mapped demonstrating linkages to priority habitats and supporting habitats along all foreshores, all creeklines and public and private open space. Tools are broad and may be applied across the whole SSROC area.

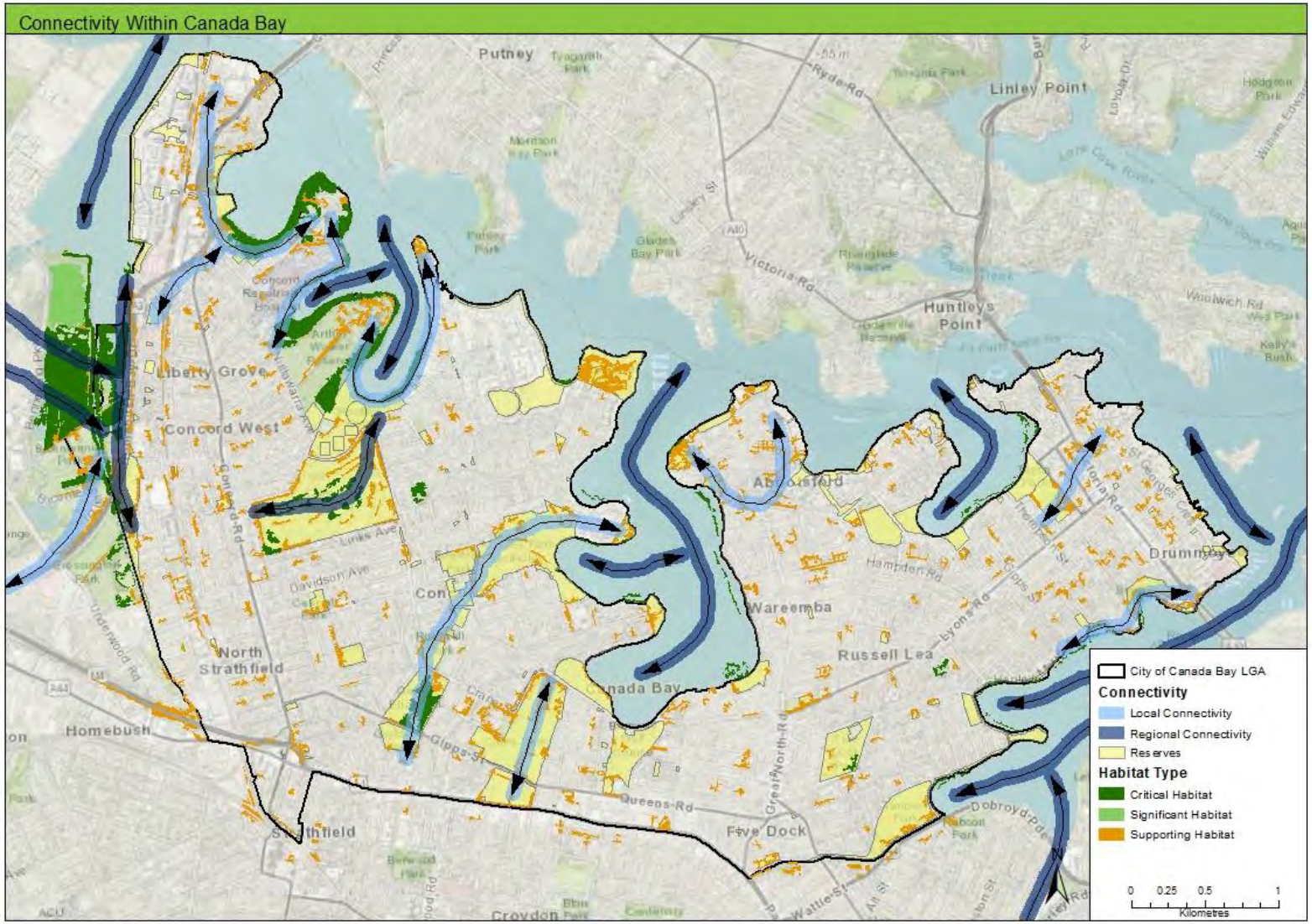

Figure 11: Connectivity within Canada Bay

4. Field Investigations and Stakeholder Consultation

Field investigations and stakeholder consultation were designed in collaboration with Council staff. Project collaboration included Council's capital works design team and planners and Councillors.

4.1 Field Investigations

shows the field survey of selected sites that were undertaken as part of the preparation of the Biodiversity Framework. The results for each site are outlined as a profile that describes:

- the vegetation type and condition,
- visible waterway condition issues,
- important local habitat,
- corridor enhancement opportunities,
- significant biodiversity threats/ issues,
- park photographs and
- maps the native vegetation communities and vegetation condition of the park.

4.1.1 Bushcare Consultation

During the field survey portion of the Biodiversity Framework, ELA consulted with local Bushcare groups on the habitat values, trends and opportunities within Canada Bay's terrestrial habitats. The Bushcare groups included Chiswick, Concord, Quarantine Reserve Abbotsford, Sisters Bay and Yaralla.

4.2 Stakeholder Consultation

After conducting consultation with a wide array of stakeholders, some of the key issues and opportunities identified were:

- There is an ageing demographic within the Bushcare groups as well as a lack of consistent volunteers.
- Impacts associated with native bird habitat such as dogs off leads and the removal of preferred habitat through both development and landscaping and maintenance activities.
- Concerns over the dieback of mangroves due to wash from RiverCats along Parramatta River.
- A loss of diversity in native vegetation and habitat due to maintenance 'tidying up', lack of fires and vegetation succession.
- Collaboration opportunities:
    - Continuing to work with the SOPA on the mangrove education program;
    - Working with the SOPA with the Homebush Bay walking and cycling circuit project to ensure it is in line with the Sydney Olympic Park Environmental Guidelines and Biodiversity Management Plan;
    - Working with OEH and the Sydney Coastal Council Group to develop a Parramatta River – Sydney Harbour Coastal Management Program; and
    - Ensuring differing teams within Council such as the natural resources, sustainability and landscape maintenance teams, work together to ensure better biodiversity outcomes.

The results of the full consultation are outlined in Appendix G.

5. Threats

The biggest threat to fauna has historically been habitat loss and encroachment; Canada Bay was one of the earliest parts of Sydney to experience extensive urban development, with development practically complete by 1945 (Hobcroft 2003).

The biodiversity values of the City of Canada Bay (CoCB) LGA are threatened by factors typical of urban areas. Two factors particularly relevant to CoCB are increased pressure on existing biodiversity from a rapidly expanding population and ongoing edge effects on already small and fragmented remnants. Other key threats include the loss of understorey, woody debris and other habitat due to 'tidying up' vegetation and the ageing and decline of the traditional Bushcare volunteer. Removal of native understorey, fallen and dead material, as well as rocks to achieve a 'tidy' look contributes to three key threatening processes under the BC Act listed as 'bushrock removal', 'removal of dead wood and dead trees' and 'clearing of native vegetation'.

Threats to Canada Bay's biodiversity are discussed below and are based on a review of literature, including previous ecological studies, bush regeneration activity reports and CoCB Plans of Management, field inspections and consultation with Bushcare volunteers.

5.1 Edge effects

Most of the native vegetation within Canada Bay is located along the Parramatta River foreshore and creek lines. The long linear shape of the majority of these areas creates a high edge to area ratio, so that edge effects such as weed invasion penetrate the entire reserve. As such, the native species richness of most reserves in CoCB is currently threatened by edge effects including weed invasion, pollution and disturbance from neighbouring residential and commercial areas. In contrast, larger patches of vegetation such as those between Brays Bay and Yaralla Bay contain a core of vegetation buffered from impacts by surrounding vegetation.

An edge effect impact on biodiversity that is generally less known is the effect of artificial lighting on nocturnal fauna, such as micro-bats which have been recorded as occurring within the LGA (**Table 8)**. Biosphere (2007) noted that a single back yard spotlight can dislocate fauna for 50 metres either side of the light source. This can effectively reduce the area of habitat for some native fauna. The large bright lights at sporting fields can impact adjacent bushland due to the height and intensity of the light, e.g. the lights surrounding Goddard Park, Drummoyne Oval and Timbrell Park (Figure 12).

Table 8: Micro-bat records within Canada Bay and within 5km of the LGA.

Common Name	Scientific Name	Records	Records post-1990	NSW status
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	123	122	Vulnerable
Eastern Freetail-bat	*Mormopterus norfolkensis*	13	13	Vulnerable
Greater Broad-nosed Bat	*Scoteanax rueppellii*	1	1	Vulnerable
Little Bentwing-bat	*Miniopterus australis*	1	1	Vulnerable
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	8	8	Vulnerable

Figure 12: Spotlights at Timbrell Park.

5.2 Increased runoff and nutrients

The relatively large area of impermeable surfaces in highly developed urban areas such as Canada Bay including roads, car parks, paving and the roofs of buildings increases the amount of stormwater runoff entering Parramatta River, creeks and drainage lines. This runoff contains nutrients that change the soil nutrient levels of urban bushland and favours the growth of weeds. So, in addition to weed invasion from the edges of reserve, the presence a drainage line within the centre of many of Canada Bay's reserves provides another source of nutrient and weeds including "garden escapees" from residential areas.

5.3 Weed invasion

Weed invasion is a significant and pervasive threat for all Canada Bay's remnant bushland areas. The resilience or ability of Canada Bay's bushland to resist and recover from weed invasion has been compromised by a long history of disturbance, fragmentation of bushland, the small size of remaining bushland patches and urban stormwater run-off. Invasion and establishment of exotic vines and scramblers, Lantana and exotic perennial grasses, as well as and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants are four key threatening processes listed under the BC Act.

A number of Council reserves have been worked as a part of an ongoing bush regeneration program for a relatively long period (particularly Queen Elizabeth Park which has been worked for over 20 years) and

Council staff and Bushcare volunteers currently work in several Council reserves. These Bushcare groups have made substantial progress, but weed invasion remains a significant problem for vegetation in the LGA.

In an urban landscape such as Canada Bay, pro-active on-going management is required to conserve and maintain the biodiversity values and functions of fragmented remnant bushland. Areas that receive an inadequate level of management or no management will decline, eventually permanently losing their viability and potential for restoration (ability to recover). As Canada Bay supports only a small area of remnant bushland, pro-active management of all surviving remnants is warranted. A high priority for management focus is for the majority of Council-managed remnant vegetation to be under an ongoing bush-regeneration program before resourcing revegetation works (areas with no remnant vegetation) in other areas of open space.

Further bush regeneration and weed management opportunities have been documented under Fauna corridors and habitats.

5.4 Altered or absent fire regimes

Fire regimes have a crucial role in the life cycle in Canada Bay's remnant vegetation by stimulating the release or germination of seeds, facilitating the establishment of seedlings by liberating resources and reducing the competition of standing vegetation (Auld and Keith 2009).

The lack of fire within urban bushland also alters the species composition towards that of a mesic (moist rainforest-like) forest instead of fire-adapted sclerophyllous vegetation, which is generally typical of the native vegetation along ridges and plateaus within Canada Bay. Species diversity generally declines with increasing time since fire in sclerophyllous native vegetation, as mesic natives (e.g. *Pittosporum undulatum*) and exotic fire sensitive weeds become dominant. It is likely that in an urbanised environment such as Canada Bay most remnant vegetation is long unburnt. The occurrence and diversity of some long-lived fire-sensitive species is probably an indication that fire has had negligible impact in some areas.

Environmental/ecological burns can assist with regenerating urban bushland, creating patches of differing flora height and density, and allowing fire-adapted species to re-sprout or shoot. On the contrary, areas of bushland that are burnt too frequently will result in the loss of native species richness, particularly from obligate seeders. Obligate seeders are plants which do not re-sprout following fire, but regenerate from seeds buried in the soil or retained in woody fruit. The fire-interval must be long enough to allow such plants to grow and reproduce to produce a seed bank (Gill and Williams 1996).

Willoughby City Council began trialling ecological burns in 2007 and found a dramatic increase in native plant species diversity - particularly those species absent from the mid-storey layers prior to the burn (WCC, n.d.). During the post-fire survey, native species were found in the burnt area that had not been recorded in the reserve system for 20+ years. WCC undertakes pile and raft burns that could be utilised within vegetation communities that are in decline in Canada Bay, of concern being Sydney Turpentine-Ironbark Forest. This would require careful investigation and would need to comply with Best Practice Guidelines for Sydney Turpentine-Ironbark Forest (Department of Environment and Climate Change, 2008), practices outlined in Restoring Natural Areas in Australia (Buchanan, 2009) and Standards for Pile Burning (NSW RFS and Fire and Rescue NSW, n.d.).

5.5 Domestic pets and introduced fauna

Predation and disturbance by cats, dogs and foxes is the main reason for the significant decline and extinction of terrestrial ground dwelling mammals and reptiles in Canada Bay such as the Long-nosed Bandicoot and Eastern Blue-tongue Lizard. Large reptiles including blue-tongue lizards, bearded dragons, goannas and large snakes are scarce due to loss of habitat and predation by domestic and feral animals. The lack of vegetative cover and habitat in the form of fallen timber and rocks and the small size of reserves makes terrestrial mammals and large reptile species more vulnerable to predation.

Several introduced bird species occur in Canada Bay, including the ground-foraging granivores Spotted Dove and Rock Dove, and the omnivores Common Myna and Common Starling. These species are generally exploiting human environments including planted vegetation along streets and parks and in front and rear yards (Insight Ecology 2014).

Of particular concern are pet dogs and cats in the LGA, for both predation and disturbance. Dogs off leashes in reserves, or even those on leashes, can scare away or predate native species. Dogs in foreshore habitats have been directly observed chasing and scaring resting shorebirds, including the listed migratory Bar-tailed Godwit (Hobcroft 2003, Insight Ecology 2014). Hobcroft recommended that dogs be excluded from the immediate foreshore areas of Halliday Park, Prince Edward Park, Bray's Bay Reserve and Yaralla. Efforts to prevent this have been undertaken, such as the Dog Save Bird campaign, but it remains an issue for the many migratory and local shorebirds which are regularly found in Canada Bay. During the 2014 fauna survey, cats were also regularly observed in reserves at night and are a suspected predation risk.

5.6 Aggressive native birds

Small insect eating birds such as wrens, thornbills, and fantails have been especially affected by urbanisation and are now largely absent in most of the built-up areas of our cities. A major cause for their decline is the abundance of larger native birds such as ravens, currawongs and butcherbirds which have adapted well to urbanisation. Several of these species are voracious nest predators (Birdlife Australia n.d.) preying upon small bird nestlings and eggs during the breeding season.

The Noisy Miner is a sedentary, highly aggressive honeyeater endemic to eastern Australia which has benefitted by large scale vegetation changes such as the loss of understorey vegetation. These birds are strongly implicated in the loss of small birds from cities because they aggressively exclude smaller species in competition for food resources (DoEE 2014). Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners is a key threatening process under the BC Act.

5.7 Development and infrastructure

Development and infrastructure works in parks or reserves can impact native vegetation communities through clearing and disturbance. Typical works include maintenance of existing infrastructure, including pathways, adjoining recreational facilities, underground services, powerlines, adjoining roads and stormwater. Similarly, developments occurring on adjoining properties or upstream from parks and reserves can have negative impacts. Poor site management and inadequate sediment controls can lead to waste material impinging on the reserves as well as increased stormwater, erosion and sediment load.

While Canada Bay has been almost completely urbanised since 1945 (Hobcroft 2003) there is development continuing in the LGA, such as the current and planned redevelopment of the Rhodes peninsula (DPE 2017). The peninsula is located between the two largest areas of remnant habitat in the LGA so risks affecting both areas if poorly managed. Conversely, the development of the peninsula also represents an opportunity to better connect the two habitats, for small birds, shore birds and mammals.

An increasing population in high density developments put greater pressure on open spaces and natural environments. This is due to increased foot traffic, waste production, potential transport of non-native seeds into new areas, potential increase in domestic pets, increased light pollution, and increased likelihood of informal pathways and vandalism through native areas. It can also lead to demand for additional infrastructure that may directly or indirectly impact areas of high biodiversity values.

5.8 Deliberate damage to trees

Mangroves play a vital role in foreshore ecosystems, stabilising creek banks, filtering water, providing habitat for juvenile fish, birds and terrestrial fauna and more. Mangroves are also protected under the *Fisheries Management Act 1994* due to their role in estuarine ecosystems. Despite their importance and legal protection, the mangroves in Canada Bay have experienced continued vandalism, primarily from residents concerned that the mangroves obstruct their foreshore views (Figure 13, R. Stevenson – pers. comm. 2018). The Mind our Mangroves project seeks to minimise this threat, but vandalism remains an issue in the area.

Figure 13: Mangrove vandalism at Drummoyne (City of Canada Bay n.d.).

5.9 Water Pollution

Stormwater polluted with litter, chemicals such as pesticides and oils, nutrients and sediment enter creekline and estuarine ecosystems with a corresponding reduction in aquatic biodiversity. The major threats in Canada Bay include:

- The high flows of nutrients from stormwater drains increasing mangrove incursion into mudflats
- Poor water quality from Iron Cove Creek, Cintra Park and other stormwater canals
- Wave erosion of foreshores caused by boats and ferries
- Sediment smothering seagrass beds affecting light penetration
- Decaying green waste siphoning oxygen from the water detrimentally affecting and even killing plants, fish and other animals in the aquatic ecosystem
- Heavy metals and pesticides bio-accumulating in aquatic plants and animals and concentrating up the food chain
- Plastic debris clogging waterways and deposited in Sydney Harbour entangling or poisoning wildlife as it breaks down,
- Fishing line and stainless steel or alloy hooks discarded from boats, beaches, jetties or anywhere else remaining in the aquatic environment for very long periods of time continuing to kill or injure marine life.

These contribute to 2 key threatening processes under the BC Act, including entanglement in or ingestion of debris in estuarine environments, and alteration to the natural flows of rivers and streams and their floodplains and wetlands.

5.9.1 Damage to Seagrass Meadows and Aquatic Habitat

Canada Bay's seagrass meadows occur in sheltered areas and shallow waters along the harbour foreshore. Seagrass meadows serve three key ecological functions (DPI 2007):

- Provide habitat for fish and other aquatic fauna,
- Help to reduce erosion and improve water quality
- Provide a source of food for fish and other aquatic fauna.

Research has indicated that seagrasses are among the planet's most effective natural ecosystems for capturing and storing carbon; but if degraded, they could leak stored carbon into the atmosphere and accelerate global warming (Mcreadie et.al 2013).

Seagrass beds are extremely fragile habitat that can be easily destroyed; they are often damaged directly by boating-related activities (mooring and driving over seagrass in shallow waters) and by dredging and reclamation. In Canada Bay, this may relate to boating activities such as the River Cat undermining foreshore and depositing sand on marine habitats. Foreshore structures such as pontoons and jetties can also shade seagrass, causing indirect damage. Stormwater outlets can cause physical scouring of seagrass beds and can smother seagrass with sediment (DPI 2007).

5.10 Global Climate Change

Anthropogenic climate change is listed as a key threatening process under the BC Act and will impose major impacts on species and ecosystems, although many of the potential impacts on ecological processes remain poorly understood (Auld and Keith 2009). The means by which global climate change could affect biodiversity include increased frequency of extreme weather events, disrupting the life

cycles of flora and fauna, exposure to new pathogens and predators and loss of habitat from sea level rise (Auld and Keith 2009). Examples of the potential impact of climate change in the Canada Bay LGA are sea level rise inundating harbour-side vegetation habitats and changing the distribution of seagrass meadows, and the exacerbation of weed invasion from changed temperature and moisture regimes.

6. Opportunities

6.1 Strategic planning and improving connectivity and habitat

One of the overarching goals for biodiversity in Canada Bay is the enhancement and connectivity of remnant and fragmented habitat which has benefits for multiple species of native flora and fauna across a locality. Canada Bay comprises a variety of high-value habitats ranging from some of the only patches of Sydney Turpentine-Ironbark Forest in metropolitan Sydney to interconnected fringing Swamp-oak forest and saltmarsh habitat on the Parramatta River foreshore. Sydney Turpentine-Ironbark Forest is an Endangered Ecological Community, listed in Part 2 of Schedule 2 of the *Biodiversity Conservation Act 2016.* Remnants of this community in excellent condition occur in Dame Eadith Walker Reserve and Queen Elizabeth Park (Lembit 2009). The northern part of the LGA has the greatest diversity of vegetation (Figure 14).

Improving connectivity in Canada Bay requires a multifaceted approach, due to the patchiness of remaining habitat and reduced available space within the LGA to recreate habitat (Figure 11). Connecting habitats and protecting/enhancing biodiversity should focus on improving habitat in Council reserves; maintaining and improving native vegetation on school and church grounds and golf courses; and encouraging native planting and supporting biodiversity on private lands (Lembit 2009). Connecting both public and privately-owned areas can provide important areas of habitat and contribute to linkages to bushland patches.

The Local Environmental Plan (LEP) and Development Control Plan (DCP) are key mechanisms to implement vegetation controls for protection and enhancement to effectively improve connectivity and native habitat in Canada Bay. The LEP and DCP can also encourage emerging innovations to increase habitat and biodiversity, such as green roofs and integrated open spaces. The Green Grid should be integrated into the planning controls.

The Green Grid (Eastern City District Plan, updated 2018) identifies projects important to the District at:

- Powells Creek and Mason Park Strathfield near Sydney Olympic Park,
- Rhodes and Concord Open Space and Hospital Precinct near Dame Eadith Walker Estate,
- Arthur Walker Estate and Brays Bay, and
- Hen and Chicken Bay Foreshore.

The Green Grid also identifies other opportunities to meet the objectives to increase urban tree canopy cover and to link parks, open spaces, bushland and walking and cycling paths. These have been included in the analysis of existing and future habitat connectivity and appear as Regional priorities.

'A strategic approach to protecting the biodiversity in the Eastern City District involves investing in connected bushland corridors and protecting larger pockets of remnant vegetation, as large and connected areas of bushland give the District's wildlife the greatest chance of survival. Councils are also working together to map opportunities to restore and reconnect areas of habitat in established urban areas. This approach complements the delivery of the Greater Sydney Green Grid. Selected species of trees and understorey plants for parks and street planting in targeted areas support the movement of wildlife and help strengthen connections between areas of habitat.

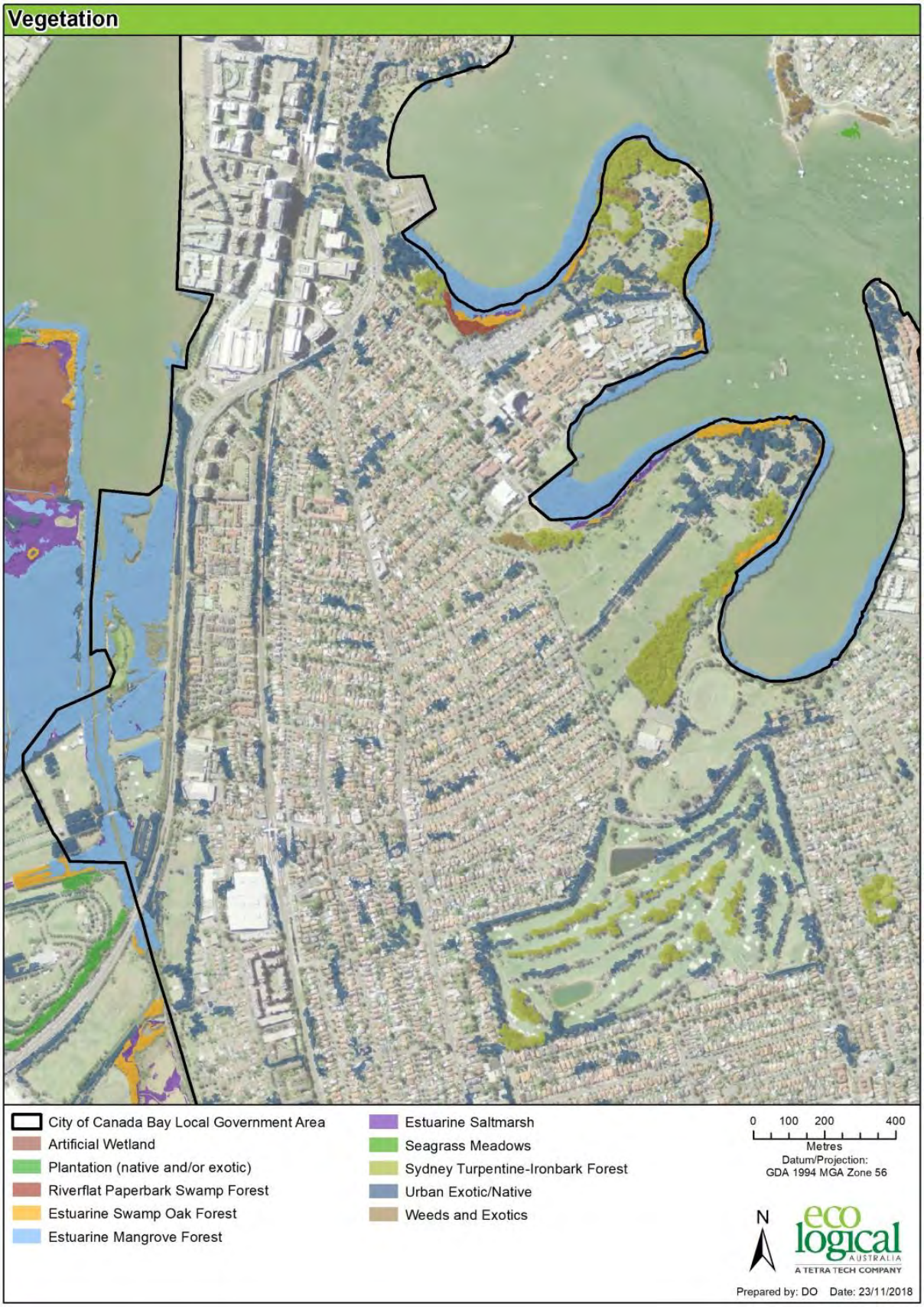

Figure 14: Area of greatest vegetation diversity in Canada Bay

Strengthening the protection of bushland in urban areas will help preserve the District's scenic landscape and enhance its tourist and recreational values. Remnant vegetation should be recognised as an asset that can be incorporated into the planning and design of neighbourhoods, for example in parks, school grounds and as street trees.' (Eastern City District Plan, updated 2018).

Green Grid and other habitat connectivity opportunities are discussed in more detail Section 8 and **Appendix H.**

Natural areas within Canada Bay may be allocated a natural asset value with recurrent and capital funding so they can be managed in the same way as other assets within the LGA and valued accordingly. This would allow better protection of the areas and reduce competition from other stakeholders. Support for joint projects between the Sustainability section and Bushcare section of Council is also recommended, as it will allow for wider ranging outcomes for the community and the natural areas. This would also increase the opportunities for Council to access more grants and funding for larger projects.

6.1.1 Increasing density of shrubs, rocks and logs

Many small birds, mammals and reptiles rely on mid-storey and shrubby habitat, both for food resources and protection from predators. Unfortunately, these habitats are often actively removed from urban habitats due to perceived concerns about security and aesthetics. In Canada Bay, improving small bird biodiversity would require increasing shrub density within the LGA. Most reserves/parks in the LGA have opportunities to increase shrub density, such as in Timbrell Park, within bushland extending towards the canal (Figure 15) and in Henry Lawson Park along the vegetated slopes (Figure 16). Revegetation of the riparian zone with higher shrub density and the presence of logs and rock structures would increase the habitat, food availability and provide predation refuge for small birds, mammals and reptiles in the LGA.

Other opportunities for increasing shrub density occur in the LGA. Council is currently 'naturalising' canals into creeks in the LGA such as at Powells Creek, replacing concrete banks with gently sloping banks with sandstone and native plants. This provides habitat for birds and other native species and may improve habitat connectivity within the LGA. This program should be undertaken throughout the canals in the LGA. It is recommended that not only canopy trees and grasses are planted but also shrubs and mid-storey trees where possible.

There should be a focus on maintaining and enhancing shrubby small bird habitat as a part of landscape maintenance works undertaken by Council and Golf Course staff in developed open space. There is also opportunity for community planting days to restore bird habitat and create linkages on public land, such as during National Tree Day.

Plant selection is important to avoid shrubs such as grevillea and callistemon that have flowers which are accessed by Noisy Miner, and to plant shrubs such as *Indigofera australis, Melaleuca thymifolia, Dillwynia, Daviesia* and *Pulteanea species, Bursaria spinosa, Kunzea ambigua, Hakeas*. These plants have attractive flowers and will draw in a wide variety of pollinators. Some have spikes and will attract smaller birds. Plant selection should be based on the habitat that is to be created, or if within a threatened ecological community, the species composition for that community, matched to available specialist stock plants from licensed indigenous native plant nurseries.

Figure 15: Opportunity to increase low shrub and mid-storey density in Timbrell Park

Figure 16: Opportunity to increase low shrub and mid-storey density in Henry Lawson Park

6.1.2 Supporting and encouraging private native planting

Shrub density can also be provided by private gardens; however, many residents tend to favour a more ordered and tidy aesthetic and are unaware of the importance of dense shrubs to small native birds. Small birds, such as the Superb Fairy-wren are both photogenic and widely valued by the public. These species could be the focus of an educational campaign on encouraging native species in private gardens and an incentive program such as a plant giveaway. There is a strong sense of environmentalism in

Canada Bay (City of Canada Bay 2018), so a public education program could be very successful, particularly if paired with incentives for planting native shrubs in residential gardens. Small birds represent one of the key areas in biodiversity within the LGA and are widely valued by the community (Insight Ecology 2014), so could become an icon for promotion and enhancement of biodiversity values within Canada Bay.

6.1.3 Fauna corridors and habitats

There are several opportunities to better connect habitats both within the LGA and with neighbouring LGAs discussed here and in Section 3.5. For example, Iron Cove Creek acts as a hard barrier for fauna to move across (Figure 17). While this will be improved when the creek is naturalized as identified in future works, connectivity could be further enhanced with the construction of a green bridge across the creek. Green bridges are landscape bridges or wildlife overpasses planted with a variety of local trees or shrubs and other vegetation. They allow birds, mammals and insects to keep moving despite urban infrastructure railway blocking their path. They create a crossing point for wildlife movement, connecting habitats and they are also used by wildlife as a habitat, create a crossing point for people and benefit pollinators, as well as integrating infrastructure barriers into the surrounding landscape. This could facilitate fauna movement and would likely be supported by the community due to the increasing desire for green public spaces. There are parks on either side of Iron Cove Creek, so this initiative would be a joint project between Canada Bay and Inner West Council.

There are records of the Rakali (formerly called the Water-rat, *Hydromys chrysogaster*) in Canada Bay. Other than the platypus, the Rakali is Australia's only native amphibious mammal and could be the focus of greater public education and protection due to its elusive nature and unique biology (Insight 2014). Public education could focus on the importance of the Rakali and its differences from feral *Rattus* species. Montague Park / Bay Run presents opportunities to supplement Rakali habitat, such as artificial burrows and enhancement of foreshore habitat.

There is opportunity for retention of old trees with hollows that provide habitat for a range of for fauna within Canada Bay which has several reserves with hollow-bearing trees. Loss of hollow-bearing trees is a key threatening process under the BC Act. Hollow formation in Eucalypts can take 100 years to form a small hollow, 200 years to form a medium-sized hollow and longer for a large hollow, therefore retention of such trees is critical (Mackowski 1984; Menkorst 1984; and Scotts 1991). Many species of fauna use and are dependent on hollows, including bats, possums, owls, parrots, ducks, rosellas and kingfishers as well as numerous species of snakes, frogs and skinks. Where old trees occur, exclusion zones can be introduced to address safety issues for members of the public where required. Creation of artificial hollows, installation and monitoring of nest boxes, and re-erection of hollows from removed trees should also be considered and implemented where appropriate. The Royal Botanic Gardens hosts the program 'Hollows as Homes' for Council and the community to record hollow availability and wildlife sightings. Retention of fallen branches and logs is important for fauna habitat.

The implementation of the Dog Saves Bird program has been very successful in Canada Bay. The program aims to reduce interactions between domestic dogs and native birds, especially shorebirds. By encouraging dog owners to keep dogs on leads and away from resting shorebirds, there is potential to increase shorebird use of Canada Bay's foreshore habitats and better protect migratory birds, which need sufficient food and rest for their migrations. In a joint program with Abbotsford Public School, Council installed several educational signs along the foreshore pathway of Hen and Chicken Bay as well

as nearby Henry Lawson Park and Halliday Park. Consideration should be given to introducing The Dog Saves Bird program at Rodd Point and other key shorebird habitats. As with Hen and Chicken Bay, this could be done in conjunction with the trialled leash-free areas of the Canada Bay LGA, allowing dog owners opportunities to let dogs off leashes in safe areas, while still protecting important native species.

Other recommended areas of enhancement or focus for connectivity include the small bird habitat in Liberty Grove; Rhodes peninsula to Iron Cove (Figure 17Figure 17); linking Lovedale Place and the Kokoda track; Queen Elizabeth Park to Cintra Park; and Quarantine Reserve to Abbotsford Point. Connectivity opportunities are discussed further in Section 8 and **Appendix H**.

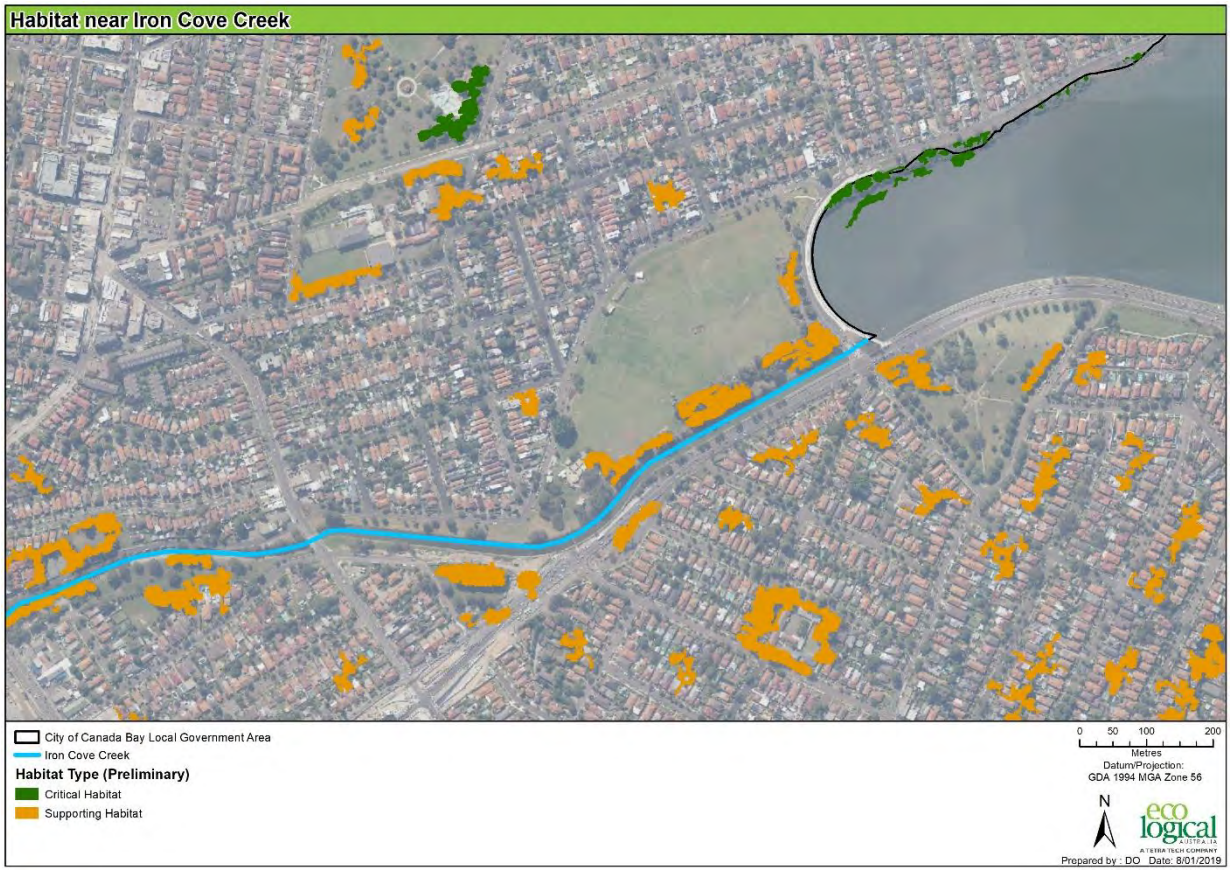

Figure 17: Habitat near Iron Cove Creek

6.1.4 Light pollution

Light pollution can be reduced by limiting the duration of spotlight illumination, reducing the brightness of lights where possible, installing shield fixtures to reduce light scattering, and using narrow-spectrum light sources to reduce the wavelengths likely to interfere with animal behaviour (Gaston et al 2012). High priority areas where the implementation of measures to reduce light pollution should be considered would be located adjacent to important habitat.

6.1.5 Run-off and nutrients

The run-off and nutrients entering creeks and Parramatta River can be reduced by mitigation measures such as establishing natural wetlands and detention basins. These soft and hard structures allow sediment to settle out of the water column and encourage native plant species to filter the water before

it enters larger waterbodies. These biofiltration systems can be installed as raingardens in smaller urban sites and constructed wetlands in larger areas of open space (Biofilters and wetlands for stormwater treatment and harvesting, CRC for Water Sensitive Cities, 2014).

Additionally, measures can be undertaken to reduce the total sediment and nutrients washed off terrestrial areas. This includes methods such as enforcement of sediment measures in construction sites and educating the public on techniques such as using low-phosphorous fertilisers in gardens.

Other techniques to improve water quality and improve habitat value are to include environmental objectives in the design or retrofitting of flood retention basins on playing fields, to treat water quality as well as quantity.

6.2 Bushcare groups

Canada Bay is fortunate to have several active Bushcare groups, consisting of many highly motivated and experienced individuals. There is opportunity to develop and enhance these groups, particularly with the strong community support that these groups have within the LGA. It is noted that many of the long-time members of the Bushcare groups are increasing in age. Encouraging recruitment would allow the experienced individuals to train newcomers thoroughly before retiring from these groups. This would allow the wealth of knowledge accumulated by experienced members to be retained even after they leave. Increasing Bushcare volunteers should be an ongoing, long-term project. Other LGAs use local radio for advertising and promotion of the Bushcare Program. In some urban Councils local schools are involved in the Bushcare program through a Bushcare Group working in the grounds, primary school involvement or senior students through TVET at TAFE.

Bushcare groups require consistent and strong focus from Council to ensure those volunteering their time feel that it is worthwhile. At least two full time staff with reasonable resourcing would arguably be a cost saving measure for Council, due to the value for money and extensive hours contributed by Bushcare groups (**Table 9)**. Several Bushcare members interviewed expressed the importance of feeling appreciated and supported by Council, not just for retaining members but encouraging interested people to become regular members. One Bushcare volunteer (Annette Ellison, pers. comm. 10/12/2018) emphasised that it takes a substantial amount of time for a volunteer to learn and become comfortable with native species, so it is particularly important to support the development and retention of long-term volunteers.

Another Bushcare volunteer (Frances Davis, 10/12/2018) mentioned having worked for Willoughby Council, and being particularly impressed by the quality of their organised volunteer program. Due to the diverse and changing nature of Canada Bay's population it becomes particularly important to communicate with different community groups to determine the best way to get them involved in environmental projects.

Table 9: Hours works and estimated value of Bushcare volunteering in Canada Bay

Financial year	Hours worked	Estimated value by Council ($35/hour)
2015/2016	826	$28 910
2016/2017	838	$29 330
2017/2018	725	$25,384

6.3 Schools and community programs

Council experienced significant success in their Sustainability Schools Network, and so also launched the Sustainable Childcare Network, both of which provide educational resources for educators, students and the school/centre community.

Canada Bay has had significant community support for one-off events, such as the National Tree Day, Schools Tree Day and Clean Up Australia Day. Further one-off events, where people are not required to make an ongoing time commitment, may be organised community action events encouraging more regular engagement (such as joining Bushcare groups). There have also been several students using environmental volunteering to fulfil components of the Duke of Edenborough Award, so this may be another opportunity for Council to further encourage.

Council should consider community involvement through programs that could include:

- Guided walks along foreshores and bushland areas
- Workshops for bee/insect hotel building, or partnership with 'Mens Sheds' workshops to construct bee/insect hotels
- Promoting or offering bush tucker workshops and dining experiences for residents to learn about edible weeds and native plants becoming more engaged with their natural environment and decrease chemical weed control.

6.4 Dame Eadith Walker Estate and Arthur Walker Reserve

The Dame Eadith Walker Estate is adjacent on two sides to large patches of native vegetation. Previously, the lawn area along the southern side of the estate was reduced by approximately 10-15m to allow the native vegetation in Arthur Walker Reserve to expand. Due to the long, linear nature of this area, even a 10-15m increase results in several hundred square metres of new bushland. This reduces the edge to area ratio which also increases reserve management viability. A further increase could make a substantial difference to the area of native vegetation in the Yaralla/Rivendell area. This is important for the viability of the Turpentine- Ironbark Forest EEC on site and would expand the width of linkages.

Arthur Walker Reserve also has potential opportunities for ecological burns, particularly in the section in poor condition (many exotic species). It may be a candidate for a trial of ecological burns in the LGA, such as only burning small patches of the reserve and determining the change in species over time. Some non-native species can exploit cleared areas following fire, so this would also require continued follow-up maintenance in the reserve.

6.5 Queen Elizabeth Park

Queen Elizabeth Park is the flagship for Sydney Turpentine-Ironbark forest in Canada Bay, having been enhanced and improved for over 20 years by dedicated volunteers. There is opportunity to increase natural regeneration and extend the areas of vegetation (Anne Gibbins, pers. comm. 10/12/2018). Paths through the forest could be formalised and the remaining vegetation either fenced off to reduce trampling or have low barriers installed to allow the vegetation cover to increase. Further signage is also recommended as it improves the public's perception of the park, both for the importance of the native vegetation and to reducing trampling through the area.

7. Current Funding and Programs

7.1 Regular Bushcare budget

City of Canada Bay invests in a yearly Bushcare budget, and contributes tools, morning tea and the time of Bushcare supervisors. This budget is then extended by the time and effort of the Bushcare volunteers. Council approximates the value of Bushcare volunteers at $35 an hour, so in the 2016/17 financial year the 838 hours worked by volunteered had an estimated value of $29 330 (**Table 9)**.

7.2 Our Living River

City of Canada Bay is part of the Our Living River campaign, a program focused on making the Parramatta River, west of the Harbour Bridge, swimmable again by 2025. This involves the development of swimming sites along the Parramatta River foreshore, regular water quality testing, and enforcement of laws and policies reducing the pollution and sedimentation of Parramatta Rivers.

7.3 Yaralla Bushcare Rehabilitation project

Council and the Yaralla Bushcare group completed the Yaralla Bushcare Rehabilitation Project through a grant supported by Greater Sydney Local Land Services through funding from the Australian Government's National Landcare Program. They have since won a second grant, with the support of the Sydney Local Health District for the conservation of the Sydney Turpentine Ironbark Forest (STIF) bushland remnant at Yaralla Estate in Concord West.

Grant funds will go towards bush regeneration contractors targeting weeds currently impacting on the endangered ecological community, and a Bushcare event for volunteers (City of Canada Bay 2017).

7.4 Estuary Management Program / Mind our Mangroves project

Council received a grant in January 2013 for an Estuary Management Program to increase public awareness of the importance of mangrove habitats, deter further incidents of vandalism and identify areas for enhancement of estuarine vegetation. The project was completed in May 2014. The project has since been developed into the Mind our Mangroves Project.

7.5 Sustainable Schools Network and Sustainable Childcare Network

As mentioned above, these are programs designed to educate students and children in sustainable living and protecting the environment.

7.6 Community grants and programs

Council administers the Small Environmental Grants for School program, the Small Grants Program for Individuals, the annual Community Grants Program and the ClubGRANTS program to support environmental work within the community.

Council also runs the Love Your Place program to encourage community groups, residents, local businesses and schools to get involved in the preservation and enhancement of natural areas in Canada Bay.

8. Future Opportunities for Connectivity

An area of highest priority for connectivity opportunities exists within the Yaralla and Rivendell peninsulas, which include some of the remaining stands of woodland/forest habitat for native fauna. There are also opportunities to protect and enhance connectivity for fauna habitat at Bicentennial Park with the current extent of remnant and planted vegetation around the three bays – Brays, Yaralla and Majors. These opportunities for connectivity include a link to Concord Golf Course and opportunities for enhancement of habitats within the golf course. Other priorities for increasing habitat connectivity and improving existing key fauna habitat occur between Massey Park Golf Course, Queen Elizabeth Park and Barnwell Park Golf Course, Abbotsford to Nield Park at Rodd Point, and Rodd Point to Timbrell Park. Areas of opportunity are described in **Table 10** and indicated by red circles in **Appendix H.**

Table 10: Habitat connectivity opportunities

Location	Highest Priority Habitat Connectivity Opportunities - Summary	Reference
Sydney Olympic Park – Powells Creek	Critical habitat for migratory waders, aquatic species including frogs. Vegetated by mangroves, saltmarsh, Swamp Oak. Linkages to Brays Bay/ Rhodes Peninsula for mobile species such as birds, microbats. Aligns with Green Grid project site at Powells Creek and Mason Park along renaturalised creekline, also linkages along railway line and west to east (Eastern City District Plan). Retain good small bird habitat at Liberty Grove, Wilga Street, Woonda Road. Opportunity to replant western side of Homebush Bay Drive for small bird habitat. Opportunities for riparian linkages along the foreshore, watercourses and in developments (constructed wetlands).	Hobcroft Insight PRCG SSROC
Rhodes Peninsula, Brays Bay Rivendell and Yaralla	Foreshore / critical habitat for migratory birds protected under the EPBC Act (Bar –tailed Godwit Bar-tailed Godwit, Sharp-tailed Sandpiper, Red-necked Stint and White-bellied Sea-eagle), mangroves, STIF. Aligns with Green Grid project site from Rhodes to Concord Open Space and Hospital Precincts (Rivendell and Yaralla – Thomas Walker, Concord and Dame Eadith Walker hospital grounds, Concord Golf Course and RSL). Opportunity for linkages - expand foreshore vegetation and create linkages to Rhodes Peninsula for mobile species through park and street planting, green rooves. Link Lovedale Place and Kokoda Track. Weedy vegetation in Yaralla provide small bird habitat and removal is staged	Hobcroft Insight PRCG SSROC
Majors Bay/ Concord Golf Course	Critical habitat for migratory and water birds (Bar-tailed Godwit) mangroves, STIF in SE part of Yaralla, STIF remnant trees and dams on Concord Golf Course. Opportunity for linkages – expand park, street and golf course plantings. Aligns with Green Grid project site.	Hobcroft Insight PRCG SSROC
Queen Elizabeth Park to Cintra Park	Critical habitat, STIF, opportunities for linkages through expansion of remnants, park and street tree plantings and school properties – linkage opportunities to create/enhance habitat for small birds, canal plantings and offline wetlands to enhance habitat for terrestrial and aquatic fauna. Aligns with Green Grid project site from Queen Elizabeth Park to St Luke's Park.	Hobcroft Insight PRCG SSROC
Quarantine Reserve to Abbotsford Point	Supporting habitat Isolated swamp oak forest, mangroves foreshore opportunities for park planting/ revegetation to provide native fauna habitat. Aligns with other Green Grid opportunity map. Feeding location for migratory birds at Wymston Parade Walkway and within Canada Bay.	Hobcroft Insight PRCG SSROC
Iron Cove to Rodd Point	Supporting habitat foreshore isolated mangroves (Bar-tailed Godwit, Bush Stone-curlew), linkage opportunities for revegetation with trees, shrubs and understorey to create/enhance	Hobcroft Insight

Location	Highest Priority Habitat Connectivity Opportunities - Summary	Reference
to Timbrell Park and Iron Cove Creek/ Canal	habitat for small birds, canal naturalisation where possible, riparian plantings and offline wetlands to enhance habitat for aquatic and terrestrial fauna. Aligns with other Green Grid opportunity map. Potential Dog Saves Bird project site (Bar-tailed Godwit with Abbotsford Public School).	PRCG SSROC

Other areas exist for linkages within streets, golf courses and waterways, urban parks and foreshore areas in the LGA:

- Concord West: in an east west link via home gardens and street verges in along Coonong, Bangalla and Wunda Roads, from Concord Road to Queen Street. Located between Yaralla Estate and Bicentennial Park, there is potential for street planting to enhance the remnant eucalypts Red Mahogany and Grey Ironbark in backyards and hedges providing habitat for small birds.
- Majors Bay to Massey Park Golf Course, via Majors Bay Reserve, Concord Golf Course, Majors Bay Road Reserve, and Edwards Park
- Kings Bay to Cintra Park via Barnwell Park Golf Course
- Exile Bay and Massey Park Golf Course, via Bayview Park, Durham St foreshore
- Kings Bay to Canada Bay, via Halliday Park, Friend Ave Reserve, Barnwell Park, Maple Reserve, Charles Heath Reserve, and Cintra Park
- Hen and Chicken Bay to Abbotsford Bay, via Russell Park, Chambers Park, Blackwall Point Reserve, Armitage Reserve, Figtree Bay Reserve, Wiremill Reserve, Abbotsford Cove Foreshore Park, Werrell Reserve, Battersea Park, Quarantine Reserve, and Henry Lawson Park
- Extension to Drummoyne Park, via The Esplanade, and Taplin Park
- Five Dock Bay to Nield Park, via Russell Park, Lysaght Park, Campbell Park, and Alison Park.

Locally indigenous plants suitable for corridors are included in **Appendix I**.

9. Priority Ranking

Areas of vegetation across the LGA have been prioritised in accordance to habitat value and potential threat to biodiversity.

Areas that are critical habitat form the basis of effective biodiversity linkages within and outside of the LGA, and have been identified to promote and maintain regional biodiversity habitat connectivity. These areas should be managed for these values where possible.

Potential threats to biodiversity were identified and ranked to determine which areas of biodiversity are at risk and require management emphasis (Figure 18). Using habitat values and threat values for Reserves within the Canada Bay, a management priority was derived for Reserves using the management priority matrix (**Table 11**).

Table 11: Management priority for reserves based on habitat value and potential threats

		Critical Habitat	Significant Habitat	Supporting Habitat
Potential Threat Value	**High**	VH	H	M
	Moderate	H	M	L
	Low	M	L	VL

Areas of Very High (VH) prioritisation have the greatest urgency for management and action, whereas areas identified as Very Low (VL) prioritisation have a lower priority for management.

Critical habitat is prioritised as very high having the greatest urgency for management and action, however Supporting Habitat and prioritised linkages also have high priority for action to create habitat linkages (Figure 19 and Figure 20).

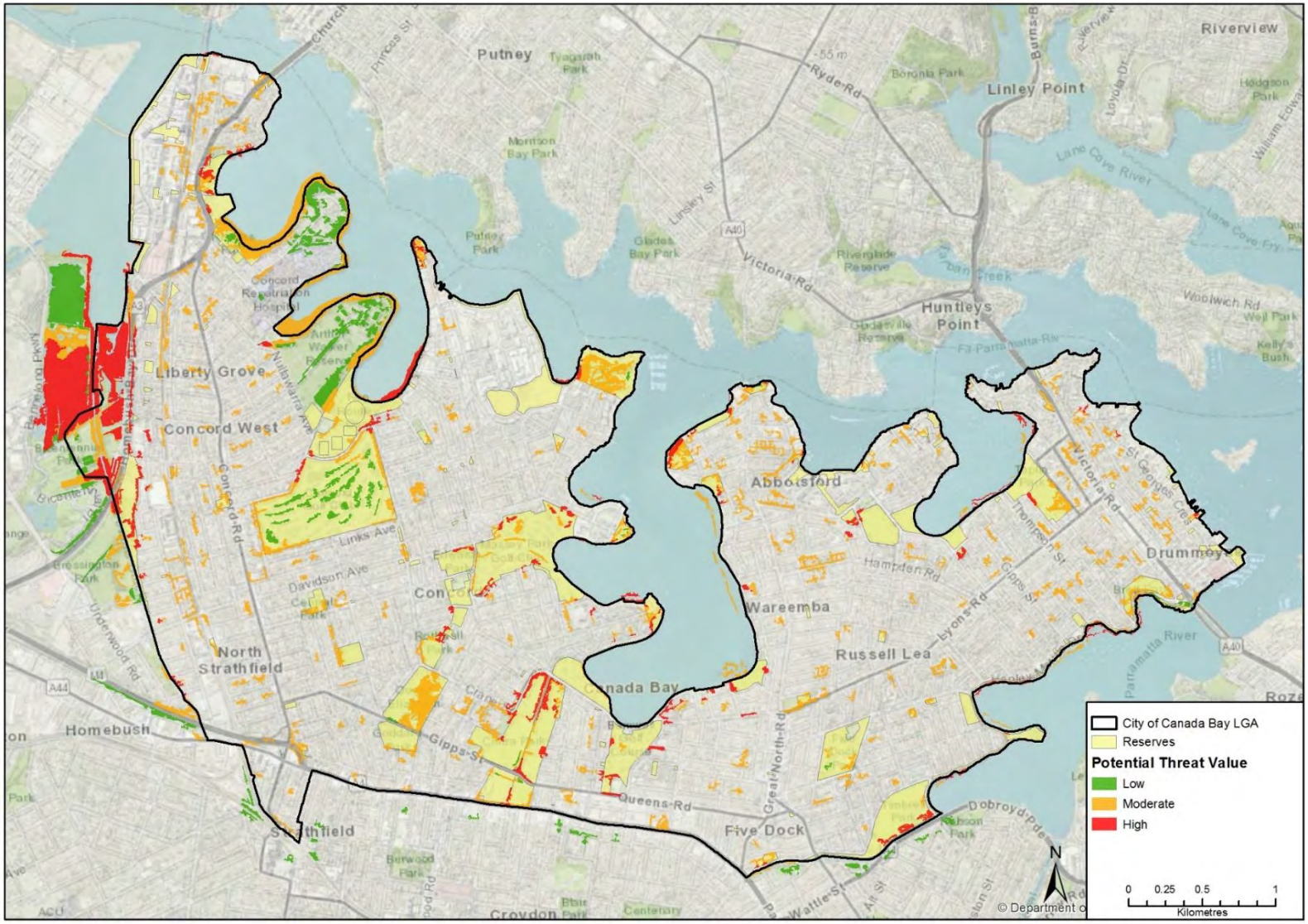

Figure 18: Potential habitat threat values

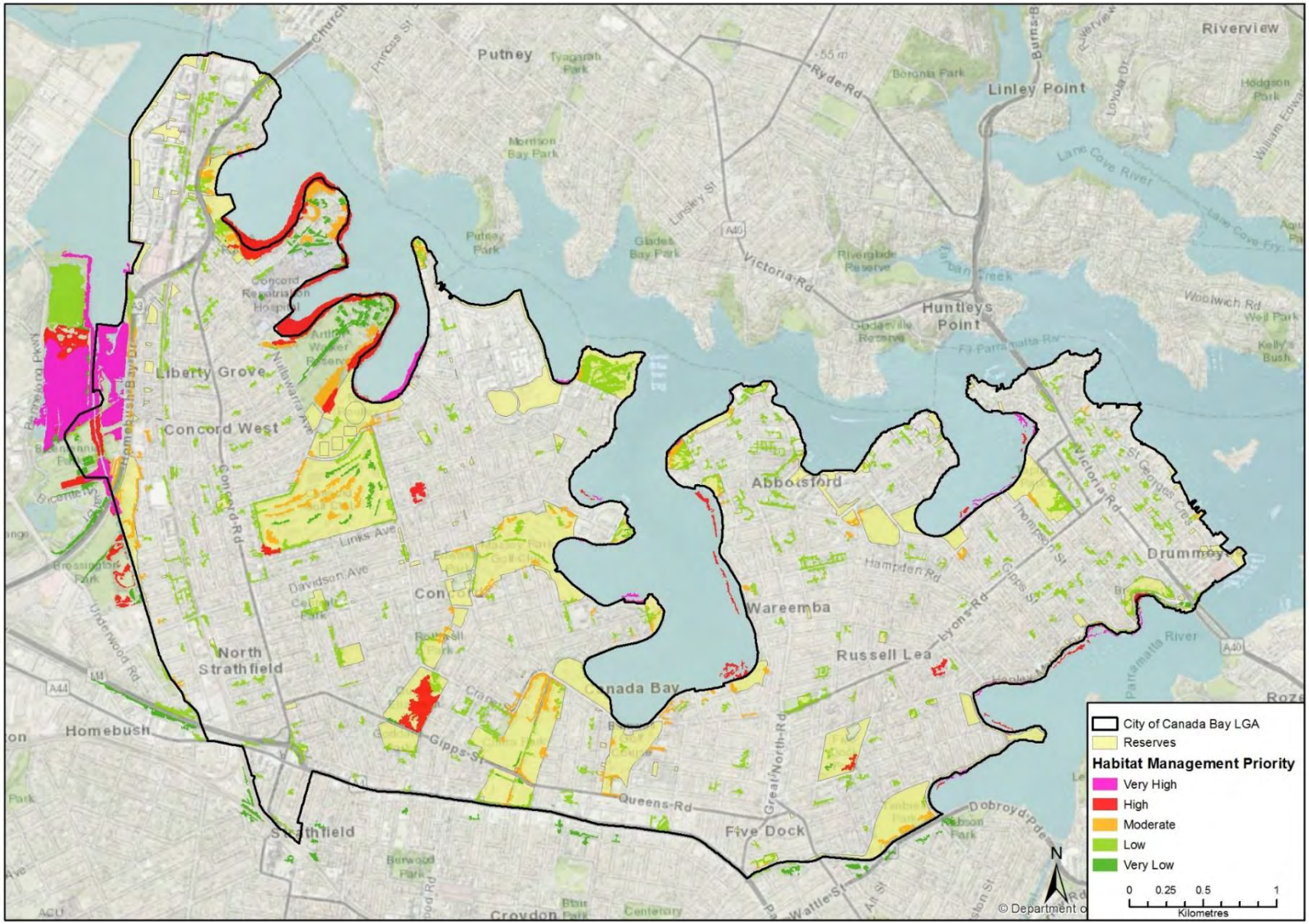

Figure 19: Priority ranking - reserves for management action

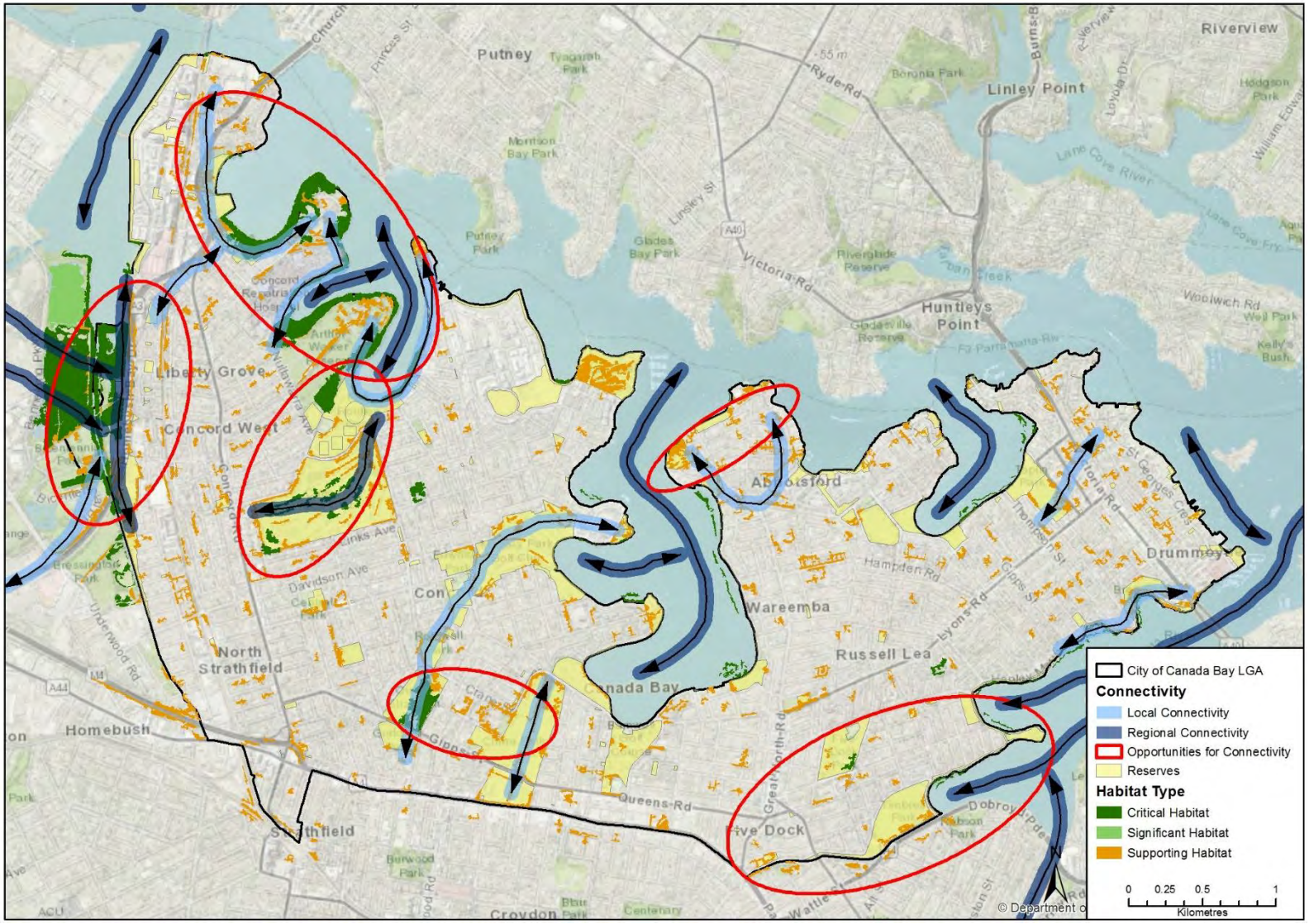

Figure 20: Highest priority areas for ecological connectivity in Canada Bay

Priorities for connectivity resulting in a 'Very High' and 'High' priority ranking are listed below in Table 12 and individual area maps are in **Appendix H.**

Priorities for management action also include additional areas that have critical habitat outside the priority corridors and are ranked as 'Very High' and 'High' priorities in **Table 13.** The full list of priority ranking of reserves is in **Appendix H.**

Table 12: Connectivity priority ranking

Priority Connectivity Areas	Reserves	Connectivity Ranking
Area 1 Sydney Olympic Park- Rhodes	Sydney Olympic Park, Powells Creek Reserve,	Very High
	Cole Park, Village Green, Eliza Park, Charlton Park, Bradley Park, Brunswick Park, Railway corridor land	High
Area 2 Concord West	McIlwaine Park, Brays Bay Reserve, Rhodes Park, Lovedale Place, Majors Bay Reserve, Arthur Walker Reserve, Yaralla, Dame Eadith Walker Estate Rivendell, Rocky Point	Very High
Area 3 Concord	Concord Golf Club, Arthur Walker Reserve, Majors Bay Reserve	Very High
Area 4 Concord- Canada Bay	Queen Elizabeth Park, Cintra Par, St Luke's Park, Goddard Park	Very High
Area 5 Abbotsford Point	Quarantine Reserve, Wymston Parade Walkway	Very High
	Henry Lawson Park, Battersea Park, Werrell Reserve	High
Area 6 Iron Cove – Rodd Point	Timbrell Park, Croker Park, Rodd Point, Neild Park	Very High
	Roberts Reserve, Larkins Reserve, Five Dock Park, Half Moon Bay, Sisters Bay	High

Table 13: Reserve management action priority ranking

Management Action Ranking	Council Reserve Name
Very High	Bay Run (includes Brett Park and Montague Park)*, Bayview Park, Edwin Street Reserve, Foreshore Walk, Homebush Bay Corso, Howley Park, John Whitton Reserve, Majors Bay Reserve, McIllwaine Park, Northcote Street Reserve, Powells Creek Reserve, Rodd Park, The Esplanade Foreshore Reserve, Wymston Parade Walkway, Younger Reserve
High	Brays Bay Reserve, Cabarita Park, Concord Golf Club, Five Dock Park, Halliday Park, Prince Edward Park, Quarantine Reserve, Queen Elizabeth Park, Rhodes Park, Brett Park

* Brett Park and Montague Park were manually added following GIS analysis of habitat rank as these reserves are located adjacent to Bay Run and are high priority for fauna

10. Biodiversity Measures

Strategic biodiversity measures are necessary to assess the performance of the Biodiversity Plan. Priority programs for Canada Bay have been identified based on the relationship of the vision and themes for the plan, along with Canada Bay's and State targets that are relevant.

The broad themes, programs and actions identified in this Plan are aligned with the Canada Bay Community Strategic Plan (CSP) 2030 theme to be environmentally responsible, with the vision:

'Our community shares a collective responsibility to protect our environment and actively participates in innovative programs to mitigate climate change. These programs, along with our well cared for and cherished, active and passive open spaces and waterways, are sustaining our future.'

The Plan supports the NSW Government target that five million trees will be planted by 2030, whereby Canada Bay LGA will increase its current canopy cover of 16-25% to contribute to this target (NSW Government 5 million trees program, 2019). It also links to Canada Bay's Environmental Sustainability Strategy 2014.

The Biodiversity Framework and Action Plan is to be implemented through being incorporated into the Council's Operational and Delivery Plans.

Table 14: Biodiversity framework programs by theme

Theme	Programs
Native Vegetation: protecting, managing and restoring Canada Bay's Native Vegetation	**1.1:** Endeavour to protect 100% of native vegetation in Council Reserves **1.2:** Improve vegetation within critical habitat areas that are considered to have opportunities for connectivity **1.3:** Retain the maximum amount of native vegetation across development and infrastructure zones **1.4**: Roll-out biodiversity education for residents and Council staff **1.5:** Maintain and improve the condition of vegetation in Council reserves
Urban Waterways: restoring waterways and surrounding environments.	**2.1**: Measurable improvement in water quality across Canada Bay waterways **2.2**: Protect significant wetlands and Coastal Saltmarsh **2.3:** Restore the ecological function of critical habitat, waterways and wetlands **2.4** Develop community education programs and engage schools, community groups and residents in restoring the biodiversity along the foreshore.
Corridors and Connectivity: enhancing landscape linkages	**3.1**: Measurable increase in connectivity within reserves **3.2**: Increase in numbers and density of urban trees, shrubs and understorey across CoCB **3.3**: Measurable increase in habitat coverage within and adjacent to identified priority for connectivity
Public Spaces: Managing our reserves to promote biodiversity and community interaction	**4.1**: Actions identified in Plans of Management for reserves and the Biodiversity Framework and Action Plan are implemented **4.2**: All recreational activities in reserves with a conservation objective are compliant with biodiversity protection and increase people's interaction with nature

Theme	Programs
Urban Habitat: Protecting and managing biodiversity in the urban landscape	**5.1**: Maintain and improve native species richness of flora and fauna in Council reserves **5.2**: Decrease in populations of pest fauna species in reserves **5.3**: Ensure weed density is managed in critical habitat areas to ensure protection of significant areas. **5.4:** Establish and implement monitoring of condition and values within critical habitat areas **5.5**: Increase participation numbers in Bushcare groups and community programs that educate about biodiversity **5.6:** Increase biodiversity habitat & protection on private land
Green Infrastructure: opportunities for innovation, enhancements and excellence in biodiversity	**6.1:** Increased community involvement in biodiversity education programs **6.2:** Improve Council performance in biodiversity conservation and green infrastructure **6.3** Increased Council knowledge and partnerships for biodiversity conservation and green infrastructure **6.4** incorporate promotion of innovation in sustainable urban design as part of planning and approvals

11. Action Plan

To achieve the outcome of conserving Canada Bay Shire's species, populations and communities of native flora and fauna, an Action Plan has been developed to guide biodiversity conservation outcomes. The process will be based on six themes including protecting, managing and restoring native vegetation; restoring the river foreshore environment of the Parramatta River and urban waterways; enhancing landscape linkages of corridors and connectivity; managing public spaces to promote biodiversity and community interaction; managing biodiversity in urban habitats with the community; and providing green infrastructure and opportunities for innovation. Annual action plans will be derived from this action plan and integrated into Council's operational and delivery plans.

11.1 Biodiversity Theme 1: Native Vegetation: protecting, managing and restoring Canada Bay's Native Vegetation

Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
1.1: Endeavour to protect and conserve 100% of native vegetation in Council reserves.	For Council reserves containing TEC's and remnant vegetation: • Ensure that TEC's are being actively restored through bush regeneration and where required, that revegetation is undertaken using locally sourced stock from agreed planting list • Identify threats to vegetation communities (e.g. Drainage lines, tracks, rubbish dumping, infrastructure works in parks) and seek to incorporate into future Reserve plans of management • Where projects occur, firstly avoid impacts on native vegetation, next minimise impacts and finally offset any residual impacts through compensatory planting • Control and regulate access with fencing / delineation and signage particularly STIF, Swamp Oak, mangrove and saltmarsh remnants subject to high levels of disturbance • Investigate opportunities for ecological burning of TEC's compliant with OEH Guidelines, Bush Fire Environmental Assessment Code for NSW, Restoring Natural Areas in Australia and Standards for Pile Burning • Conduct regular targeted field surveys of mapped STIF and Swamp Oak to validate and clarify condition.	H			

Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
1.2 Improve vegetation within critical habitat/ priority areas that are considered to have opportunities for connectivity.	Look for opportunities to expand and/ or restore remnant vegetation and create Council managed habitat components within reserves, particularly for areas with opportunities for connectivity Expand and/ or consolidate vegetation restoration areas along the linear edges of Sydney Turpentine-Ironbark Forest at priority sites where possible i.e., Dame Eadith Walker Estate, Queen Elizabeth Park Reserves Identify opportunities for Council planning controls to provide greater provision for protection of native vegetation and bird habitat (e.g. inclusion of critical habitats, wetlands and priority areas as E2 or Terrestrial Biodiversity in the LEP and Sydney REP, and update clauses, maps or overlays within LEP and DCP)	M			
1.3: Retain the maximum amount of native vegetation across development and infrastructure zones	Regularly update and provide TEC identification and impact assessment guidelines for Council staff including development planners. Council to consider TECs when reviewing and developing controls and policies. Review current standard conditions of consent to include biodiversity consideration in development within or adjacent to Bushland as defined in SEPP 19 (Bushland in Urban Areas), particularly for identified TECs. DCP Develop an Offsets Policy for inclusion into the DCP to compensate the loss of vegetation on public and private land.	M			
1.4: Roll-out biodiversity education for residents and Council staff.	Develop and maintain a standardised environmental data collection process (templates) and information repository (natural assets database) for use by Council staff, consultants and volunteers Where synergies exist seek to tie in with research by local schools, universities and community to determine ecological processes within reserves containing critical habitat, including fire ecology, soil seedbank, fragmentation, response to disturbance and recovery of TEC's. Review Councils revegetation planting scheme for TEC's and remnant native vegetation to ensure the correct species are being used for rehabilitation work in line with Council priorities. Establish a regular update and review of flora and fauna survey mapping approximately every 10 years.	M			

Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
1.5: Maintain and improve the condition of vegetation in Council reserves	Review bush regeneration program (contracts) to ensure the highest priority areas are being actively managed in conjunction with procurement processes. Identify new sites of critical habitat / priority areas that would benefit from establishment of a new Bushcare group where interest has been identified by the community. Prepare a Priority Weed Management Strategy (incorporating both private and public lands) which ensures the consideration of impacts on TECs and protected foreshore vegetation for WoNS and priority weeds and undertaking weed control. The strategy should include Regulatory, Educational and On-ground related actions and activities as well as be consistent with current Bushcare programs, bush regeneration and weed control activities. Monitor impacts on biodiversity of exotic and pest species and pathogens and undertake control where required. Investigate appropriate fire management practices for ecological burns to maintaining maximum plants species richness and regeneration where feasible. Consider and investigate opportunities to establish Biodiversity Stewardship Sites or other incentives to help manage land for biodiversity and serve as a funding source. Add the current and updated habitat assessment, threat assessment, regional and local connectivity layers to Councils GIS repository.	H			

11.2 Biodiversity Theme 2: Urban Waterways: restoring the river foreshore environment, waterways and their surrounds

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
2.1: Measurable improvement in water quality across Canada Bay waterways	Reduce sediment inputs through bank stabilisation revegetation works in estuary tributaries Minimise impacts of moorings and boating on seagrass through buoy markers and education Manage public access at environmentally sensitive foreshore locations. Priority areas may include key habitat and vegetation communities located in areas that are frequented by the public and require detailed design to achieve biodiversity protection.	H			

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
	Reduce the unauthorised clearing of riparian and estuarine vegetation. Work with private landholders and Bushcare groups to encourage and assist in the revegetation of foreshore areas, and the management and conservation of existing vegetation. As a priority, target landholders with ecologically significant vegetation present on their land.				
2.2: Protect foreshores, significant wetlands and Coastal Saltmarsh	Validate and update mapping of Coastal Saltmarsh EEC and develop a management plan to control/remove any relevant threatening processes. Identify opportunities for Council planning controls to provide greater provision for protection of foreshore wetlands, mangroves, saltmarsh, seagrasses and migratory and wader bird habitat (e.g. inclusion of critical habitats, wetlands and priority areas as E2 or Terrestrial Biodiversity in the LEP and Sydney REP, and update clauses, maps or overlays within LEP and DCP) Prepare a Council policy to conserve mangroves, mudflats, seagrass and shorebird habitat. Identify site specific threats and implement appropriate management options in accordance with the Parramatta River Estuary Management Plan. Participate in the preparation and implementation of Estuary and Coastal Management Plans and the draft NSW Marine Estate Management Strategy. Ensure that foreshore infrastructure masterplans and implementation protect wetlands, saltmarsh, mangroves and seagrasses. Ensure that public and private projects protect foreshore vegetation, mudflats, and where seawalls are required ensure they are designed as biodiversity friendly seawalls.	H			
2.3: Restore the ecological function of high priority waterways and wetlands	Protect and restore Key Fish Habitat (mangroves, saltmarsh and seagrass) mapped by NSW DPI Fisheries https://www.dpi.nsw.gov.au/content/research/areas/aquatic-ecosystems/estuarine-habitats-maps/IINSW_EstMac_map39a.pdf and https://www.dpi.nsw.gov.au/content/research/areas/aquatic-ecosystems/estuarine-habitats-maps/IINSW_EstMac_map39b.pdf Protect areas of intertidal mudflat, saltmarsh and mangrove to provide habitat for migratory waders	H			

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
	Identify opportunities for Council planning controls to provide greater provision for improving water quality and habitat value of urban waterways through introducing planning controls/ clauses, maps or overlays within LEP and DCP Conduct regular targeted field surveys of threatened migratory bird species feeding and roosting sites Restoration works to enhance aquatic habitat (e.g. feeding sites, and native fish habitats) on waterways / corridors Target management of threats in waterways / corridors e.g. Bar-tailed Godwit and dogs – continue and expand 'Dog Saves Bird' project from Hen and Chicken Bay to key foreshore habitats such as Rodd Point Educate internal stakeholders on the importance of estuarine wetlands. Create constructed wetlands to improve water quality and expand habitat diversity and foraging opportunities using native plants for biofiltration systems and raingardens where possible. Continue creek naturalisation projects. Promote off leash dog beaches to draw this recreation activity away and protect sensitive (feeding) areas for migratory waders Conduct a feasibility study to determine the viability of the creation of artificial oyster reefs. Protect nesting, roosting, feeding sites from fox predation. Explore opportunities to install fish crates to create submerged and emergent habitat.				
2.4 Develop education workshops, programs and to engage schools, community groups and residents to establish a sense of ownership and participation and restoring the biodiversity along the foreshore.	Target management of threats in waterways / corridors e.g. Bar-tailed Godwit and dogs – continue and expand 'Dog Saves Bird' project from Hen and Chicken Bay to key foreshore habitats such as Rodd Point and Bayview Park. Change 'Continue Mind Our Mangroves' project to expand community education about mangrove and salt marsh protection/conservation. Educate the community on issues surrounding biodiversity and water quality and it's impacts on biodiversity along the foreshore.	H			

11.3 Biodiversity Theme 3: Corridors and Connectivity: enhancing landscape linkages

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
3.1: Measurable increase in connectivity within reserves	Continue targeted restoration (weeding, planting of trees, shrubs and understorey, retention of tree hollows, fallen branches, logs and shrub layer, removal of threats) within reserves to enhance connectivity and habitat values.	H	Environment	M	M
3.2: Increase in numbers and density of urban trees, shrubs and understorey across CoCB	Outside of reserves, Council to implement a corridor reconstruction program – in particular: • retain senescent trees as habitat where safe to do so (exclusion zones/ fencing) • plan for tree removal and replanting through staged succession planting • plant along habitat corridors identified in this Plan • increase the number of street trees on nature strips along quiet roads using species well-adapted to soil conditions, which are low maintenance and have high fauna habitat values (eg. Melaleuca species provide a dense shrub layers and flowering for native birds; Eucalypt, Angophora and Banksia species provide both foraging and shelter habitat for a range of fauna species), include stepping stone patches of shrubs and understorey. Work with providers of local native species and offer 2 free native trees per resident per year for collection from Council for planting in home gardens. Ensure plants are of local provenance and obtain community feedback.	M			
3.3: Measurable increase in habitat coverage within and adjacent to identified priority corridors	Identify opportunities for Council planning controls to provide greater provision for restoration of corridors (e.g. inclusion of critical habitats, wetlands and priority areas as E2 or Terrestrial Biodiversity in the LEP and Sydney REP, and update clauses, maps or overlays within LEP and DCP) Collaborate and look for opportunities with other large landholders including SOPA, Department of Health Lands, Golf Courses, Schools to undertake plantings and restoration work to enhance connectivity. Link with other corridor projects in adjacent LGA's, e.g. in Iron Cove and SOP Provide initiatives for residents to provide habitat in their yards. Consider habitat coverage and connection value in reviewing planning controls for properties with or adjacent to bushland and current/ proposed corridors. Ensure all applications for development in riparian areas are in accordance with Councils WSUD principles, concepts and technologies and DPI - Water Guidelines.	H			

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
	Engage with residents around management and planting of native flora on residential/private land. Engage with schools on issues surrounding biodiversity, native flora and fauna, tree planting, water quality and weed management.				

11.4 Biodiversity Theme 4: Public Spaces: Managing our reserves to promote biodiversity and community interaction

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
4.1 Actions identified in Plans of Management for reserves and the Biodiversity Framework and Action Plan are implemented	Plans of Management should continue to target weeds, bushfire, feral animals, planting and regeneration, retention of hollows, fallen branches and logs, protection of shrubs, particularly within the identified ecological corridors and critical habitat areas The Biodiversity Framework and Action Plan, and works in Plans of Management are programmed when setting annual operational and delivery works plans and budgets High priority actions are to be allocated funds for implementation Consider developing Plans of Management for the priority reserves.	H			
4.2: All recreational activities in reserves are compliant with biodiversity protection and increase people's interaction with nature	Consider rehabilitation of unmanaged trails as required and encourage community to use formalised walking trails in parks such as Queen Elizabeth Park Investigate potential for relocation of an upgraded playground within developed part of Queen Elizabeth Park and restoration of the current playground site as bushland Incorporate biodiversity protection and increasing people's interaction with nature into masterplans for foreshore areas, recreational and visitor activities, as well as existing and new plans of management and for bushland, parks and reserves. This can be undertaken by locating access paths, seats and interpretive signs to complement habitat enhancement. Recreational strategies and masterplans to incorporate habitat linkages as multifunction corridors through, for example, planting for habitat and shade along western boundaries of ovals, planting suitable habitat along sections of recreational pathways, etc.	H			

11.5 Biodiversity Theme 5: Urban Habitat: Protecting and managing biodiversity in the urban landscape

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
5.1: Maintain and improve native species richness of flora and fauna in Council reserves.	Retention of dead timber in reserves as habitat for fauna and to create a more complex understory structure and shelter sites from predators. Consider artificial shelters for terrestrial mammals i.e. nest boxes to replace tree hollows for possums and parrots, native bee hotels, etc. Development consent should include the use of nest boxes to replace cleared habitat. Nest boxes are to be species specific, not encourage undesirable species and to be monitored. Staged retention and gradual replacement of weedy vegetation being utilised as habitat by native birds and animals. Consider species selection and climate change. Provide clear accessible lists of preferred species associated with maps.	M			
5.2: Decrease in populations of pest fauna species in reserves	Develop and undertake regular feral animal control programs in conjunction with surrounding local government areas, for pest animals such as rats, rabbits and foxes particularly in areas with high threat ratings such as Yaralla and Arthur Walker Reserve. Consider implementation of cat control should the problem become more prevalent. Investigate opportunities and options to manage the impacts of companion animals (dogs and cats) in critical habitat areas. Undertake inspections of parks and reserves where companion animal issues have been identified. Increase enforcement of dogs off leads in foreshore bird habitat. Restoration of bushland should replace exotic weed species with a diverse and complex mid-storey and understorey of native plant species to discourage aggressive bird species such as noisy miners that prefer a park like environment or canopy with no mid-storey. Encourage community, contractors and volunteers to report feral animals (foxes, cats, rabbits, rats) observed in bushland. Educate people about de-sexing pets as per the 'Choosing and Managing your Pet' pamphlet.	H			

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
5.3: Ensure weed density is managed in critical habitat areas to ensure protection of significant areas.	Review bush regeneration program to ensure critical habitat sites are being actively managed. Maintain monitoring and reporting of bush regeneration and bushcare sites. Utilise condition bushland mapping to monitor progress of sites.	H			
5.4 Establish and implement monitoring of condition and values within critical habitat sites	Educate parks / reserves maintenance and project staff to increase awareness of legislative responsibilities for protection and management of threatened species, populations and ecological communities for staff.	M			
5.5: Increase participation numbers in Bushcare groups and community programs that educate about biodiversity	Investigate planning and incentives programs to promote and encourage protection and management of EEC's and critical habitat on private land including funding sources. Advertise Bushcare groups and undertake recruitment and promotion of Bushcare, particularly in areas identified as very high and high priority that do not currently have a Bushcare group Investigate options for funding such as mechanisms such as Voluntary Conservation Agreements to promote the protection of significant habitat (such as EECs) on non-Council owned land. Continue to work with land owners such as Department of Health and other landowners such as schools, with EECs outside of Council ownership and provide targeted education re EEC's (values, threats and recommended management) of mapped EEC remnants for these landowners. Encourage and promote best-practice management of EECs on private land through preparation and distribution of fact sheets for each EEC's to be distributed to identified landholders. Liaise and support major landholders to protect and manage critical habitat through preparation of site-specific Plans of Managements (e.g. Private landholders, schools, golf courses, Department of Health). Develop a brochure to educate residents on the benefits to wildlife of using native plant species in residential gardens.	H			

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
	Engage residents and extended community through programs and workshops to educate about the benefits of native vegetation on private land.				
5.6: Increase biodiversity habitat & protection on private land	Work with Planning department to develop tools for developers to provide suitable habitat on development sites Develop planning instruments that ensure developments are sympathetic to biodiversity and neighbouring bushland Develop tools for assessment officers to assess impacts on biodiversity during the preliminary assessment of a development application. Engage with applicants in pre-DA lodgement discussions to include biodiversity considerations. Develop and implement native plant give-aways in priority areas. Consider species selection and climate change. Provide clear accessible lists of preferred species associated with maps.	H			

11.6 Biodiversity Theme 6: Green Infrastructure: opportunities for innovation, enhancements and excellence in biodiversity

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
6.1 Increased community involvement in biodiversity education and green infrastructure programs	Develop threatened species and endangered ecological community interpretive educational materials and conduct educational programs in key bushland and foreshore reserves. Use River Mascot species for community engagement. Consider developing a Council Guided Walks Program. Develop training for parks / reserve staff and volunteers in wildlife habitat requirements e.g. retention of shrubs, dead wood and stags, weed and native look-alikes, controlling the spread of weed seed, staged removal of lantana to retain habitat for small birds. Develop a Community biodiversity education strategy incorporating impacts of dogs on migratory birds, feeding native and feral animals, values of mangroves, plants to attract wildlife to residential gardens, impacts of and alternatives to dumping garden waste, importance of responsible pet ownership, etc.	M			

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
	Promote 'citizen science' activities such as Birds Australia, ClimateWatch, Australian Museum's FrogID, Habitat Hollows and other activities/ organisations. Ensure biodiversity achievements and activities are promoted in Councils community newsletters and Annual report. Install regulatory signage at bushland and foreshore reserves and parks to educate visitors about the biodiversity impacts of: • rubbish dumping and plastic waste • removal of fallen branches and dead wood • dogs chasing birds and dog faeces Identify and prioritise sites suitable for corporate planting events / activities. Promote and encourage local businesses to participate / sponsor planting events and activities. Enhance opportunities for corporate planting events ensuring the sites are sympathetic to prioritisation of natural areas. Develop information factsheets on priority threatened and migratory and feral species for distribution to the community via the website. Promote and undertake planting of tree canopy and understorey vegetation to combat urban heat island effects. Develop a Significant Tree Register that recognises the value of indigenous trees and trees as habitat, as one of the criteria for selection.				
6.2 Improve Council performance in biodiversity conservation and green infrastructure	Train Council staff (including checklists and reference materials): • Environmental considerations in concept and detail design of new infrastructure, including options for green infrastructure • Environmental considerations for Council's asset maintenance, • Create a natural asset register • Environmental considerations for Council's purchasing Ensure foreshore pathways, cycling paths, park developments and other infrastructure projects such as constructed wetlands, consider biodiversity protection as a high priority objective. Habitat planting in parks, sportsgrounds, road reserves, creek/ canal naturalisation and SQIDS.	M			

Priority Programs	Actions	Priority	Responsibility	Budget Estimate	
				Capital	Operational
	Focus on sea level rise and the need for wetlands and mudflats to migrate landwards and incorporate into climate change adaptation planning. Continue to improve Council's carbon reduction actions.				
6.3 Increased Council knowledge and partnerships for biodiversity conservation and green infrastructure	Council staff to maintain professional networks with organisations such as SOPA, PRCG and colleagues to: • coordinate regional actions e.g. migratory bird programs, pest animal and weed control • collaborate on grants • share specialist resources • learn about policy and legislative changes • innovate with green technologies and programs i.e. green roofs and walls, cool roads, wildlife friendly lighting (i.e. filtered yellow-green and amber LEDs wavelength of 590 nm with light shield protection controlling light spill) • introduce smart technologies to further enhance community engagement and education on the natural environment, adaptation to climate change, awareness of natural hazards, interpretation and way-finding. Participate in committees, studies, plans and programs for Coast and Estuary Management. Include relevant clauses within DCP for green infrastructure (green roofs and walls, SQIDS, etc.). Land use planning to protect and enhance corridor connectivity. Council staff to establish contact with specialist consultants and academics to obtain advice or additional resources as needed.	H			

12. Monitoring, Review and Reporting

It is essential that actions are monitored and reviewed to determine if they are meeting the strategic and specific objectives. Monitoring and performance reporting is a standard requirement for grant funds and an important way to demonstrate effective use of public funds. The monitoring and reporting requirements for each action will align with the themes.

The Action Plan should be reviewed and updated by Council in five years, and both the Action Plan and Framework should be reviewed and updated in ten years. Results of performance monitoring should be considered in the reviews.

Council's Annual Report to the community should identify:

- the type and location of actions taken
- lessons learnt for future action
- measurable changes for the year against the strategic objectives
- cumulative changes against the strategic objectives since implementation of the Biodiversity Action Plan commenced.

A regular update and review of vegetation mapping and fauna survey should occur every 10 years. Good baseline data already exists to build on from previous flora and fauna studies. Standardised data collection templates should be developed and the data for each reserve should be collated by a nominated Council officer to ensure consistency over time.

Consider using survey guidelines and standards developed by OEH for threatened species and field surveys:

http://www.environment.nsw.gov.au/surveys/GuidelinesForCarryingOutASurvey.htm

http://www.environment.nsw.gov.au/threatenedspecies/surveyassessmentgdlns.htm

Some of this data can be collected through collaboration with primary, secondary and tertiary educational institutions and community groups, to encourage community involvement and biodiversity education, for example, bird observations, weeds and water quality monitoring.

http://www.environment.nsw.gov.au/surveys/SurveyParticipation.htm

http://www.environment.nsw.gov.au/surveys/CommunityBiodiversitySurveyManual.htm

Ensure all data captured through flora and fauna assessments and surveys is incorporated into the BioNet Atlas of NSW Wildlife http://www.bionet.nsw.gov.au/ht

The flora and fauna review every 10 years should be documented in a separate report that includes the results of the flora and fauna survey and mapping including the extent of vegetation communities and presence/absence of fauna (birds, mammals, reptiles, frogs).

This should inform the review of the Framework and Action Plan which should include:

- Re-evaluate critical habitat assessment using updated information to document changes in threat and management priority over the five-year period
- Action status and any issues towards achievement should be outlined
- Actions that have been executed should be dated with data provided to indicate the success or otherwise of this action.
- Priority programs should be listed along with comments on status and progress as well as any barriers preventing these targets from being met.
- Monitor changes in legislation, policy and information relevant to biodiversity plan including a discussion of how this changes the priority of actions.

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Appendix A Biodiversity Values, Concepts and Design Principles

Biodiversity Values

Biological diversity, or biodiversity, is the variety of life forms in all terrestrial (land) and aquatic (water) environments on Earth. There are three levels of biodiversity:

- genetic diversity—the variety of genetic information contained in individual plants, animals and micro-organisms
- species diversity—the variety of species e.g. *Eucalyptus moluccana* (Grey Box) and *E. tereticornis* (Forest Red Gum)
- ecosystem diversity—the variety of habitats, ecological communities and ecological processes. An ecosystem is a dynamic combination of plant, animal and micro-organism communities and their non-living environment (e.g. soil, water and the climatic regime) interacting as a functional unit e.g. Sydney Turpentine Ironbark Forest ecological community.

Biodiversity is interconnected, interdependent and constantly changing. It can be increased by genetic change and evolutionary processes or reduced by threats such as habitat clearing or disease which lead to population decline and extinction.

Biodiversity supports ecosystem products and services which are essential for human survival. Types of ecosystem services are illustrated and discussed in more detail below. The loss of biodiversity directly influences the capacity of an ecosystem to produce and supply essential services, and can affect the ability of ecological, economic and social systems to adapt and respond to pressures.

Figure 21: Ecosystem services (Source www.tweeb.org)

Economic value of biodiversity

A strong and sustainable economy relies on having healthy ecosystems. However, biodiversity and associated ecosystem services are often regarded as 'free' natural capital and are 'taken for granted'. The economic value of ecosystems may not be realised or appreciated until they are damaged, by contamination or clearing for example, and then require substantial costs for repair or restoration.

Researchers at the Victoria Institute of Strategic Studies found that natural infrastructure has a direct impact on property value and resulting tax revenue. The presence of trees was found to increase the selling price of residential units from approximately two to nine percent, and the proximity of open green space correlates with an increase in property sales prices. AECOM's 2017 Brilliant Cities Report on green infrastructure estimated that an increase of 10% in the leaf canopy of street trees alone could increase the value of Sydney properties by an average of $50,000 per unit (based on three suburbs).

Health and wellbeing

Biodiversity is important for the physical and mental health of urban dwellers. For many people, green spaces are the main avenue for direct contact with the natural environment. Interaction with the natural environment contributes to a range of measurable positive benefits at individual and societal levels including:

- general health
- degree of social interaction
- respite from mental fatigue
- opportunities for reflection.

The psychological benefits of green spaces increase with biodiversity (Fuller et al 2007), as green space users can perceive and appreciate species richness, particularly plants and birds. Conserving and enhancing urban biodiversity is therefore not only important for the provision of ecosystem processes but also creates opportunities for increasingly urbanised communities to have contact with nature, thus enhancing societal and community wellbeing.

Community and environmental resilience

Nature and natural infrastructure are critical assets in strengthening cities' resilience to a broad range of shocks and stresses (Earth Economics 2018). For example, the ability of vegetation to reduce urban heat is well understood and will be increasingly important in protecting communities from extreme heat as the climate changes. A diverse vegetation structure and composition that is suited to its landscape setting will be more resilient to disease and other potential impacts.

Indigenous culture and biodiversity

Indigenous people have an interest in the conservation and sustainable use of native species and environments through their relationship with their traditional lands and waters. The Aboriginal people who inhabited the land refer to themselves as the Wangul clan of the Eora nation. Wangul culture was strongly focused around the foreshore with Hen and Chicken Bay being a major meeting place for Aboriginal people from Port Jackson and the wider Sydney region and as such is a significant cultural and historical site. The Parramatta River provided a large focus for local traditional food gathering, however the Wangal people also hunted animals, harvested plants and gathered raw materials in the local area.

Key concepts

The biodiversity value of an area is determined by the integrity of the vegetation based on its composition, structure and function, and the suitability of habitat. Information is provided below to explain the following concepts relevant to biodiversity:

- connectivity, fragmentation and edge effects
- habitat characteristics
- threatened species, populations and communities
- weeds and pest animals
- green infrastructure.

Habitat

Habitat is the natural home or environment where an organism lives. Examples of habitat available in the City of Canada Bay LGA include:

- hollow bearing trees and stags
- waterways, including ponds and dams
- river banks and foreshores including rock platforms, reefs, rock pools, mud and sand
- dense shrubs, grasses and marshes
- canopy trees and mangroves
- leaf litter and logs
- built structures such as stormwater culverts and bridges that may have secluded niches.

Animals may use different habitats for breeding, roosting or foraging (feeding). For example, many parrot species forage in trees that have seeds and fruit but need hollows to nest and breed.

Patch size and edge effects

Increased size of habitat areas enhances available resources and allows more ecosystem niches, therefore supporting more species and larger, more sustainable populations. Larger patches of habitat have a relatively low edge to area ratio, which means the habitat has a higher biodiversity value. Edge effects include weed invasion, spill of artificial lighting, rubbish dumping and vandalism. There is a greater adverse edge effect if the habitat patch has a long linear shape or is fragmented.

Corridors

Biodiversity corridors (also known as wildlife corridors or ecological corridors) are areas of connected habitat across the landscape that:

- allow the movement of animals and the dispersal of plants
- ensure genetic exchange of flora and fauna populations that may otherwise become extinct in the long-term
- allow recolonisation of habitat areas by fauna and flora that have become locally extinct from events such as land clearing, fire, disease, fluctuating food supply and extreme weather
- provide a relatively safe route for the movement of animals across the landscape.

If an event causes local extinction or reduction of the population, complete or partial connectivity of patches allows replenishment and re-establishment of the species. Smaller patches of habitat can link

large patches as 'stepping stones' to facilitate movement of more mobile species. Patches of habitat can be terrestrial, aquatic or a combination of both within the urban and riverine environments of Canada Bay.

Status of species and ecological communities

The biodiversity value of an area is also affected by the proportions of native and introduced species. Areas of higher biodiversity value are associated with the presence of threatened species and communities. Biodiversity values decrease if weeds and pest animal species are present.

The conservation status of species, populations and communities is determined by scientific committees that advise the NSW Office of Environment and Heritage and Commonwealth Department of Environment. Council and the community have no direct role in the process. Further information about the conservation status of species and communities in the Canada Bay LGA is provided in Chapter 3.

Green infrastructure

Green infrastructure is defined by the GANSW (2017) as the network of green spaces, natural systems and semi-natural systems that are strategically planned, designed and managed to support a good quality of life in an urban environment. Elements of green infrastructure include roof gardens, residential gardens, local parks, streetscapes, service corridors, waterways, water sensitive urban design features and regional recreation areas. Figure 22 illustrates some of the benefits of green infrastructure, which include increased biodiversity and improved microclimate.

Green infrastructure that comprises a fully-functioning ecological community that sustains a suite of naturally occurring species, has high biodiversity value. An example to explain this concept is as follows: a streetscape planted with *Syncarpia glomulifera* (Turpentine) and *Eucalyptus paniculata* (Grey Ironbark), which are characteristic species of the endangered community Sydney Turpentine-Ironbark Forest, whilst of value to biodiversity is of lower biodiversity value than a large patch of Sydney Turpentine-Ironbark Forest that is weed-free.

Carbon capture or sequestration is another benefit of green infrastructure. Plants naturally capture carbon from the atmosphere through photosynthesis. Photosynthesis works by combining carbon dioxide together with sunlight in a chemical reaction to produce oxygen and glucose. The carbon is held in the vegetation until the vegetation is burnt or dies and decomposes, thus releasing carbon back to the atmosphere and soil. Vegetation planting and regrowth can help to sequester carbon and thus offset the impacts of emissions that contribute to climate change.

Figure 22: Benefits of green infrastructure in urban areas such as Canada Bay LGA (GANSW 2017)

Design principles

The following biodiversity management and design principles apply to the Canada Bay LGA under this Strategy:

- Local corridors along waterways and major cycleways should integrate with regional corridors. The Green Grid for the Eastern City District (GSC 2018) provides a regional context for corridors.
- Protect and enhance areas of high biodiversity value and critical habitat within the Canada Bay LGA. This will involve improving connectivity, reducing fragmentation and increasing the size of habitat patches by regrowth of native species following weed control supplemented by revegetation. The habitat patch size or corridor should be as wide as possible to reduce edge effects.
- Rehabilitate or restore landscapes using bush regeneration techniques consistent with the Bradley Method (Bradley 2002) and the Bush Regenerators Handbook (National Trust, 2010) i.e:
  - Secure and maintain the best areas first by rigorous and timely weed control

  - Minimise disturbance to the natural conditions e.g. soil
  - Do not overclear – let the regeneration of the bush set the pace of clearance.
- Plant species that are characteristic of naturally occurring vegetation communities and habitat requirements.
- Introduce aquatic and terrestrial habitat features such as logs and nest boxes where possible.
- Offset any loss of vegetation in accordance with the Biodiversity Offsets Scheme under the *Biodiversity Conservation Act 2016* or other agreed vegetation replacement scheme (see Section 0 below).
- Create green infrastructure where possible in areas of lesser biodiversity value.
- Involve the community in environmental protection, management and monitoring.

Offsets and replacement planting

Developments and activities should be designed and constructed to:

1. avoid environmental impacts
2. minimise environmental impacts
3. ameliorate or mitigate environmental impacts.

As a last resort, consideration should be given to 'offsetting' or compensating for an environmental impact. Expert advice should be sought regarding the type of offset scheme, if any, that is applicable. For example, the Biodiversity Offset Scheme Entry Tool can determine if a development will trigger the threshold for offsetting under the BC Act.

Canada Bay Council's roles and responsibilities regarding biodiversity impacts and offsets include:

- as the proponent causing the impact e.g. during asset construction or maintenance
- as the regulator providing advice and approval to developers in the area
- as the owner or manager of public land that:
  - could provide an offset site
  - maintains an offset site.

Key features of biodiversity offset and replacement planting schemes are summarised below. Further advice should be sought from a specialist if Council or another party wishes to be involved in these schemes.

Biodiversity offsets scheme

The Biodiversity Offsets Scheme (BOS) is a voluntary market-based scheme established in 2017. The BOS is administered in accordance with the *Biodiversity Conservation Act 2016* by the Biodiversity Conservation Trust, which is a statutory not-for-profit agency within the portfolio of the NSW Minister for the Environment.

The BOS enables 'biodiversity credits' to be generated by landowners and developers (including Canada Bay Council) who commit to enhancing and protecting biodiversity values on their land through a Biodiversity Stewardship Agreement. The biodiversity credits can then be sold, generating funds for the management of the site. Credits can be used to offset the impacts on biodiversity values that occur from development.

Ecosystem and species credits may only be created where management actions are proposed to be carried out on a biodiversity stewardship site. Where land has an existing conservation obligation, biodiversity credits may only be created where the management actions are additional to any biodiversity conservation measures already being undertaken (see section 13.11.11 of the 2017 Biodiversity Assessment Method). For example, if a conservation obligation under a Council Plan of Management for a reserve expires without having been implemented, then Council could revise the Plan of Management so that it includes a Biodiversity Stewardship Agreement for the site. However, an offset cannot be created on land that has previously been used as an offset site or has been deemed not eligible.

Some impacts cannot be offset because they are likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct. Under Clause 6.7 of the Biodiversity Conservation Regulation 2017 an impact is considered 'serious and irreversible' if:

- 'it will cause a further decline of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline
- it will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size
- it is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution
- the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.'

Importantly, an offset area would need to be managed for conservation in perpetuity. An example could be where part of a public reserve is dedicated in perpetuity for conservation purposes as an offset site, and other parts of the reserve which are not covered by the Stewardship Agreement are to be used for recreation (e.g. cycleway, sports fields) or other purposes.

To identify and establish an offset site, Council and proponents should refer to the Priority Areas in Section 9 and **Appendix H** of this Biodiversity Framework. Further analysis of the suitability of priority areas to establish an offset would involve a feasibility assessment by a Biodiversity Assessment Methodology (BAM) Accredited Assessor including review of the land tenure and biodiversity characteristics, as well as consideration of the need to match the species and/or ecosystem being impacted. This may be difficult within the Canada Bay LGA due to the small size of the remnants.

Once an offset site is identified, the BAM Accredited Assessor would:

1. undertake a detailed biodiversity assessment to establish the number and types of potential biodiversity credits that could be created
2. prepare an application for a formal Biodiversity Stewardship Agreement to be submitted to the Biodiversity Conservation Trust.

Once the Biodiversity Stewardship Agreement is approved by the Trust and Agreement implemented, the landholder of a stewardship site would receive annual payments from the Trust and be responsible for ongoing management of the site in accordance with the Agreement.

Further information about biodiversity offsetting is on the NSW OEH website: www.environment.nsw.gov.au/biodiversity

Canopy tree replacement

Replacement of individual trees may be needed in circumstances where a biodiversity offset under the BC Act is not required but should be incorporated into a policy in the DCP to compensate for the many tree removals that lead to 'death by a thousand cuts'. For example, many examples of a single tree may need to be removed to enable a stormwater pipe to be repaired, a redevelopment or a path to be installed.

Replacement planting at a ratio of three trees to replace every one removed to ensure the many benefits of the urban canopy can be provided long term. Alternatively, a financial contribution could be made to Council to support public tree planting.

The location and species selection for the replacement planting should consider:

- where is the closest suitable position for the planting (consider proximity to built infrastructure such as pavements, buildings, underground pipes and overhead wires)
- what native species would be best suited to the preferred location.

Decisions related to the removal or major pruning of individual trees should be made in consultation with a Consulting Arborist and in accordance with the Australian Standard AS4970 for Protection of Trees on Construction Sites.

Appendix B Literature Review

Table 15: Plans and studies reviewed in the preparation of this document

Name	Summary	Implications for Canada Bay
City of Canada Bay Community Strategic Plan – Your Future 2030	Challenges and opportunities for Canada Bay; and community engagement responses	• Guidance for dealing with increasing and ageing population • Strong community desire for improved public transport, access to services and protection of environmental values
Eastern City District Plan	Broad scale plan for the future development of Sydney	• Canada Bay is within the Eastern City District and will have to support increases in housing, jobs and infrastructure
City of Canada Bay Local Planning Strategy 2010	The principal document for communicating the future land use planning, to assist future decision making in response to population growth and change	• This Strategy guided the preparation of the latest LEP and DCP • Specifies housing, employment and infrastructure projections and requirements for CoCB until 2031
City of Canada Bay State of the Environment Report 2017	Summary of the current environmental values in CoCB and targets for reducing environmental impacts	• Fixed targets for reducing environmental impacts e.g. waste production, water use and biodiversity
City of Canada Bay's Environmental Strategy 2014	Strategy for sustainable environmental planning	• Has targets, indicators and actions for environmental management; key focus areas; and a 4 year plan
Connecting the Heart of Greater Sydney – Greater Parramatta and the Olympic Peninsula Evidence Pack 2016	Stakeholder engagement background paper for the future development of the Greater Parramatta Area and the Olympic Peninsula	• Adjacent to Canada Bay • The area will undergo significant development over the next 20 years, which will impact the residential, commercial and environmental aspects of Canada Bay
A Liveability Framework for Sydney – DPE / Greater Sydney Commission 2017	Explains the social challenges Sydney faces (e.g. increasing population density) and its effects, as well as potential mitigation measures	• Framework for managing transport infrastructure, housing and environmental quality
Local Strategic Planning Statements: Guideline for Councils – DPE 2018	Detailed guideline on the process and scope of local strategic planning statements based on 2018 amendments to the *Environmental Planning and Assessment Act 1979* (EP&A Act)	• Helpful to ensure CoCB can get the most out of its Local Strategic Planning Statement
Concord West Master Plan 2014	New planning controls to guide the future development of sites zoned for industrial use within the study area (western side of the Northern Rail Line at Concord West)	• Urban design planning for a proposed development area within Canada Bay

Name	Summary	Implications for Canada Bay
Rhodes East Priority Precinct Investigation Area Planning Report – DPE 2017	New planning controls to guide the future development of Rhodes East	• Urban design planning for a proposed development area within Canada Bay
Rhodes Peninsula Open Space Master Plan 2015	Planning controls to guide the development of the Rhodes Peninsula	• Urban design planning for development area within Canada Bay
The Fauna of City of Canada Bay LGA: 2013-2014 – Insight Ecology (2014)	Fauna biodiversity in the City of Canada Bay	• Identification of biodiversity values
Canada Bay Council Fauna Survey 2002-2003 – Dion Hobcroft Natural History Services (2008)	Fauna biodiversity in the City of Canada Bay	• Identification of biodiversity values
Flora Inventory for Canada Bay City Council – Gingra Ecological Surveys (2009)	Flora biodiversity in the City of Canada Bay	• Identification of biodiversity values
Parramatta River Estuary Coastal Zone Management Plan – Cardno (2013)	Aims, objectives and implementation strategies for management of Parramatta River by the Parramatta River Estuary Management Committee	• Focus on bush regeneration, naturalisation of creeks and foreshore management
Parramatta River Catchment Ecological Health Project – CT Environmental (2016)	Identifies 5 iconic species from the Parramatta River catchment, links the ecological needs of these iconic species to the ecological services provided within the catchment, and recommends a hierarchy of actions for habitat management,	• All 5 species can be found in Canada Bay, but the LGA is especially important for the Bar-tailed Godwit
Our Living River Masterplan	Plan to improve Parramatta River for swimming and community use	• Opportunities for possible swimming sites along Parramatta River with improved River management.

Appendix C Topography, Geology and Soil Landscape Maps

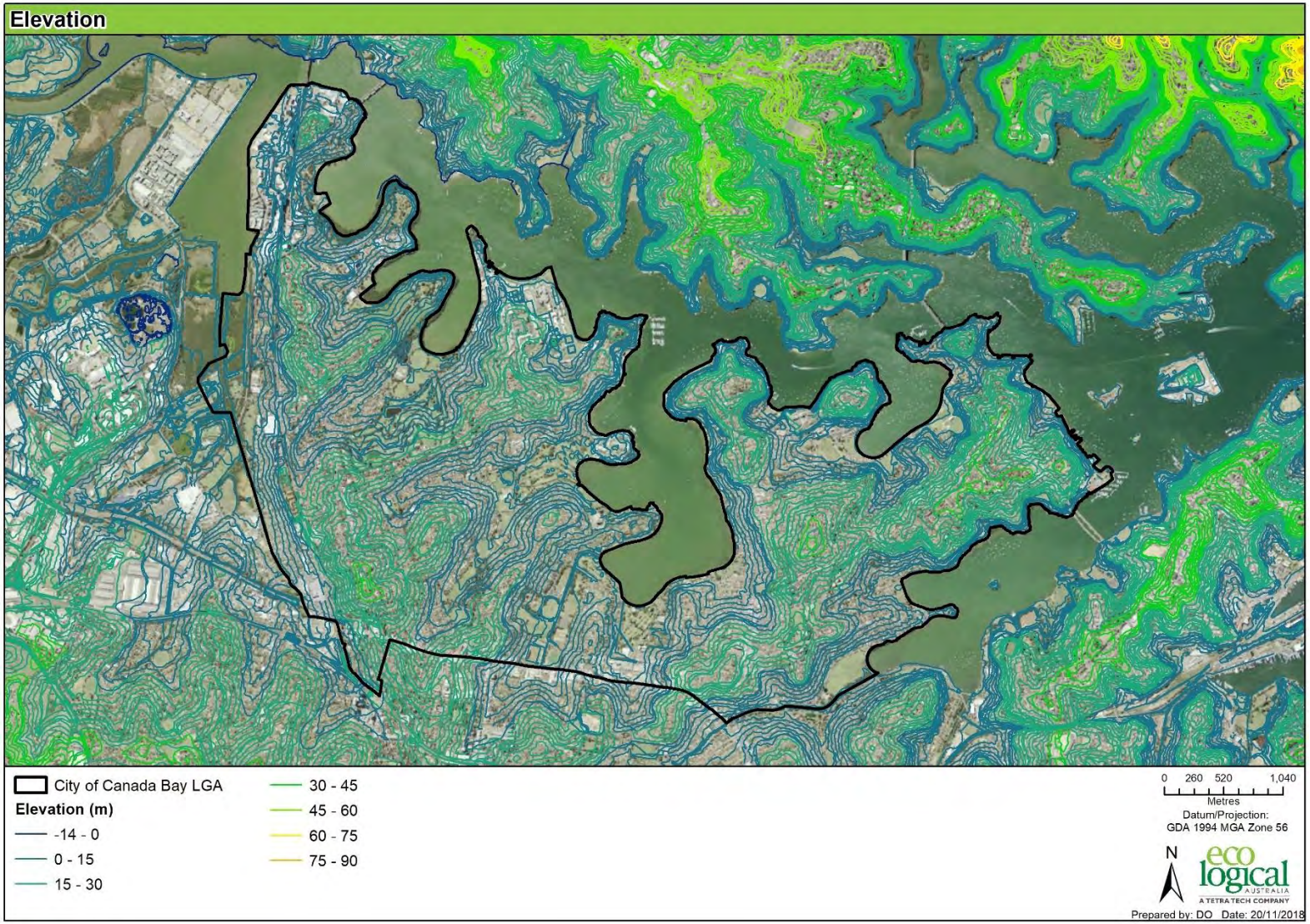

Figure 23: Elevation - topography of Canada Bay

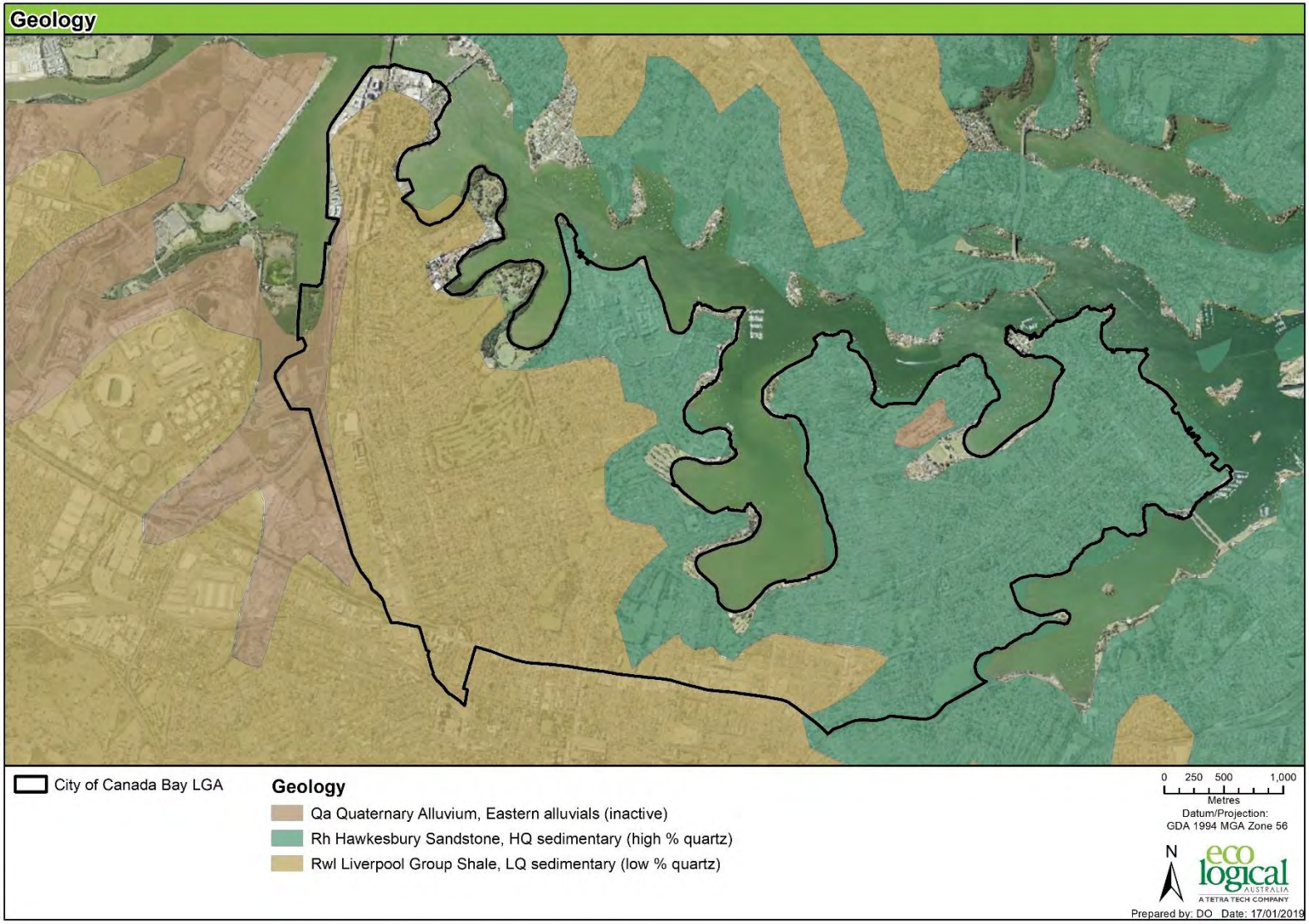

Figure 24: Geology of Canada Bay

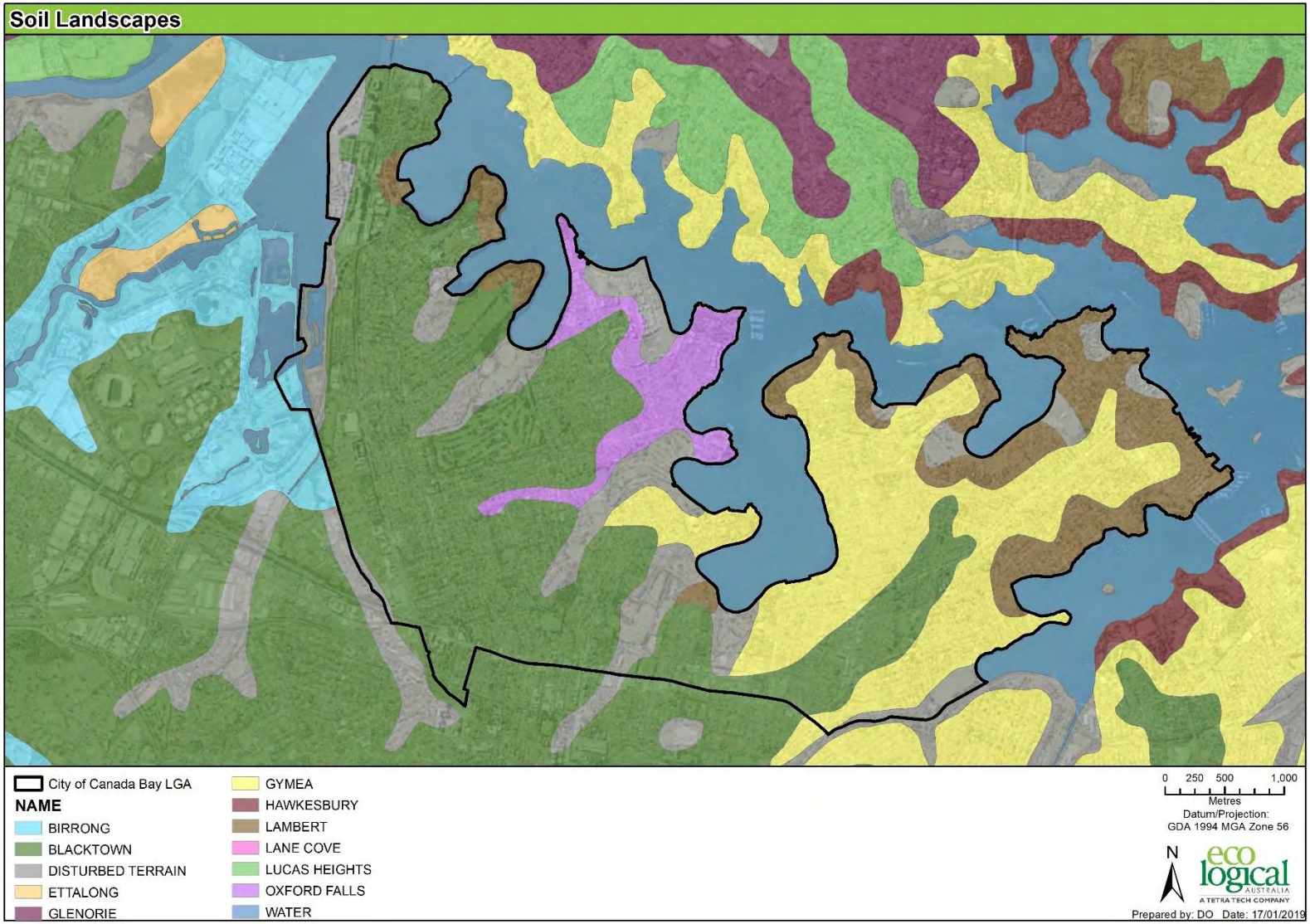

Figure 25: Soil Landscapes in Canada Bay

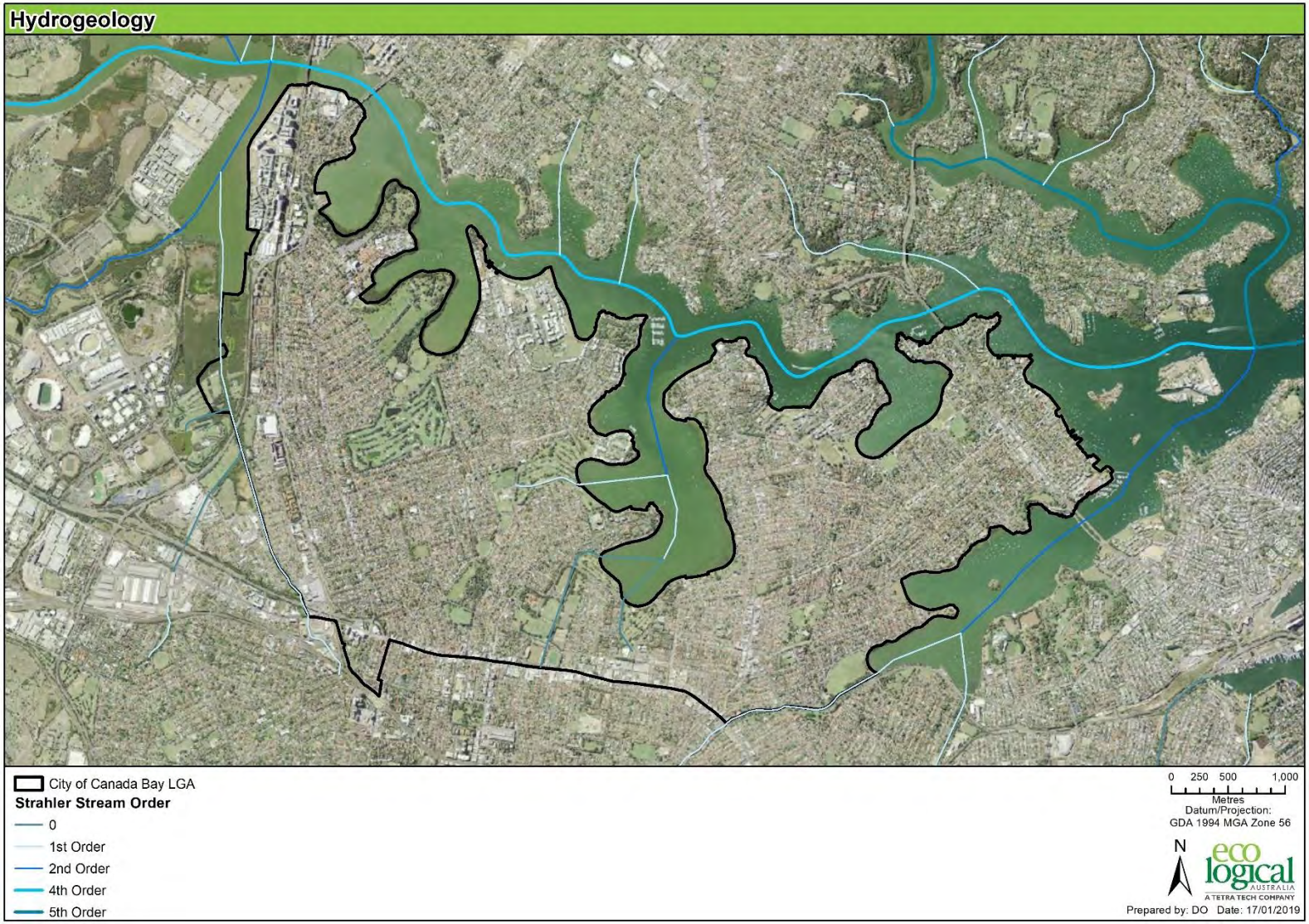

Figure 26: Hydrogeology - waterways of Canada Bay indicating the Strahler Stream Order

Appendix D Fauna and Flora of Canada Bay – Commonwealth and NSW status

KEY

Jurisdiction	Abbreviation	Protection status
Commonwealth (EPBC Act)	C	Listed on China Australia Migratory Bird Agreement
	CE	Critically Endangered
	E	Endangered
	J	Listed on Japan Australia Migratory Bird Agreement
	K	Listed on Republic of Korea Australia Migratory Bird Agreement
	V	Vulnerable
	X	Extinct
NSW (BC Act)	E1	Endangered
	E2	Endangered Population
	E4A	Critically Endangered
	P	Protected
	V	Vulnerable
	2	Sensitivity Class 2 (under the Sensitive Species Data Policy)
	3	Sensitivity Class 3 (under the Sensitive Species Data Policy)

*Note: * indicates species recorded within the LGA.*

D1 Fauna

Table 16: Fauna within 5km of City of Canada Bay, BioNet Search 2018

Common Name	Scientific name	Records	Records post-1990	Commonwealth status	NSW status
Australasian Bittern	*Botaurus poiciloptilus*	9	7	E	E1,P
Australian Fur-seal	*Arctocephalus pusillus doriferus*	1	1		V,P
Australian Painted Snipe	*Rostratula australis*	3	3	E	E1,P
Barking Owl	*Limosa lapponica*	3	3	C,J,K	P
Bar-tailed Godwit	*Ninox connivens*	828	810		V,P,3
Black Bittern*	*Limosa limosa*	5	5	C,J,K	V,P
Black Falcon	*Ixobrychus flavicollis*	1	1		V,P
Black-tailed Godwit	*Falco subniger*	14	8		V,P
Broad-billed Sandpiper	*Limicola falcinellus*	2	1	C,J,K	V,P
Bush Stone-curlew*	*Burhinus grallarius*	5	5		E1,P
Caspian Tern	*Hydroprogne caspia*	24	22	C,J	P
Cattle Egret*	*Ardea ibis*	136	133	C,J	P

Common Name	Scientific name	Records	Records post-1990	Commonwealth status	NSW status
Common Greenshank*	*Tringa nebularia*	171	168	C,J,K	P
Common Sandpiper*	*Actitis hypoleucos*	82	77	C,J,K	P
Common Tern*	*Sterna hirundo*	35	24	C,J,K	P
Curlew Sandpiper*	*Calidris ferruginea*	358	323	CE,C,J,K	E1,P
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	18	15		V,P
Eastern Bentwing-bat*	*Miniopterus schreibersii oceanensis*	123	122		V,P
Eastern Curlew*	*Numenius madagascariensis*	30	28	CE,C,J,K	P
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	2	2		V,P
Eastern Freetail-bat	*Mormopterus norfolkensis*	13	13		V,P
Eastern Grass Owl	*Tyto longimembris*	2	1		V,P,3
Eastern Osprey*	*Pandion cristatus*	5	4		V,P,3
Eastern Pygmy-possum	*Cercartetus nanus*	2	0		V,P
Eastern Reef Egret	*Egretta sacra*	1	1	C	P
Flame Robin	*Petroica phoenicea*	2	1		V,P
Fork-tailed Swift	*Apus pacificus*	2	2	C,J,K	P
Freckled Duck	*Stictonetta naevosa*	1	0		V,P
Giant Dragonfly	*Petalura gigantea*	1	1		E1
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	4	4		V,P,2
Glossy Ibis	*Plegadis falcinellus*	60	59	C	P
Great Knot	*Calidris tenuirostris*	2	1	CE,C,J,K	V,P
Greater Broad-nosed Bat	*Scoteanax rueppellii*	1	1		V,P
Greater Sand-plover	*Charadrius leschenaultii*	1	1	V,C,J,K	V,P
Green and Golden Bell Frog	*Litoria aurea*	13026	13017	V	E1,P
Grey Plover*	*Pluvialis squatarola*	2	1	V	V,P
Grey-headed Flying-fox*	*Pteropus poliocephalus*	186	184	C,J,K	P
Grey-tailed Tattler*	*Tringa brevipes*	4	2	C,J,K	P
Gull-billed Tern	*Gelochelidon nilotica*	15	15	C	P
Latham's Snipe*	*Gallinago hardwickii*	646	643	C,J,K	P
Little Bentwing-bat	*Miniopterus australis*	1	1		V,P
Little Curlew	*Numenius minutus*	1	0	C,J,K	P
Little Eagle	*Hieraaetus morphnoides*	6	6		V,P
Little Lorikeet*	*Glossopsitta pusilla*	5	5		V,P
Little Tern*	*Sternula albifrons*	8	5	C,J,K	E1,P

Common Name	Scientific name	Records	Records post-1990	Commonwealth status	NSW status
Long-nosed Bandicoot population in inner western Sydney*	*Perameles nasuta*	25	25		E2,P
Marsh Sandpiper	*Tringa stagnatilis*	40	35	C,J,K	P
Masked Owl	*Tyto novaehollandiae*	1	0		V,P,3
Pacific Golden Plover*	*Pluvialis fulva*	310	295	C,J,K	P
Pectoral Sandpiper	*Calidris melanotos*	40	36	J,K	P
Pied Oystercatcher	*Haematopus longirostris*	1	0		E1,P
Powerful Owl	*Ninox strenua*	217	216		V,P,3
Rainbow Bee-eater*	*Merops ornatus*	2	1	J	P
Red Knot*	*Calidris canutus*	17	14		V,P
Red-crowned Toadlet	*Pseudophryne australis*	7	7	C,J,K	P
Red-necked Stint*	*Calidris ruficollis*	48	34	E,C,J,K	P
Regent Honeyeater	*Anthochaera phrygia*	6	1	CE	E4A,P
Ruddy Turnstone*	*Arenaria interpres*	10	4	C,J,K	P
Ruff	*Philomachus pugnax*	3	3	C,J,K	P
Scarlet Robin	*Petroica boodang*	1	1		V,P
Sharp-tailed Sandpiper*	*Calidris acuminata*	682	630	C,J,K	P
Sooty Owl	*Tyto tenebricosa*	1	1		V,P,3
Southern Myotis	*Myotis macropus*	26	26		V,P
Spotted Harrier	*Dasyurus maculatus*	3	3	E	V,P
Spotted-tailed Quoll	*Circus assimilis*	1	0		V,P
Square-tailed Kite	*Lophoictinia isura*	1	1		V,P,3
Superb Fruit-Dove*	*Ptilinopus superbus*	4	2		V,P
Swift Parrot	*Lathamus discolor*	2	2	CE	E1,P,3
Terek Sandpiper	*Xenus cinereus*	1	1	C,J,K	V,P
Turquoise Parrot	*Neophema pulchella*	1	1		V,P,3
Varied Sittella	*Daphoenositta chrysoptera*	2	2		V,P
Western Sandpiper	*Calidris mauri*	1	0	J	P
Whimbrel*	*Numenius phaeopus*	2	1	C,J,K	P
White-bellied Sea-Eagle*	*Haliaeetus leucogaster*	274	268	C	V,P
White-fronted Chat*	*Epthianura albifrons*	238	233		V,P
White-fronted Chat population in the Sydney Metropolitan Catchment Management Area*	*Epthianura albifrons*	238	233		E2,V,P
White-throated Needletail	*Hirundapus caudacutus*	13	11	C,J,K	P

Common Name	Scientific name	Records	Records post-1990	Commonwealth status	NSW status
White-winged Black Tern	*Chlidonias leucopterus*	1	1	C,J,K	P
Wood Sandpiper	*Tringa glareola*	4	1	C,J,K	P
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	8	8		V,P
Total		18,078	17,823		

D2 Flora

Table 17: Flora within 5km of City of Canada Bay, BioNet Search 2018

Scientific name	Common Name	Records	Records post-1990	Commonwealth status	NSW status
Acacia bynoeana	Bynoe's Wattle	2	0	V	E1
Acacia clunies-rossiae	Kanangra Wattle	1	1		V
Acacia pubescens	Downy Wattle	537	523	V	V
Acacia terminalis subsp. *terminalis*	Sunshine Wattle	14	13	E	E1
Callistemon linearifolius	Netted Bottle Brush	9	6		V,3
Darwinia biflora	*Darwinia biflora*	6	3	V	V
Dillwynia tenuifolia	*Dillwynia tenuifolia*	1	1		V
Epacris purpurascens var. *purpurascens*	*Epacris purpurascens* var. *purpurascens*	31	28		V
Eucalyptus nicholii	Narrow-leaved Black Peppermint	8	8	V	V
Eucalyptus pulverulenta	Silver-leafed Gum	1	0	V	V
Eucalyptus scoparia	Wallangarra White Gum	1	1	V	E1
Genoplesium baueri	Bauer's Midge Orchid	10	0	E	E1,P,2
Grevillea beadleana	Beadle's Grevillea	1	1	E	E1,3
Isotoma fluviatilis subsp. *fluviatilis*	*Isotoma fluviatilis* subsp. *fluviatilis*	1	0	X	
Leptospermum deanei	*Leptospermum deanei*	2	0	V	V
Melaleuca deanei	Deane's Paperbark	10	2	V	V
Persoonia hirsuta	Hairy Geebung	3	0	E	E1,P,3
Pimelea curviflora var. *curviflora**	*Pimelea curviflora* var. *curviflora**	7	2	V	V
Pomaderris prunifolia	*P. prunifolia* in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	20	18		E2

Scientific name	Common Name	Records	Records post-1990	Commonwealth status	NSW status
Prostanthera marifolia	Seaforth Mintbush	2	0	CE	E4A,3
Syzygium paniculatum	Magenta Lilly Pilly	9	8	V	E1
Tetratheca glandulosa		1	0		V
*Tetratheca juncea**	Black-eyed Susan*	13	0	V	V
Wahlenbergia multicaulis	Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	67	67		E2
*Wilsonia backhousei**	Narrow-leafed Wilsonia*	98	91		V
Zannichellia palustris		5	5		E1
	Total	860	778		

Appendix E Key Habitats

Table 18: Location of and description of ranked habitat

Ranking	Location / habitat
Critical habitat	McIlwane Park/ Brays Bay/ Rhodes provides habitat for Bar-tailed Godwit, Sharp-tailed Sandpiper, Red-necked Stint and White-bellied Sea-eagle; other raptors Australian Hobby, Black-shouldered Kite and Brown Goshawk; locally uncommon bushbirds Eastern Rosella, New Holland Honeyeater, Little Wattlebird and Grey Butcherbird
	Bicentennial Park east of Powell's Creek provides habitat for Chestnut Teal, Yellow Thornbill, Silvereye, Superb Fairy-wren
	Tidal estuaries on Homebush Bay provide habitat for Royal Spoonbill, White-faced Heron and four species of cormorant
	Brays Bay Lovedale Place Park Concord West, Mangrove Forests, Riverflat Paperbark Swamp Forest and Estuarine Swamp Oak Forest habitat for Grey-headed Flying Fox, Little Lorikeet
	Rivendell and Thomas Walker Estate Concord West, Sydney Turpentine-Ironbark Forest and foreshore habitat for White-bellied Sea-eagle, Bar-tailed Godwit and Grey-headed Flying Fox, Rainbow Lorikeets, Australasian Darter, potential habitat for Powerful Owl
	Yaralla Estate Concord West, Sydney Turpentine-Ironbark Forest habitat for White-bellied Sea-eagle and Grey-headed Flying Fox, Australian King-Parrot, Grey Fantail, White-cheeked Honeyeater, Red-browed Finch, Mistletoebird, Sacred Kingfisher and White-browed Scrubwren, 4 species of skink including Eastern Bluetongues, potential habitat for Powerful Owl
	Queen Elizabeth Park, Sydney Turpentine-Ironbark Forest habitat for Grey-headed Flying Fox, potential habitat for Powerful Owl, other raptor - Tawny Frogmouth, parrots Eastern Rosella and Red-rumped Parrot and mammals
	Majors Bay, Concord foreshore and mangrove forests, Cintra Park, Concord, Hen and Chicken Bay and Prince Edward Park, Cabarita provide habitat for Bar-tailed Godwit
	Mangrove forest at Homebush Bay, Brays Bay, Yaralla Bay, Majors Bay, Sisters Bay, Brett Park and Half Moon Bay provides habitat for Rakali, waterbirds and fish
	Small pockets of saltmarsh at Bicentennial Park east, Rivendell CAF Unit, Yaralla Estate, Prince Edward Park and south-western foreshore of Iron Cove provide habitat for migratory and waterbirds
	Isolated STIF at Rhodes Park, Concord Golf Course, Mortlake Public School, Five Dock Park and Russell Lea Infants School provide foraging habitat for Grey-headed Flying Fox Powerful Owl
	Isolated swamp oak floodplain forest at Bicentennial Park east, Quarantine Reserve, Rhodes Park, Prince Edward Park and Sisters Bay provide important bird habitat
	Isolated patches of mangrove forest at Kendall Bay, Halliday Park, Exile Bay, Quarantine Reserve, and along the Iron Cove south-western foreshore between Timbrell Park and Rodd Point provide important bird habitat area, with records of Bush Stone-curlew at Iron Cove
Supporting habitat	Revegetated parks (10-30+ year-old) provide habitat with ground, shrub and canopy layers at Brays Bay Reserve and Rhodes Park, Bicentennial Park east and Cabarita Park.
	Newer plantings with trees and some ground cover with habitat value is at Rider Boulevard, Mill Park, Cintra Park, Henry Lawson Park and Brett Park
	Plantings with habitat connectivity along riparian zones and roads and enhancing remnant size are at Brays Bay Reserve and Rhodes Park, Bicentennial Park east and Rider Boulevard and, potentially, Cintra Park and Figtree Bay Reserve

Ranking	Location / habitat
	Clump plantings of grass at Massey Park Golf Course and Brays Bay Reserve provide foraging habitat and cover around a small dam at Concord Golf Course
	Isolated individual or single rows of planted trees often along paths, drainage lines or between fairways at Cintra, Five Dock, Halliday, Henry Lawson, Brett, Drummoyne and Timbrell Parks and Concord, Massey Park and Barnwell Park golf courses
	Urban neighbourhoods with older eucalypts in the rear yards of Coonong Road and Empire Avenue at Concord West, Edenholme Road at Russell Lea, and Noble Street at Five Dock
	Dense plantings in Concord West, Concord, Rhodes, Cabarita and Canada Bay and hedgerows in residential apartments north-east of Massey Park Golf Course provide good small bird habitat, as does “The Anchorage”, a residential development at Breakfast Point adjoining Cabarita Park
	Waterbird habitat is found in dams at Concord Golf Course and in small drainage lines at Massey Park Golf Course, a mangrove wetland at Bicentennial Park east and rock pools at Sisters Bay

Appendix F Field Survey

F1 Field Survey Sites

The areas for field survey are shown, and the reasoning for each site is explained.

BUSHCARE CONSULTATION

During field survey, ELA consulted with local Bushcare groups on the habitat values, trends and opportunities within Canada Bay's terrestrial habitats. The associated Bushcare groups for each survey site are also included.

Table 19: Field survey sites in Canada Bay LGA

Sites	Reasons for recommendation	Associated Bushcare group
Brays Bay Reserve Majors Bay Reserve	• Records of threatened/migratory species • Large vegetated area • Contains small bird habitat e.g. Brays Bay Reserve • Contains part or all of planned nature foreshore walks for Rivendell and Yaralla	Concord Bushcare Yaralla Bushcare
Queen Elizabeth Park Goddard Park	• Records of threatened/migratory species • Large area of non-foreshore habitat	Concord Bushcare
Henry Lawson Park Quarantine Reserve Battersea Park Werrell Reserve	• Scattered vegetated areas	Concord Bushcare
Brett Park Montague Park / Bay Run	• Records of Rakali • Scattered vegetation	Sisters Bay Bushcare
Timbrell Park Croker Park	• Records of threatened/migratory species • Thin vegetated area along Iron Cove Creek	

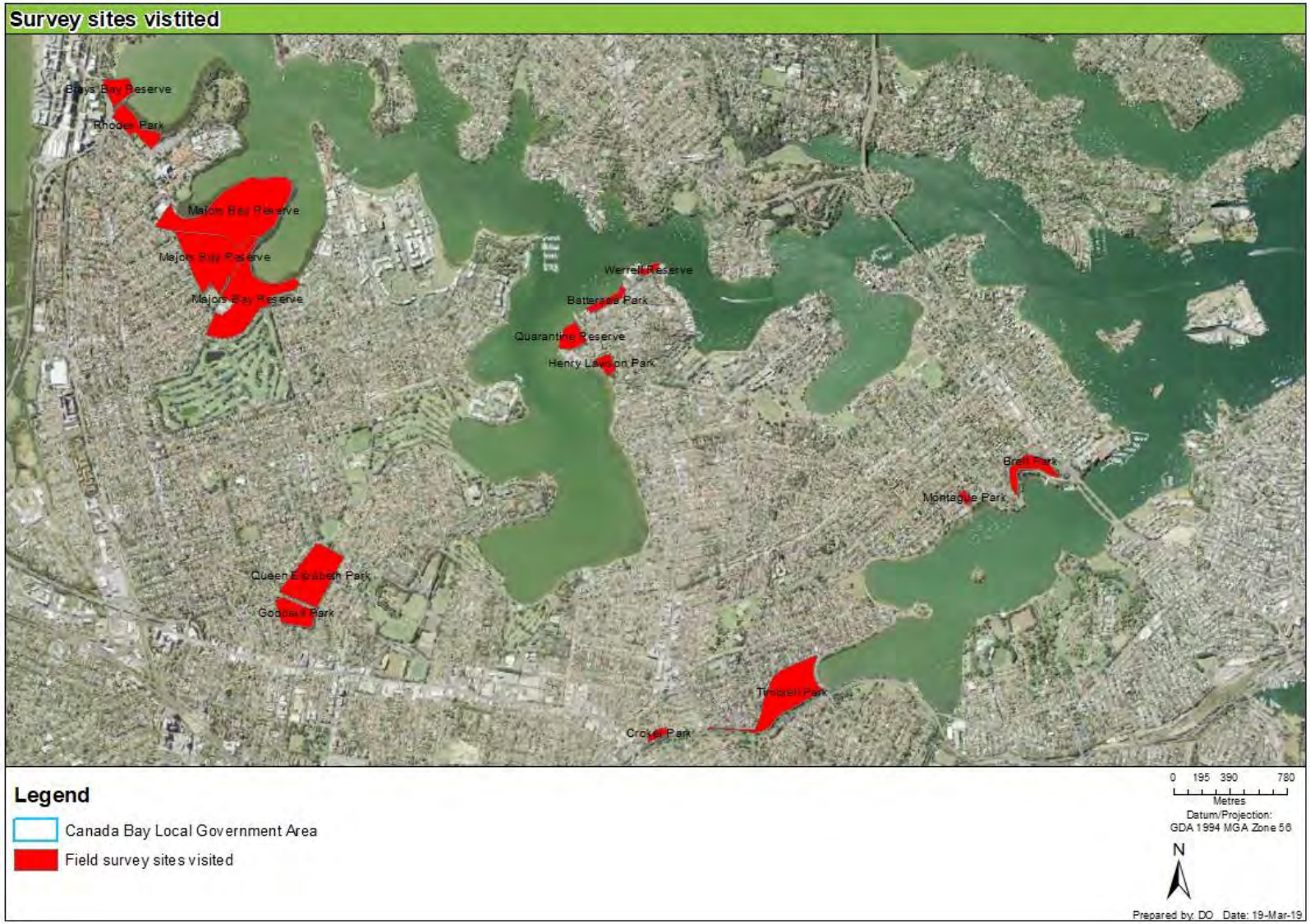

Figure 27: Field sites visited

F2 Field Survey Results

TIMBRELL PARK

Vegetation type and condition: No remnant vegetation present. Stands of vegetation has been planted with native species Estuarine Swamp Oak Floodplain Forest

Waterway Condition: Canal influenced by stormwater and pollution.

Important local habitat: Nest boxes have been installed in park which appear to be targeted to possums

Corridor enhancement opportunities: Potential 'fauna / green' bridges to connect two side of canal. Opportunities to plant more trees, shrubs and understorey in a riparian zone and naturalisation of the canal edge. Recreation use of park limits ability to plant out larger areas, trees however could be planted more along Henley Marine Drive to provide birds and arboreal fauna habitat.

Significant biodiversity threats/issues: Lighting impacts on microbats, loss of shrubs and understorey in some parts of the park.

Figure 28: Timbrell Park

Figure 29: Timbrell Park vegetation communities and condition

BATTERSEA PARK

Vegetation type and condition: Planted Urban Native / Exotic. Condition is moderate with evident of weed invasion. Native vegetation has been planted and attempt to control weeds and plant some understory species is evident.

Waterway Condition: Good.

Important local habitat: None

Corridor enhancement opportunities: Isolated reserve surrounded by residential areas. Opportunity for habitat linkages with planting of street trees with shrubby understorey and ground covers.

Significant biodiversity threats/issues: None

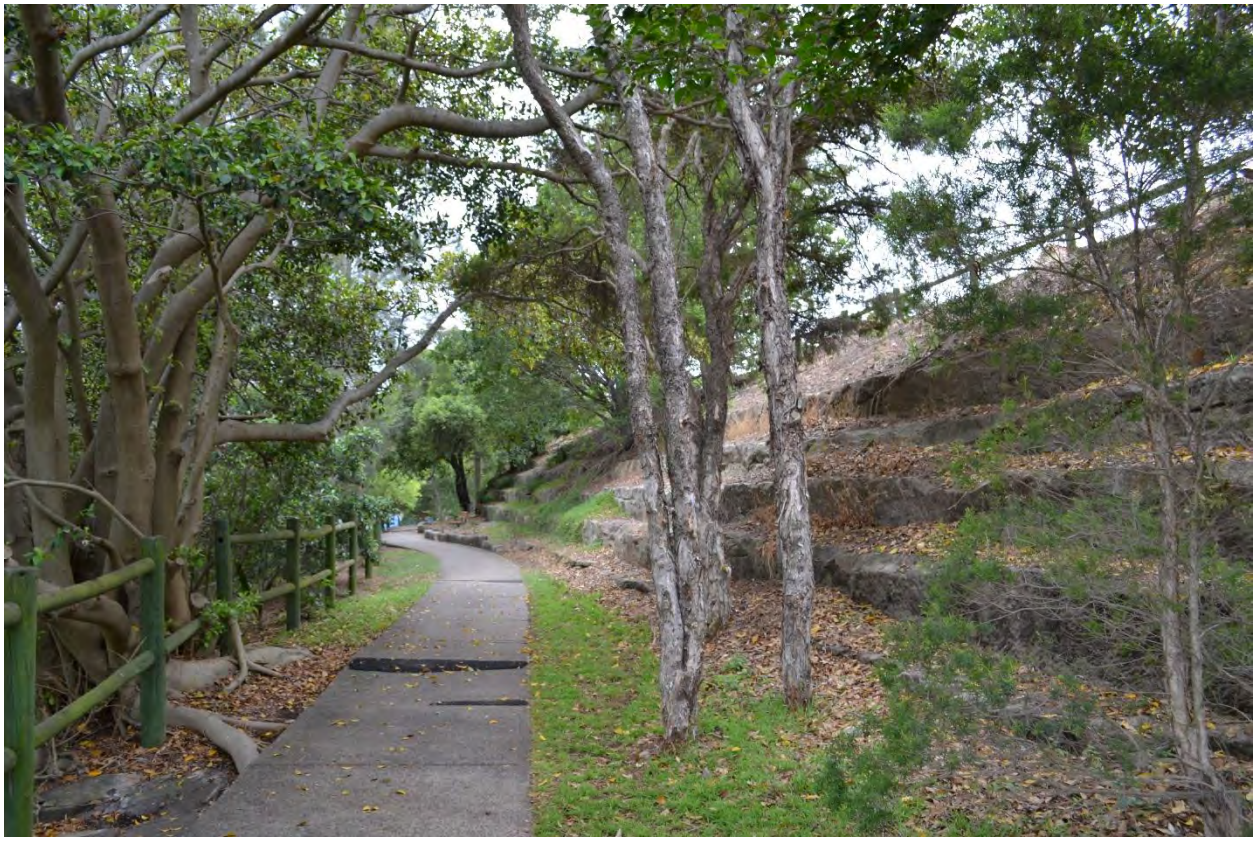

Figure 30: Battersea Park

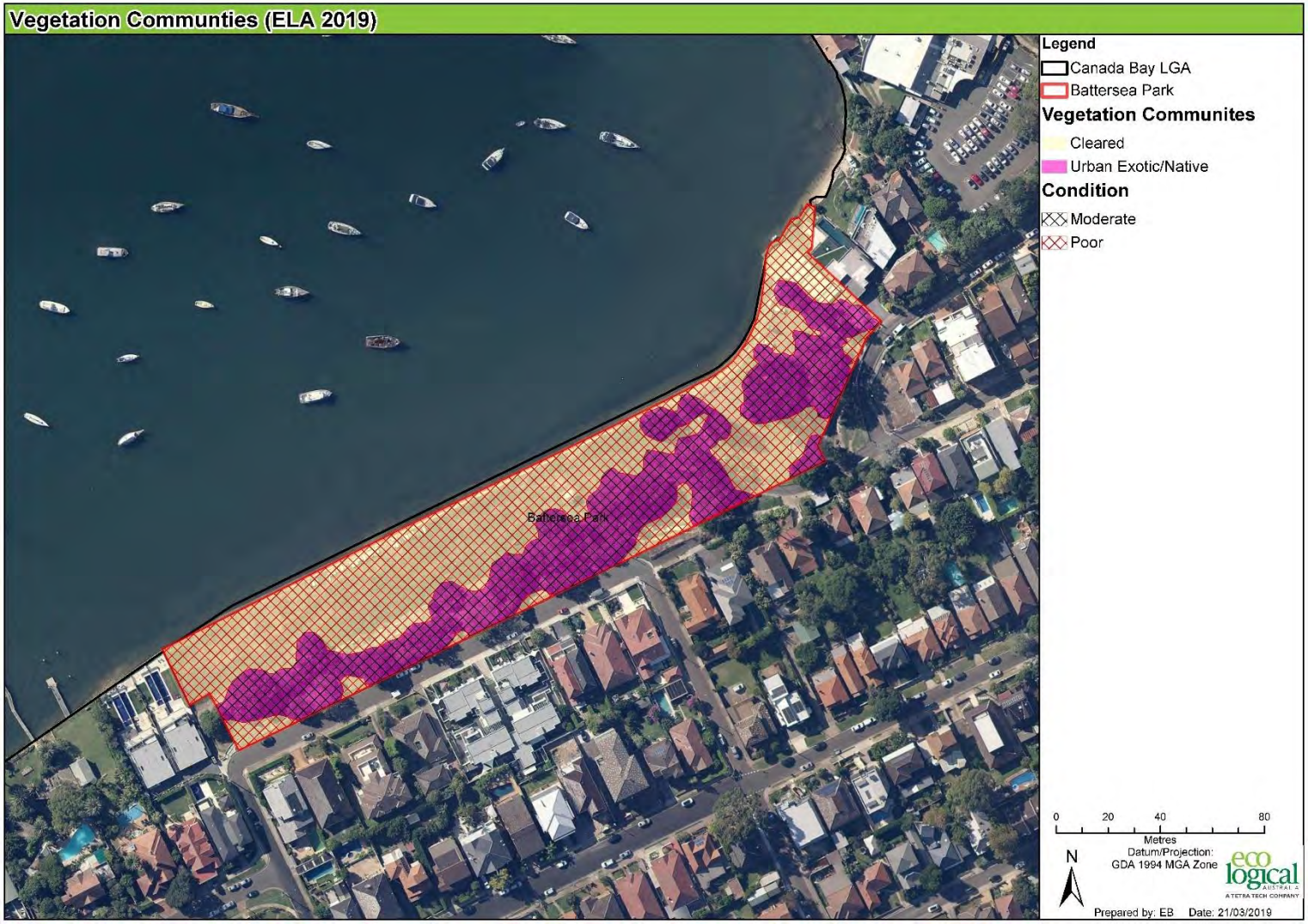

Figure 31: Battersea Park vegetation communities and condition

BRETT PARK

Vegetation type and condition: Coastal Sandstone Foreshores Forest and Urban Native / Exotic

Waterway Condition: None

Important local habitat: Large figs present, good shrub layer for birds, reptiles and ground dwelling mammals. Records of Rakali.

Corridor enhancement opportunities: Isolated reserve surrounded by residential areas. Best linked with street trees.

Significant biodiversity threats/issues: None

Figure 32: Brett Park

Figure 33: Brett Park vegetation communities and condition

CROKER PARK

Vegetation type and condition: No remnant vegetation. Likely to be all planted. Urban Native / Exotic

Waterway condition: None.

Important local habitat: Large trees present which provides habitat for birds and arboreal mammals

Corridor enhancement opportunities: Isolated reserve that has connectivity to Timbrell Park or parks on other side of canal. Opportunity for plantings to enhance riparian connectivity and renaturalisation.

Significant biodiversity threats/issues: None

Figure 34: Croker Park

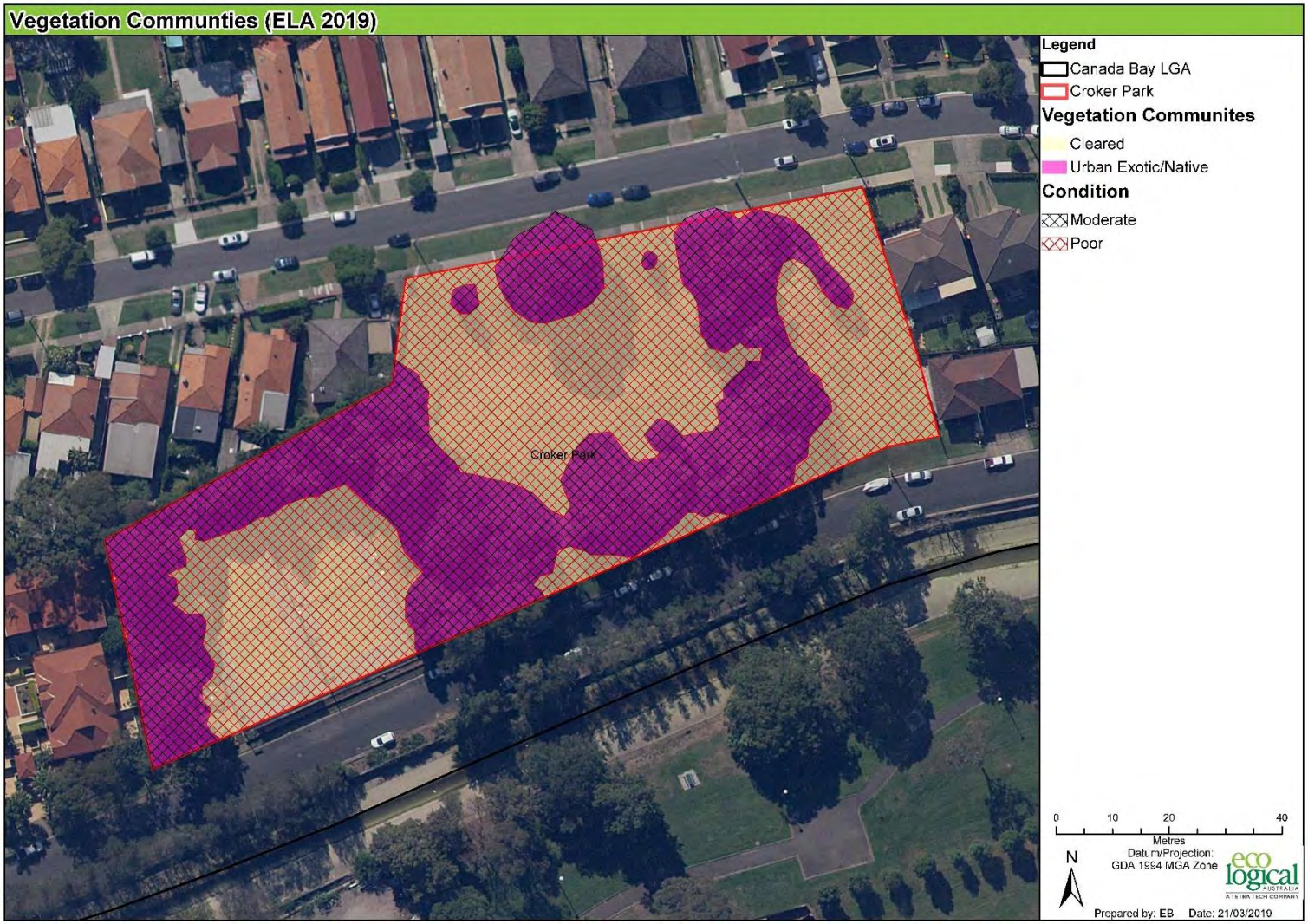

Figure 35: Croker Park vegetation communities and condition

GODDARD PARK

Vegetation type and condition: Urban Native / Exotic

Waterway condition: None

Important local habitat: Stepping stone for birds

Corridor enhancement opportunities: Opportunity for habitat linkages to Queen Elizabeth Park and St Lukes Park through planting of street trees with shrubby understorey and ground covers. Formalise paths and reduce informal paths to reduce trampling and allow vegetation cover to increase. Install signs. Opportunity to explore alternative fauna friendly lighting technology.

Significant biodiversity threats/issues: None

Figure 36: Goddard Park

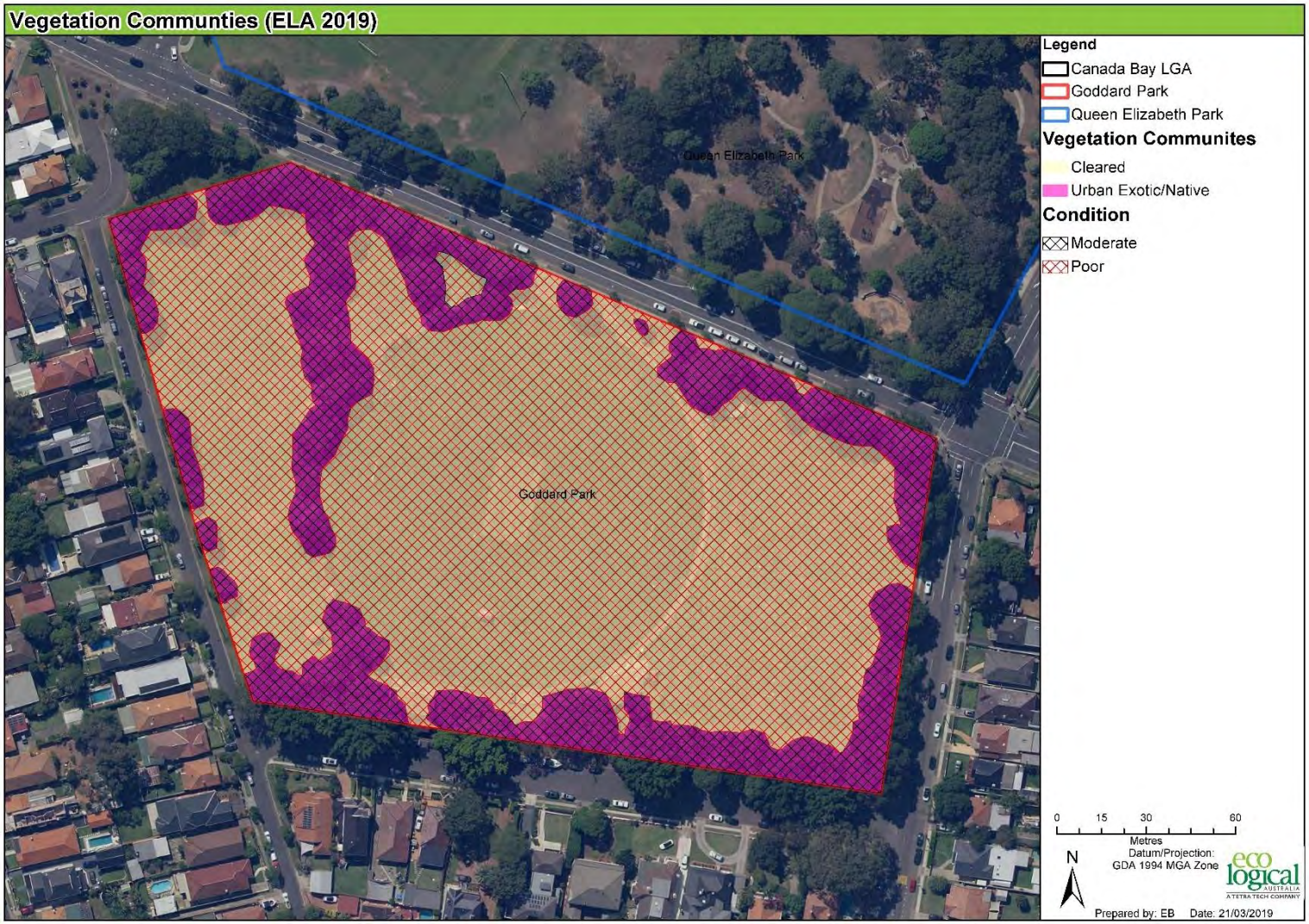

Figure 37: Goddard park vegetation communities and condition

HENRY LAWSON PARK

Vegetation type and condition: Coastal Sandstone Foreshores Forest and large Casuarina glauca present by foreshore which could indicate these could be remnant of Estuarine Swamp Oak Forest. Some large trees present. Good condition with some weeds present but evidence of control in CSFF. Understory has been cleared and is managed under the Casuarina glauca.

Waterway Condition: Good.

Important local habitat: None

Corridor enhancement opportunities: Opportunity for mid storey trees, shrub and understorey plantings in park and street trees planting to the north.

Significant biodiversity threats/issues: Loss of shrub density

Figure 38: Henry Lawson Park

Figure 39: Henry Lawson Park vegetation communities and condition

MONTAGUE PARK

Vegetation type and condition: Urban Native / Planted. Could have been historically some type of Heath Vegetation community looking at 1943 mapping on Six Maps

Waterway condition: Good.

Important local habitat: Large trees present

Corridor enhancement opportunities: Opportunity to supplement Rakali habitat on adjoining foreshore land known as 'Bay Run'

Significant biodiversity threats/issues: None

Figure 40: Montague Park

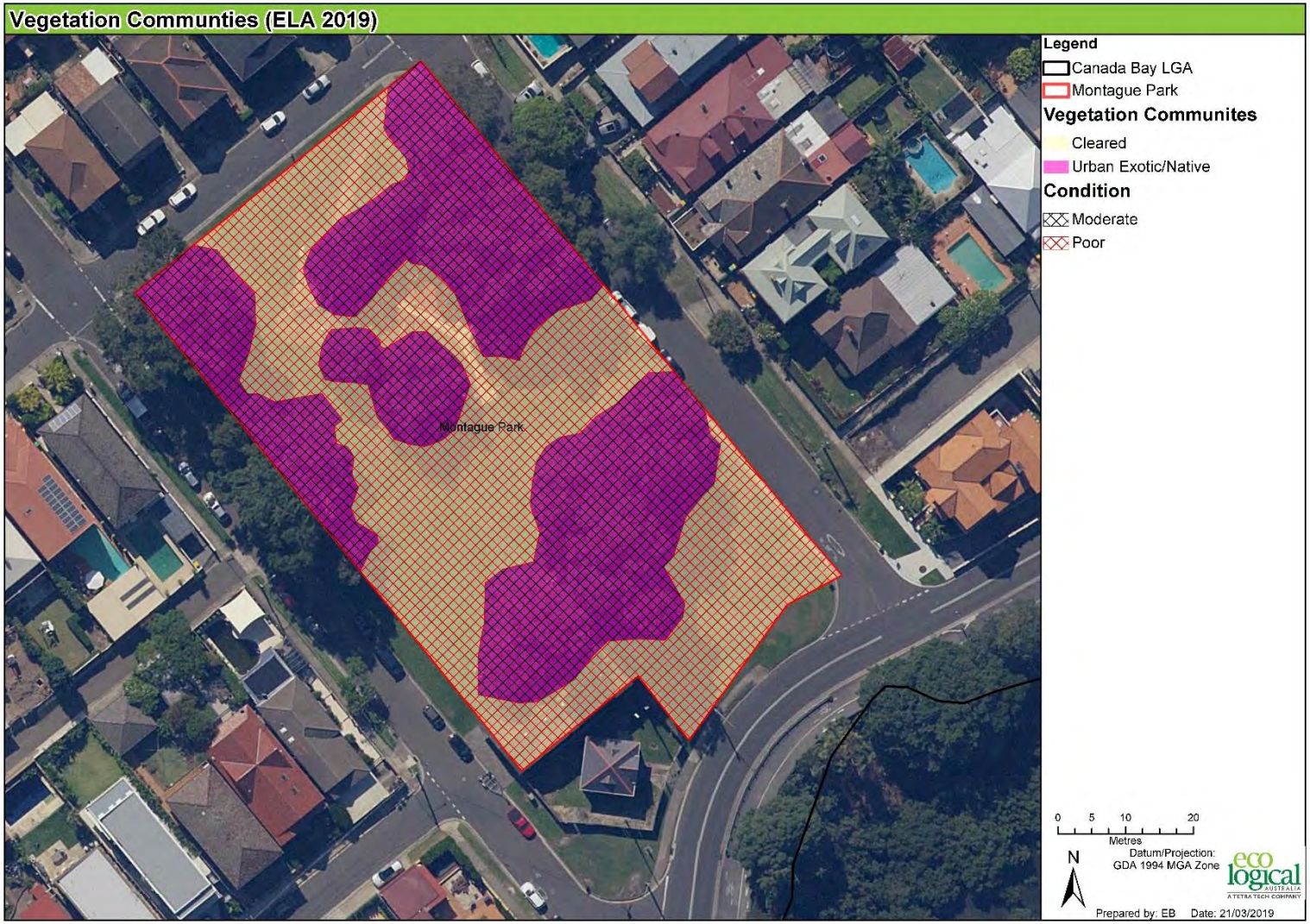

Figure 41: Montague Park vegetation communities and condition

PARRAMATTA RIVER - OBSERVATION

Vegetation type and condition: Estuarine Mangrove Forest and Estuarine Saltmarsh

Waterway condition: Good.

Important local habitat: Habitat for waterbirds, mangroves contain hollows and roosting/ nesting opportunities for other birds

Corridor enhancement opportunities: Opportunity for revegetation linkages along foreshore in areas where trees, shrubs and ground covers are absent.

Significant biodiversity threats/issues: Loss of habitat, wash from RiverCat causing mangrove dieback in places

Figure 42: Parramatta River

QUARANTNE RESERVE

Vegetation type and condition: Estuarine Mangrove Forest, Estuarine Swamp Oak Forest (Swamp Oak Floodplain Forest) and Coastal Sandstone Foreshores Forest

Waterway condition: Good.

Important local habitat: Hollows present

Corridor enhancement opportunities: Opportunity for foreshore habitat linkages with planting of street trees with shrubby understorey and ground covers.

Significant biodiversity threats/issues: None

Figure 43: Quarantine Reserve

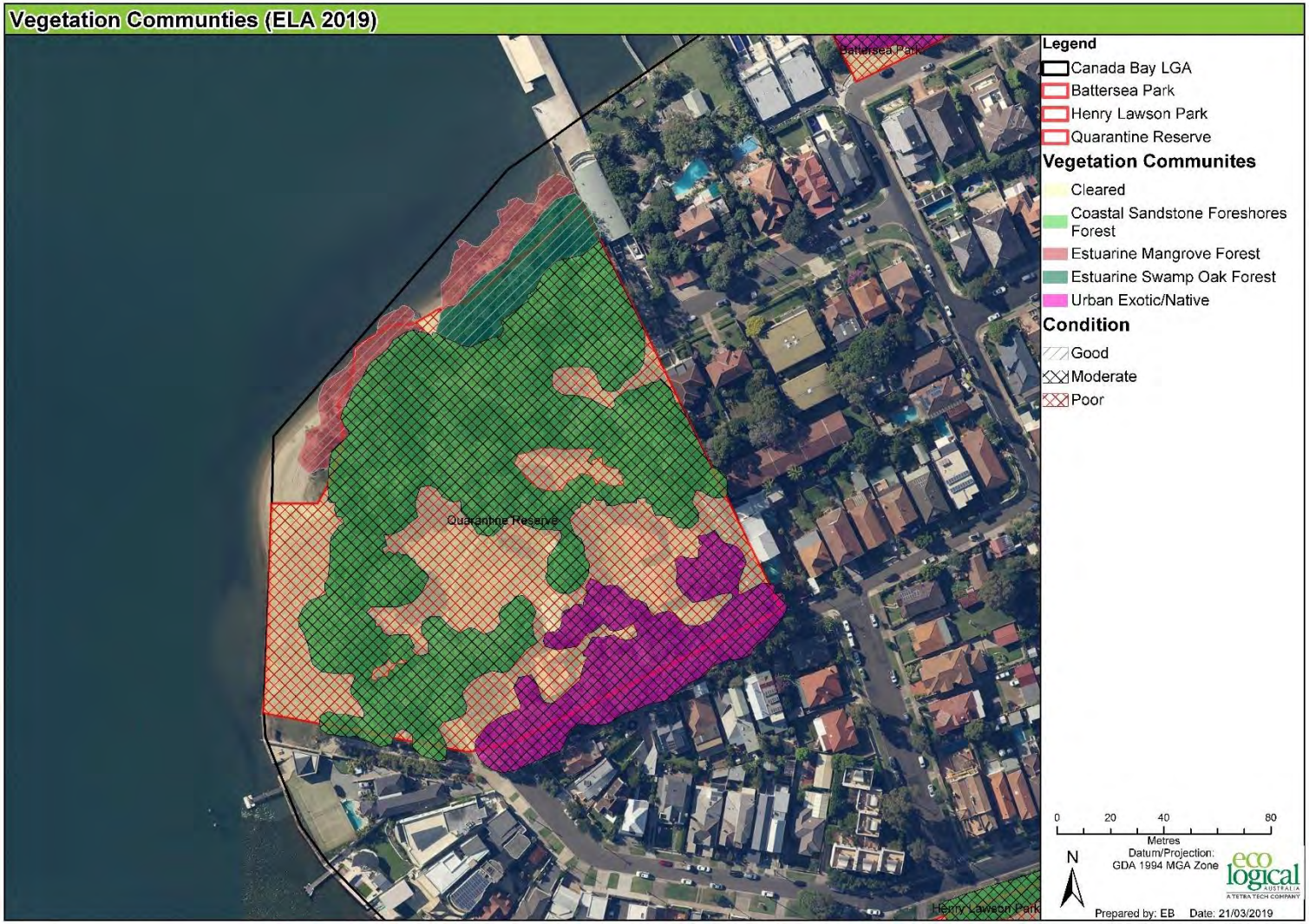

Figure 44: Quarantine Reserve vegetation communities and condition

QUEEN ELIZABETH PARK

Vegetation type and condition: Sydney Turpentine-Ironbark Forest in various degrees of condition but overall good. Planted native trees

Waterway condition: Good.

Important local habitat: Nest boxes have been installed in some trees (possum boxes). Large trees present. Native grass cover, however shrub layer is low.

Corridor enhancement opportunities: Increase size of remnant or areas of STIF by fencing areas off and stopping mowing activities. Opportunity for habitat linkages to St Lukes Park and Goddard Park.

Significant biodiversity threats/issues: Potential weed invasion

Figure 45: Queen Elizabeth Park

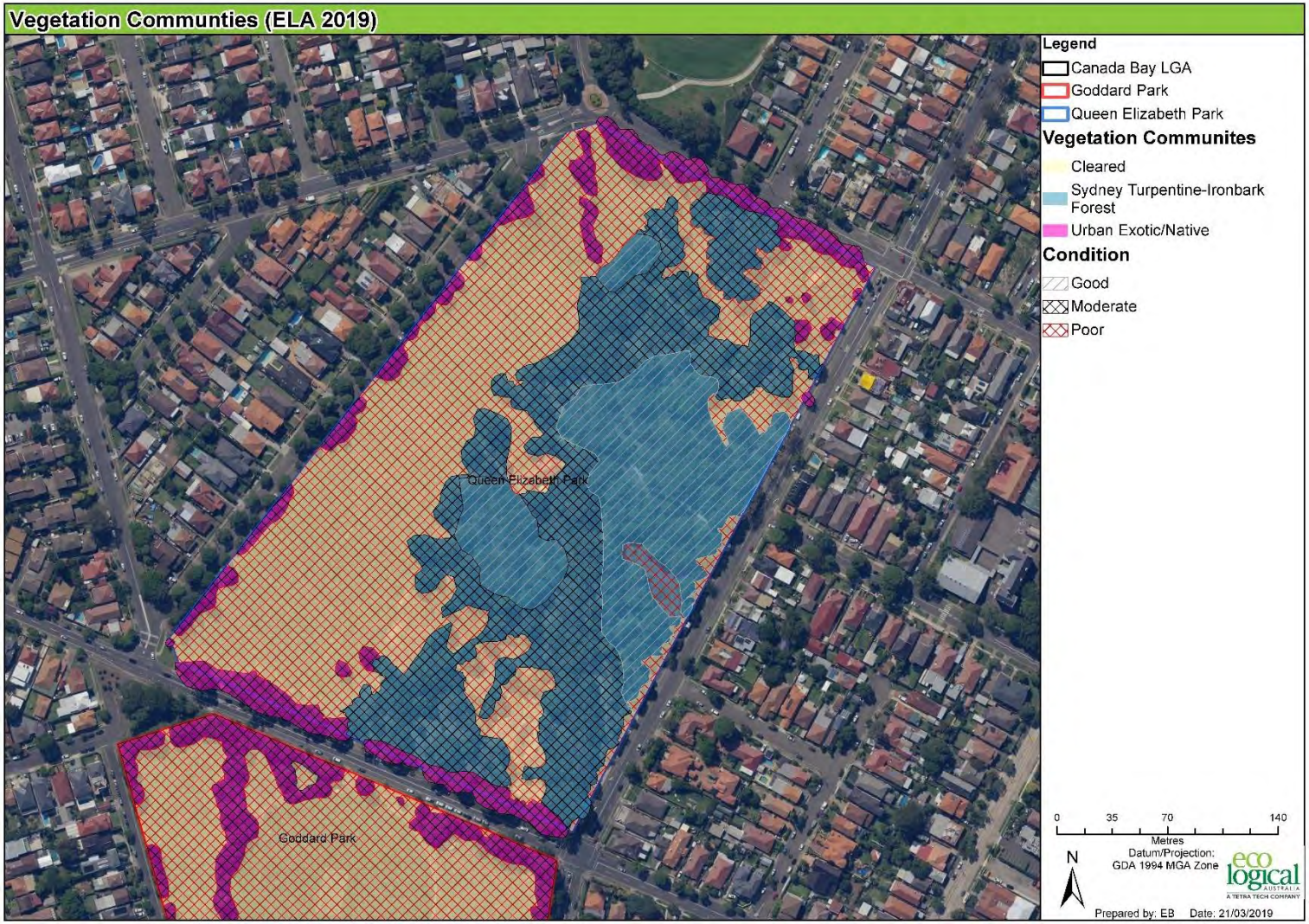

Figure 46: Queen Elizabeth Park vegetation communities and condition

WERRELL RESERVE

Vegetation type and condition: Coastal Sandstone Foreshores Forest in Moderate and Good condition.

Waterway Condition: Good.

Important local habitat: None

Corridor enhancement opportunities: Isolated reserve surrounded by residential areas. Opportunity for habitat linkages with planting of street trees with shrubby understorey and ground covers.

Significant biodiversity threats/issues: Loss of understorey shrubs and ground covers

Figure 47: Werrell Reserve

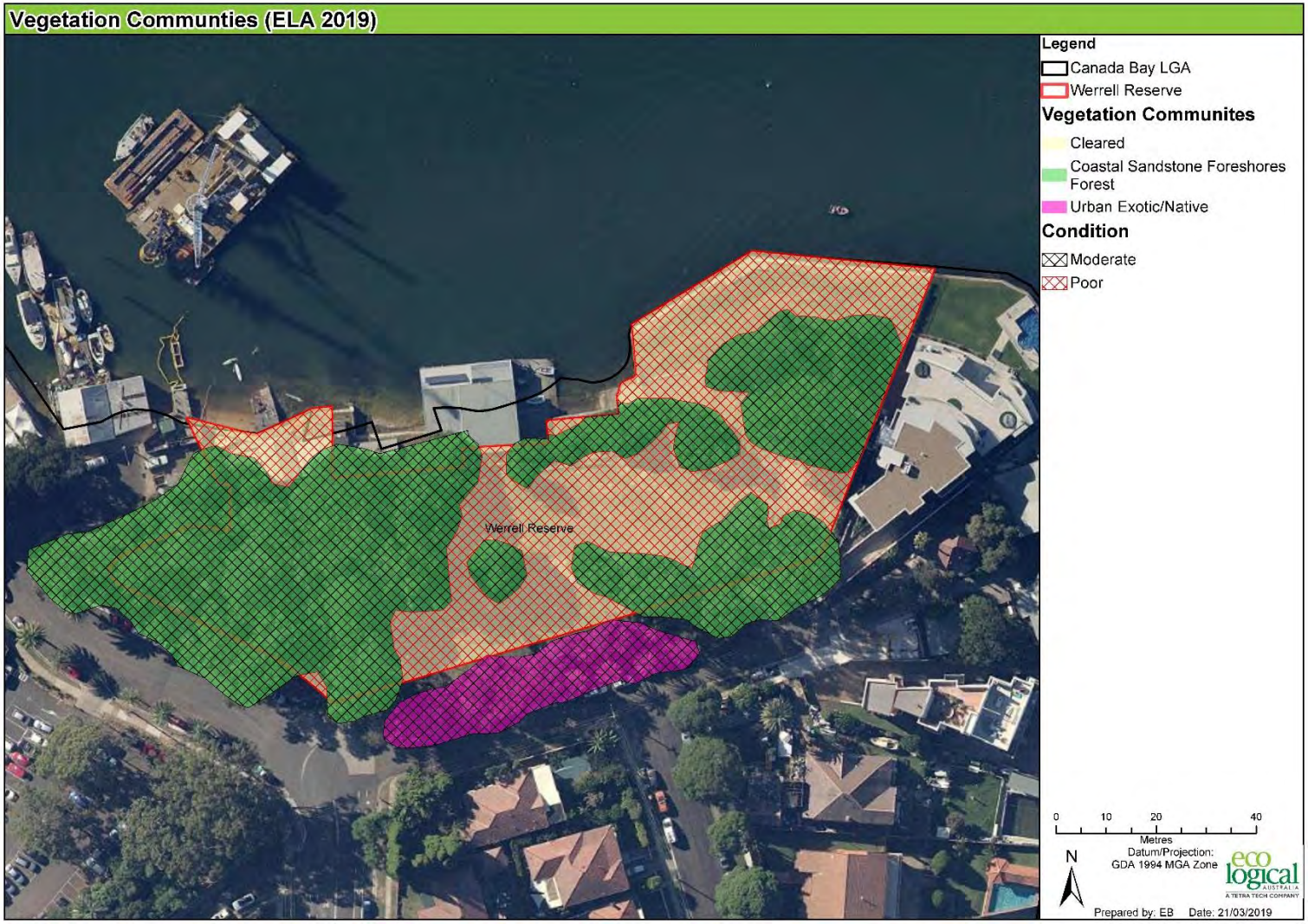

Figure 48: Werrell Reserve vegetation communities and condition

DAME EADITH WALKER ESTATE AND MAJORS BAY

Vegetation type and condition: Dame Eadith Walker Estate - Estuarine Mangrove Forest and Estuarine Saltmarsh present along the foreshore. Estuarine Swamp Oak Forest is also present. Remnant / assisted vegetation present in the of Sydney Turpentine-Ironbark Forest located on north and south side of the estate. Northern side is lower in species diversity and without bush regeneration efforts would become dominated by exotic shrubs and groundcovers in the understory. The Estuarine Swamp Oak Forest is also subject to various degrees of weed invasion from low to high. The highest is on the Majors Bay side. Majors Bay - Estuarine Mangrove Forest and Urban Native / Planted

Waterway condition: Good. Rubbish dumping along foreshore walking track.

Important local habitat: Dame Eadith Walker Estate - Large trees present and hollow-bearing trees present. Good intact shrub layer within STIF that provides habitat for small birds. Weed control works have been designed to control weeds but keep habitat present i.e. Woody lantana left in clumps. Majors Bay - Trees and mangroves present.

Corridor enhancement opportunities: Potential for revegetation / stop mowing to edge of native vegetation to create a buffer to protect the stand of vegetation from weed encroachment etc. Potential tree corridor to connect both stands of STIF for mobile fauna. Connectivity through Dame Eadith Walker Estate, Majors Bay and Golf Course to the south.

Significant biodiversity threats/issues: Potential threat to EEC's Sydney Turpentine-Ironbark Forest, Swamp Oak Floodplain Woodland and Saltmarsh through weed encroachment, impact of unleashed dogs on birds, impact on saltmarsh from track widening proposals through Yaralla.

Figure 49: Dame Eadith Walker Estate

Figure 50: Majors Bay Reserve

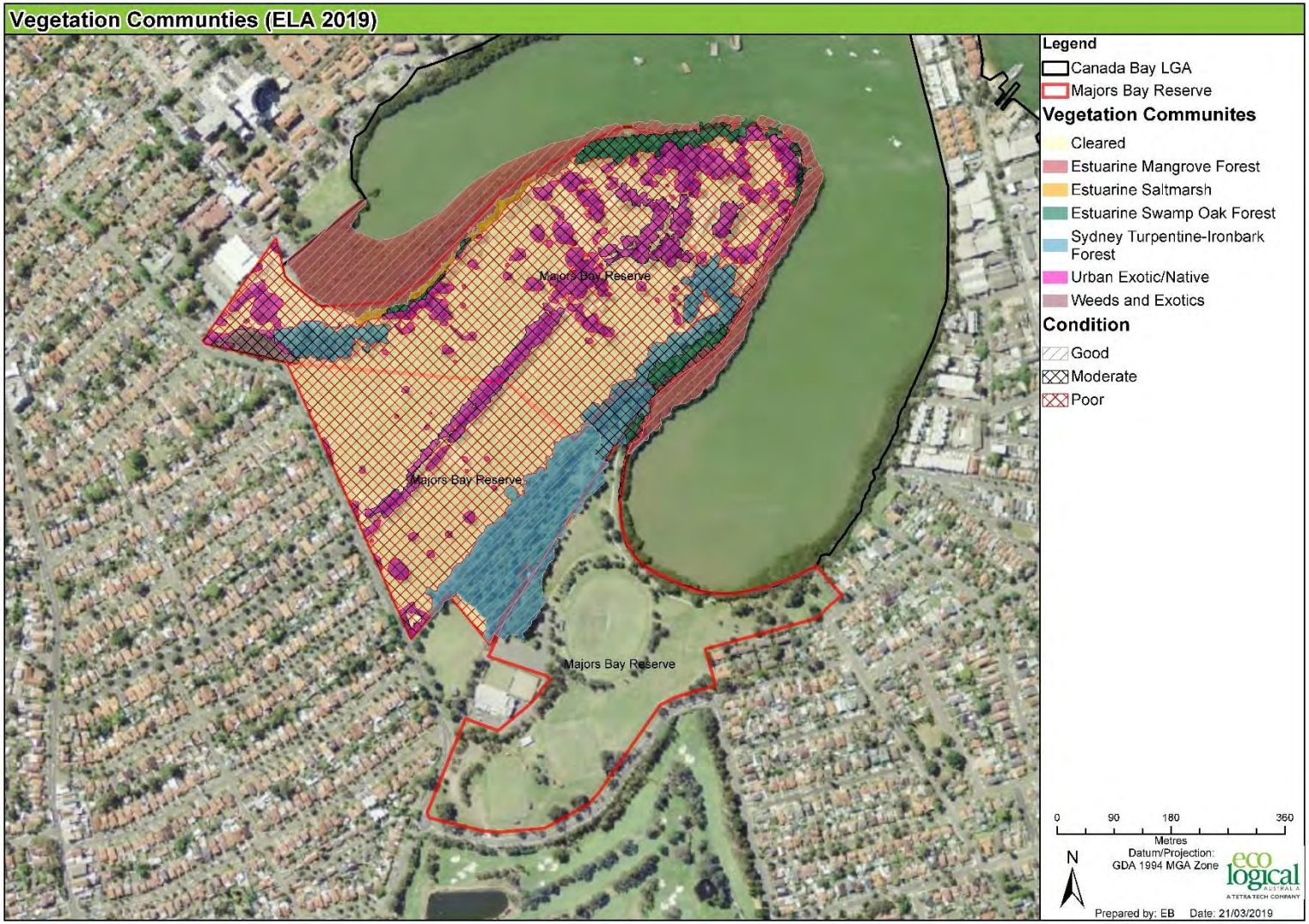

Figure 51: Majors Bay Reserve vegetation communities and condition

Appendix G Stakeholder Consultation

Introduction

The City of Canada Bay Council is developing a Biodiversity Framework to enhance and protect biodiversity values within the Local Government Area and to conserve, restore and recreate key linkages to provide connectivity with critical habitats throughout the LGA and adjoining land. Concurrent to the preparation of the Biodiversity Framework, Council is preparing several other strategic plans and Council has combined elements of the community consultation phase for the Framework with the other plans in an online survey.

Community and stakeholder engagement is important in recognising initial community and stakeholder views early in the project and to assist in mapping ecological values, and identifying threats and opportunities. Community and stakeholder views and values are central to promoting awareness of the City of Canada Bay's biodiversity values, identifying biodiversity enhancement opportunities and potential priority projects, areas of high community recreational use and relevant iconic species. The connection of people to nature in urban areas is a n important element of the Biodiversity Framework, with areas of high community interest and value including popular reserves and locations where community volunteer groups work (e.g. Bushcare). This information will be utilised develop community engagement and education programs to connect people to nature.

Eco Logical Australia (ELA) has prepared a Community Engagement Strategy and undertaken interviews with community and key stakeholders. As part of the field work, ELA has met up with bush-regenerators and local community volunteers to review their work and sight important biodiversity hotspots.

Stakeholders

Stakeholders included the following NSW Government agencies, community groups and the former Council staff Bushcare Coordinator.

Agencies and Organisations

- Office of Environment and Heritage – Aquatic Ecology Staff
- Sydney Local Health District
- Sydney Olympic Park Authority
- Parramatta River Catchment Group

Community Groups

- Canada Bay Council's Environment Advisory Committee
- Bushcare Volunteers
    - Cabarita Bushcare Group
    - Concord Bushcare Group
    - Yaralla Bushcare Group
    - Sisters Bay Bush Regeneration Group

Former Council Staff

Rob Stevenson, former Bushcare Coordinator City of Canada Bay Council.

As part of the stakeholder consultation process, the City of Canada Bay attended an Assurance and Agency Expo hosted by the Greater Sydney Commission where the following agencies were available to discuss the development of the Local Strategic Planning Statement:

- Department of Planning and Environment
- Transport for NSW
- Roads & Maritime Services
- Department of Education
- NSW Health
- Office of Environment & Heritage
- Environmental Protection Authority
- Create NSW
- Office of Sport

Conclusions from this expo have also been incorporated into the responses.

Responses

Summary of Responses

After conducting consultation with a wide array of stakeholders, some of the key issues and opportunities identified were:

- There is an ageing demographic within the Bushcare groups as well as a lack of consistent volunteers.
- Impacts associated with native bird habitat such as dogs off leads and the removal of preferred habitat through both development and landscaping and maintenance activities.
- Concerns over the dieback of mangroves due to wash from RiverCats along Parramatta River.
- A loss of diversity in native vegetation and habitat due to maintenance 'tidying up', lack of fires and vegetation succession.
- Collaboration opportunities:
    - Continuing to work with the SOPA on the mangrove education program;
    - Working with the SOPA with the Homebush Bay walking and cycling circuit project to ensure it is in line with the Sydney Olympic Park Environmental Guidelines and Biodiversity Management Plan;
    - Working with OEH and the Sydney Coastal Council Group to develop a Parramatta River – Sydney Harbour Coastal Management Program; and
    - Ensuring differing teams within Council such as the natural resources, sustainability and landscape maintenance teams, work together to ensure better biodiversity outcomes.

Agencies and Organisations

Sydney Olympic Park Authority

The Sydney Olympic Park Authority's (SOPA) direct interests lie within natural areas within the Canada Bay Local Government Area (LGA) that are immediately connected to the Sydney Olympic Park's boundaries as well as key migratory shorebird habitats that are maintained by Council. The natural areas immediately adjacent to Sydney Olympic Park are important for animal movement corridors, canopy linkages, stormwater flows, public use and bicycle corridors. Of high value to the SOPA is also the areas of waterways containing shorebird habitats, mangroves and saltmarsh.

Within the next 30-50 years, the SOPA would like to see more canopy and corridor connectivity within areas adjacent to Sydney Olympic Park as well as additional habitat for migratory shorebirds both for feeding and roosting and stormwater improvement. To help achieve this vision the SOPA believes Council could play a larger role in actioning some of the biodiversity recommendations made in previous plans and strategies within the LGA such as:

- The Canada Bay CC Fauna Report 2012-14
- Our living Catchments Program
- Parramatta River Masterplan

In accordance with the Sydney Olympic Park Environmental Guidelines and Biodiversity Management Plan, the SOPA has an extensive vegetation management program, as well as pest animal control and ecological monitoring programs. The SOPA also appreciates the mangrove education program that both Council and the SOPA run in partnership and would welcome further joint projects. In particularly, about the proposed Homebush Bay walking and cycling circuit as there are concerns relating to the pathway development through the Badu Mangroves. SOPA is seeking collaboration with Council to ensure that the project meets the requirements of the E2 zoning, the Parklands Plan of Management and Environmental Guidelines in relation to visitation management in ecologically sensitive areas, biodiversity conservation, lighting and signage.

Office of Environment and Heritage

The extensive estuarine habitats within the Canada Bay LGA, along Parramatta River are highly valued by OEH. The main concern raised regarding the management of Parramatta River, Sydney Harbour and associated habitats is the lack of a coordinated approach. OEH would like to continue to work collaboratively with Council to improve water quality and ecosystem health within these areas.

OEH and the Sydney Coastal Council Group is seeking collaborative partners to develop a Parramatta River – Sydney Harbour Coastal Management Program and encourage Council to be involved. The agreed upon management actions assigned to Council would be eligible for grant funding through OEH's Coastal and Estuary Management Program.

OEH refers to the Biodiversity Values Map updated on 8 February 2019 that relate to the Canada Bay LGA adding significant Coastal wetlands mapped under the Coastal Management SEPP (core areas only).

Sydney Local Health District

The Local Health District is very active in ensuring Dame Eadith Walker and Thomas Walker Estates' heritage and biodiversity significance is conserved. It operates under the Walker Trusts Act to allow public access and conserve the grounds and works closely with the Heritage Office to document and manage vegetation. Although the use of the estate as a wedding venue is encouraged, there is a large commitment to ensuring the use of the estate is done so in a sustainable way. For example, when it was noticed that the parking of vehicles was impacting on the roots of large trees, the parking areas were fenced off. Furthermore, the Health District has recently applied for a grant to help fund the restoration and regeneration of areas of native vegetation within the estate concurrent with the remnant threatened ecological community, Sydney Turpentine-Ironbark Forest, which is listed as endangered under NSW legislation and critically endangered under Commonwealth legislation. The Yaralla Bushcare Group undertakes weeding of the Turpentine-Ironbark Forest in the grounds with the support of both Health and Council.

They are seeking to address the main issues in achieving high biodiversity outcomes within the estate include funding for bushland restoration, impacts associated with external parties such as the dieback of mangroves from wash of RiverCats within Parramatta River, increased development causing increased usage and have increased signage to manage the conflicts of dogs off leads and the impacts it has on native birds.

Parramatta River Catchment Group

The organisation values the extensive foreshore in Canada Bay, the abundance of parks and green spaces, the valuable biodiversity at Yaralla Estate and opportunity for improving water quality.

The group recognises that the river can only be effectively managed on a catchment-wide level, with councils and agencies working together. It believes that Canada Bay has opportunities to maintain and improve its habitat for biodiversity. It selected five fauna mascots to promote environments that relate to Canada Bay. The Bar-tailed Godwit represents the estuarine environment, the Powerful owl represents the terrestrial environment, the Easter long-necked turtle and Striped marsh frog represent the freshwater environment and the Southern Myotis represents the riparian environment.

The organisation has prepared 'Our Living River – biodiversity corridor strategy' that focusses on key movement corridors and combines detailed information with strategic regional information. Canada Bay is seen as a key feeder for the biodiversity mega hotspot of SOP.

It considers that there is opportunity to enhance habitat within Canada Bay's sportsgrounds, parks and playgrounds with additional planting of grasses and shrubs on the edges. Within the estuarine environment there are oyster reefs on mudflats for shorebirds and shoreline protection areas where dog walkers need to be diverted to dog friendly areas thereby strategically guiding people and working with human behaviour. The organisation identified that offline wetlands can be constructed to provide habitat for frogs and other fauna, thereby filtering water quality, increasing swimmability of the river, enhancing biodiversity and promoting public awareness.

The group regards community involvement highly, with Abbotsford Public School being Godwit Ambassador School and part of the Riverkeeper Network and sees the opportunity to 'twin' the school with one in China to focus on bird migration and connectedness. Another key school is PLC which has a new Riverkeeper project where they are rearing Long-necked turtles for release. It sees the potential

to promote 'Adopt a Wetland' to get the school involved with a turtle release site. PRGC stressed the importance of citizen science combining experts with community involvement and highlighted the potential for joint projects with Western Sydney University.

Mangrove deaths are possibly linked to ferry wake with accelerated decline of the natural cycle, and Yaralla estate being important having a significant area of mangroves. Development should be an opportunity to ensure water sensitive design, such as sediment trapping, to provide green walls/rooves and green space, and to minimise urban heat islands with planting and retention of native vegetation. It views native grasses and trees as making a difference to heat impacts but mangroves even more, with their protection being important to the people of Canada Bay who place a very high value on the River.

PRGC views sea level rise as a threat with Canada Bay having several major high tides in the last couple of years that may become more common. The breaking of banks and overflow onto land is both an issue for foreshore infrastructure and biodiversity, where areas become inundated and there's no adjacent natural areas for species to move into.

There is opportunity for partnerships and collaboration to enhance the River for biodiversity as well as swimming through the Parramatta River Master Plan. The plan will have a dashboard on how each council is delivering on the steps in the plan. There is the need to continue to improve sewer overflows. Canada Bay is leading the way with stormwater harvesting, Bushcare and its education team. It recommends the use of the native fauna mascots when educating the public to get schools and the community involved and engaged.

Community Groups

Bushcare Volunteers

A reoccurring theme among the Bushcare volunteers was the concern of an ageing demographic within groups. It was also mentioned that there are difficulties in having younger volunteers such as children for tasks such as weeding; however, are favoured for activities such as planting. There is also a need for volunteers to participate on a regular basis as bush regeneration is a difficult activity to undertake on a one-off basis. Another issue raised is the need for stronger coordination amongst volunteers, which will help increase the reputation of the program for new interests. However, it was noted that the Bushcare program is adequately advertised.

The Bushcare volunteers discussed that there are opportunities to better conserve reserves under regeneration or even extend regeneration areas by formalising pathways, fencing off vegetation and providing more signage. Providing signage was a great way to educate the community on the works Council and the Bushcare groups are undertaking as apparently, current views of the community is that the reserves are not properly maintained.

Canada Bay Council's Environment Advisory Committee

The Canada Bay Council's Environment Advisory Committee value the Parramatta River foreshore as it provides habitat for native plants and animals which are under constant threat from impacts associated with development. The Committee suggests that enhancing the natural areas within the LGA is of great importance and recommends trying to link existing areas of native vegetation with natural habitat corridors to increase habitat corridor connectivity.

Former Bushcare Coordinator

A former Bushcare coordinator provided extensive history on the reserves within the LGA which currently have Bushcare programs. Some of the main trends he saw over his time at Council included a loss of understorey vegetation due to the need to 'tidy up' nature strips and roadside vegetation. This in turn has resulted in the loss of important habitat for birds. An opportunity to improve and increase the amount of bird habitat within the LGA is through education. For instance, ensuring maintenance workers remove exotic species such as Lantana in a staggered way and providing guidelines on which species to plant to encourage small bird habitat within backyards. Another concern was the loss of diversity over the years, which may be a result of both the lack of fires within the LGA and vegetation succession (such as the domination of Casuarina species in areas where *Wilsonia backhousia* was previously present). Mangrove encroachment into the saltmarsh and non-vegetated mudflats was also seen as an issue as it provides foraging habitat for the threatened Bar-tailed Godwit.

Opportunities provided by the former Bushcare Coordinator included the introduction of a mangrove policy to enhance foraging habitat for threatened migratory birds; re-evaluating planting lists for both development approval and for maintenance staff and promoting understorey vegetation; educating the community in regard to small bird habitat linkages and ensuring this is in line with Bird Life Australia recommendations; expanding the Dog Saves Bird program and providing stronger enforcement; and encouraging more collaborative projects between the sustainability and natural resources teams within Council.

Greater Sydney Commission Assurance and Agency Expo

It was advised that there are no specific projects proposed soon by OEH, DP&E or EPA in regard to the biodiversity of the LGA. Agencies advised that Council should upload information layers on biodiversity to the Green Grid, a connective network of high-quality green space connecting waterways, parks, biodiversity corridors and tree lined streets for walking and cycling. A Biodiversity Values Map for the LGA has been recently released. It was recommended that the Blue Grid corridors within the LGA are also considered when assessing habitat connectivity, and that the LSPS should value riparian area, intact bushland and coastal wetlands.

Online Community Survey

A subset of the questions below were used for the general online survey for the LEP Review by Place Design Group.

1. Question: Are you a resident of City of Canada Bay Local Government Area (LGA)? Yes/No

2. Question: Are you aware of any of the following environmental projects and groups in City of Canada Bay?

- Bushcare groups etc

3. Question: Are you (or have you been) involved in any of the following environmental projects and groups in City of Canada Bay?

- Bushcare groups etc

4. Question: How often do you use the City of Canada Bay's open spaces and bushland areas? Please choose closest answer.

- More than once a week
- Once a week
- 2-3 times per month
- Once a month
- 2-10 times per year
- Once a year
- Never

5. Question: What natural areas in City of Canada Bay do you visit?

Make list + "Other (please list below)"

- Harbour foreshore
- Alexandra Reserve
- Arthur Walker Reserve
- Brays Bay Reserve
- Bridge Street Wharf Reserve
- Cabarita Park
- Churchill Tucker Reserve
- Edwin Street Reserve

- Fig Tree Bay Reserve
- Northcote Street Reserve
- Queen Elizabeth Park
- Sanders Reserve
- Shadrack Shaw Reserve
- Stanton Reserve
- Other local park/reserve (please list below)

6. Question: What is your satisfaction level with Council's management of the City of Canada Bay's natural environment?

- Very satisfied
- Satisfied
- Neither satisfied or dissatisfied
- Dissatisfied
- Very Dissatisfied

7. Question: Please tick which of the following activities you use City of Canada Bay's open spaces and natural areas for:

- Walking/Jogging
- Dog Walking
- Picnic / BBQ
- Bird watching
- Boating
- Other (please list)

8. Question: Council is developing a set of actions to enhance and protect City of Canada Bay's natural environment for the Biodiversity Framework.

Please rank (1 - 4) the importance of the following actions to manage biodiversity

1. Extremely important
2. Very important
3. Important
4. Not important
    - Controlling pest animals (e.g. foxes and Indian Myna birds)
    - Controlling weeds in natural areas
    - Reducing impact of pollution on local biodiversity
    - Improving water quality of local catchments
    - Reducing negative impacts from development on the natural environment
    - Encouraging community ownership & care for the natural environment
    - Supporting community Bushcare volunteers

- Providing natural area recreation opportunities
- Creating wildlife habitat outside Council reserves
- Controlling the impact of dogs and cats
- Providing environmental education for the community
- Creating and enhancing river foreshore, bushland and wildlife corridors

9. Question: Please tick what you think are the major threats to the City of Canada Bay's natural environment?

- Clearance of vegetation for development
- Water pollution
- Impacts of climate change
- Weed invasion of bushland
- Rubbish dumping in Natural Areas
- Pest animals (foxes, Indian Myna birds, aggressive native birds e.g. Noisy miners)
- Litter in waterways
- Other (please list below)

10. Question: Have you noticed any changes (positive or negative) to natural bushland and river foreshore areas in the City of Canada Bay?

- Location
- Change noticed
- How long ago did you notice the change?

11. Question: Describe your vision for local biodiversity in 20 years' time.

12. Question *(Optional)*: Please provide any other comments or list any other threats/opportunities relating to City of Canada Bay's biodiversity.

13. Question *(Optional)*: Please give your contact details if you are willing to offer further information about the answers provided in this survey or wish to be further involved in the preparation of the Biodiversity Framework. Your details will not be made public.

Name/Address/Phone number/Email

Online Survey Results

The key findings related to biodiversity indicate that respondents consider it is extremely and very important to:

- 89% reduce negative impacts from development on the natural environment
- 91% improve water quality in local catchments
- 78% reduce impact of pollution on biodiversity
- 78% control pest animals
- 78% encourage community ownership and care for the natural environment
- 77% control weeds in natural areas
- 66% control the impact of dogs and cats
- 65% create wildlife habitats outside Council reserves
- 71% support community Bushcare volunteers

In related questions:

- 90% want public access to the waterfront
- 84% want more trees in local parks, with 43% wanting many more and 41% want some more
- 84% of new developments should contribute to the greening of the local area
- 79% want open spaces and natural habitats
- 75% of respondents want more trees in the future
- 75% want to see more street trees in their area
- 73% want more parks and open spaces
- 62% said more trees would encourage them to walk more in their local area
- 61% want more trees/ shade in foreshore sites

Other findings:

- 42% use parks/ greenspaces a few times a week and 21% visit every day
- 63% visit by walking
- 71% go for a walk/ run and 46% go to enjoy the scenery
- 36% would like to attend events at their local park (open air cinema, markets, food), 36% would like to sit and have a coffee, and 25% would like to have a picnic/ BBQ.

Appendix H Priority Area Maps and Priority Reserves

Priority areas for connectivity have been described in Section 8 to provide linkages through the urban areas to connect significant plant and animal communities remaining as endangered ecological communities, endangered populations, threatened or migratory species and their habitats. It is recognised that linkages to critical habitats may require reconstruction to play a significant role as part of a wildlife corridor or stepping stone for native flora and fauna.

Priority areas for management were developed by assessing the threat ranking, habitat value and opportunity for biodiversity programs.

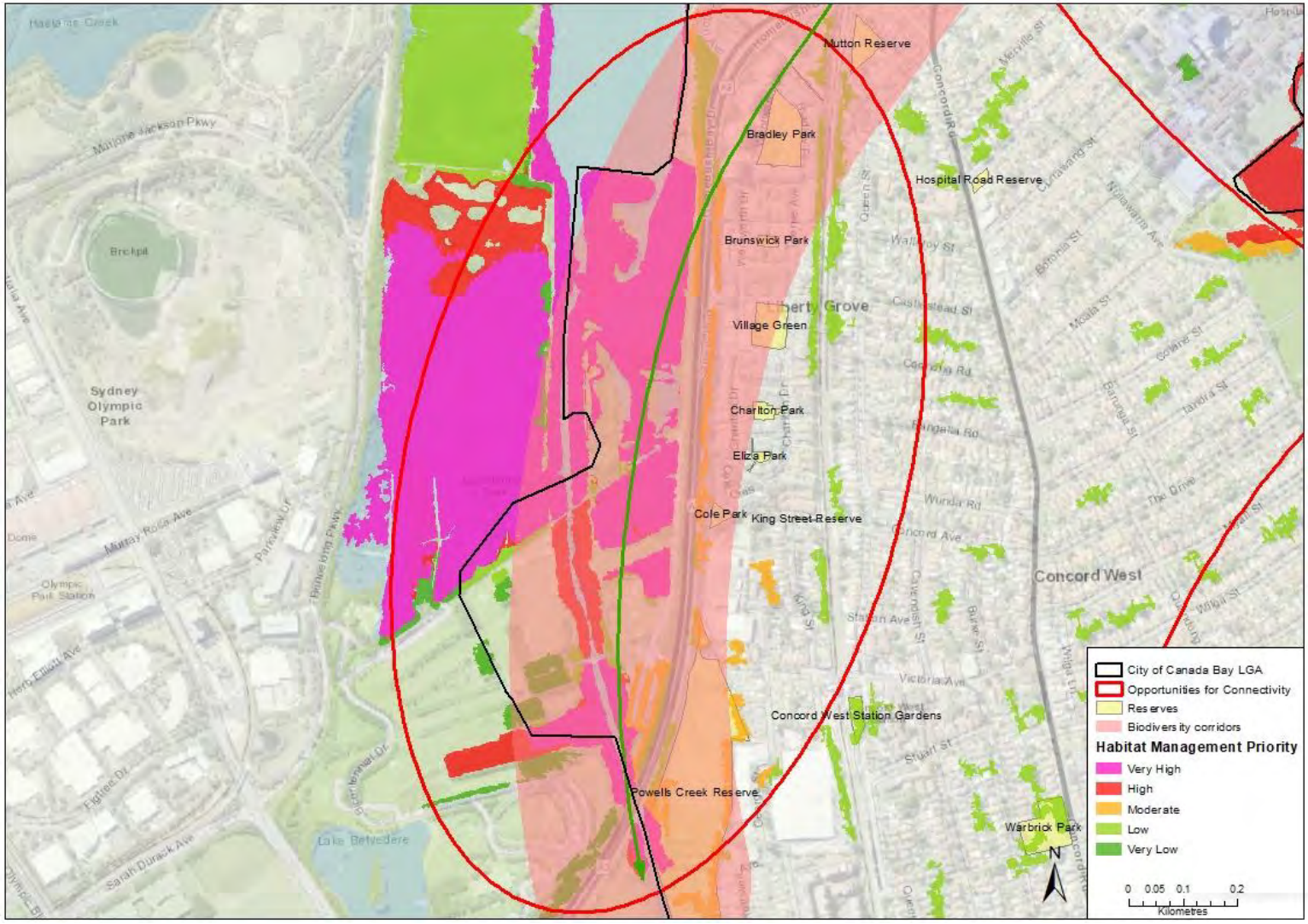

Figure 52: Priority Connectivity Area 1 - Sydney Olympic Park/ Rhodes

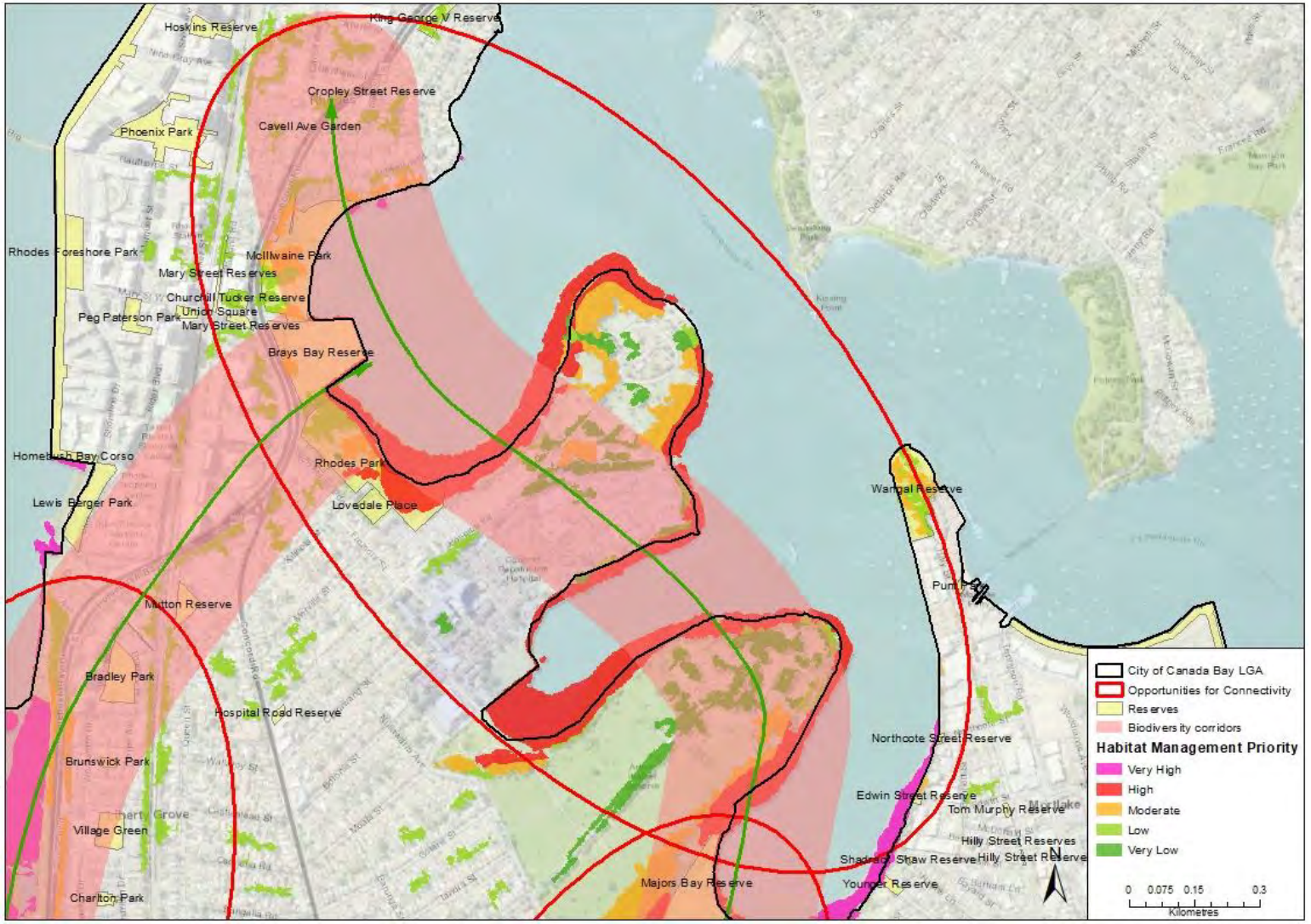

Figure 53: Priority Connectivity Area 2 - Concord West

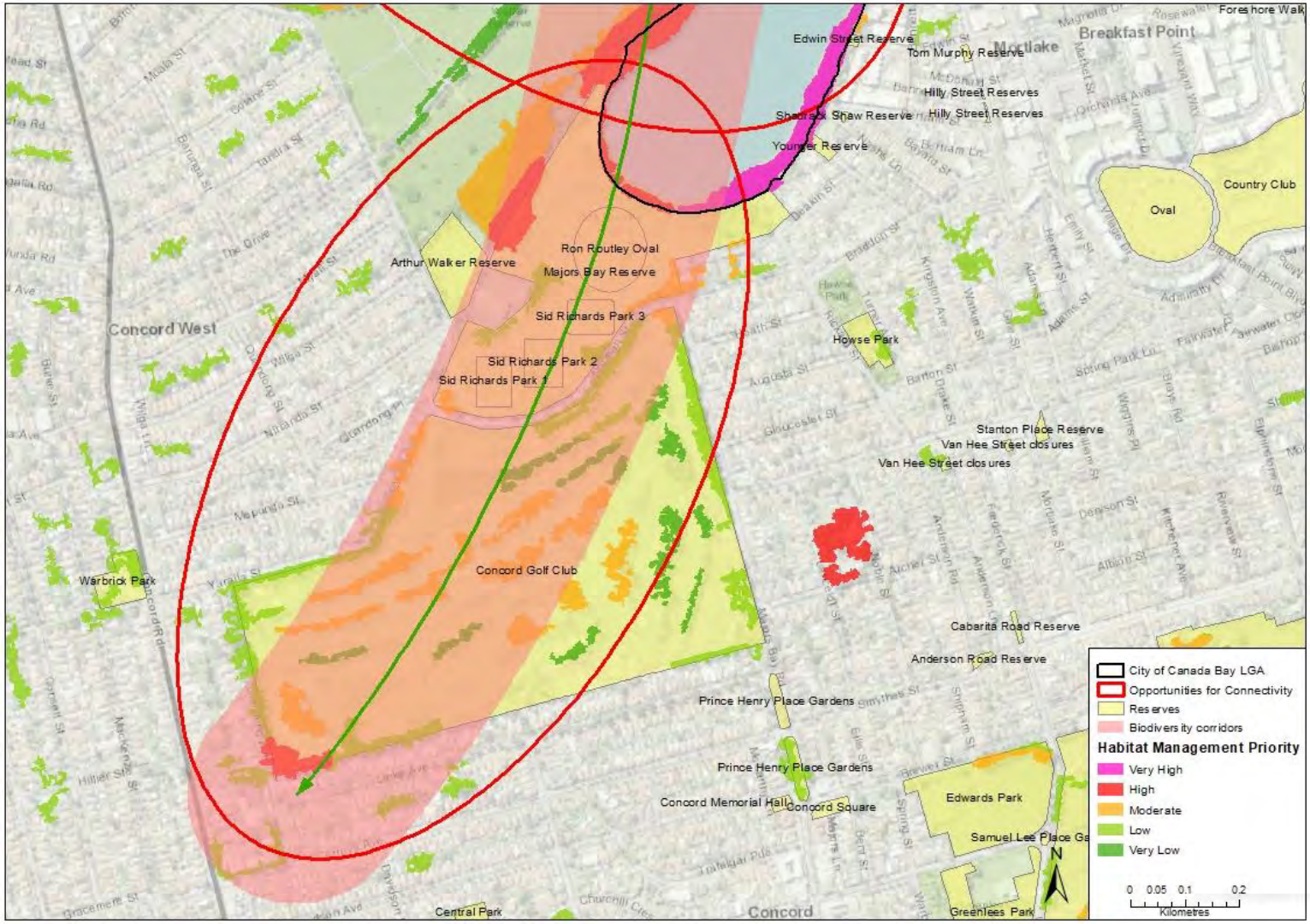

Figure 54: Priority Connectivity Area 3 - Concord

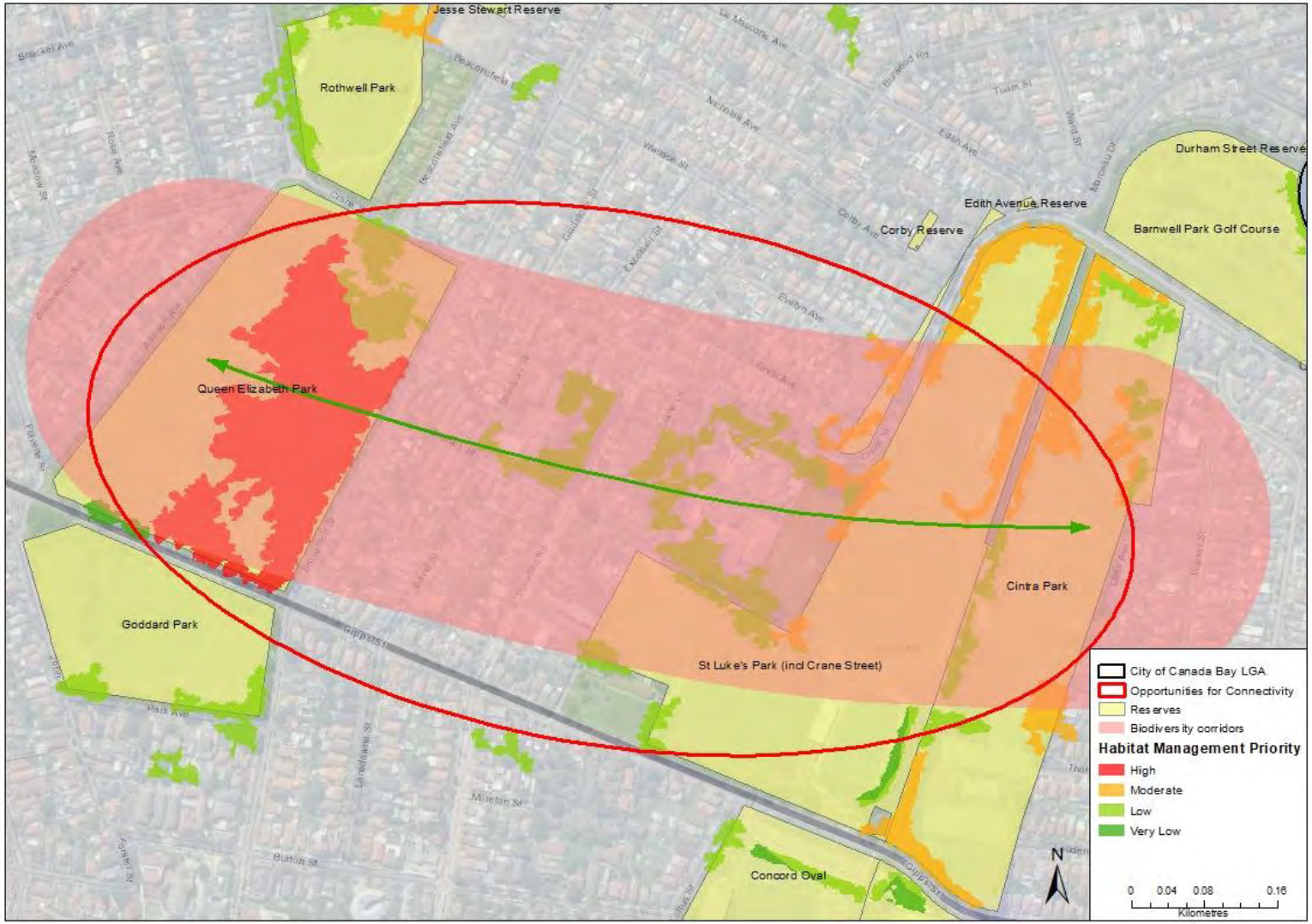

Figure 55: Priority Connectivity Area 4 – Concord/ Canada Bay

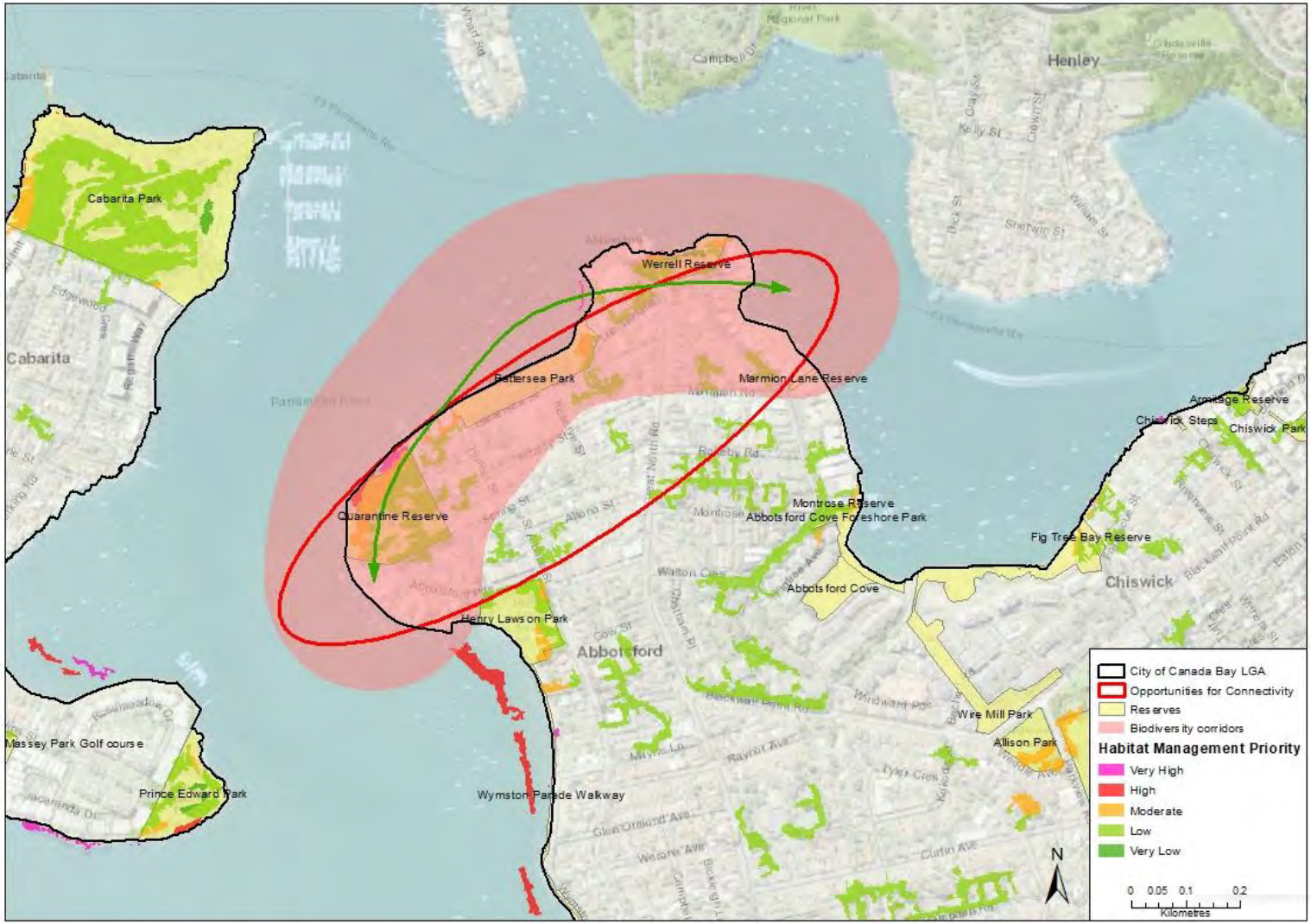

Figure 56: Priority Connectivity Area 5 - Abbotsford Point

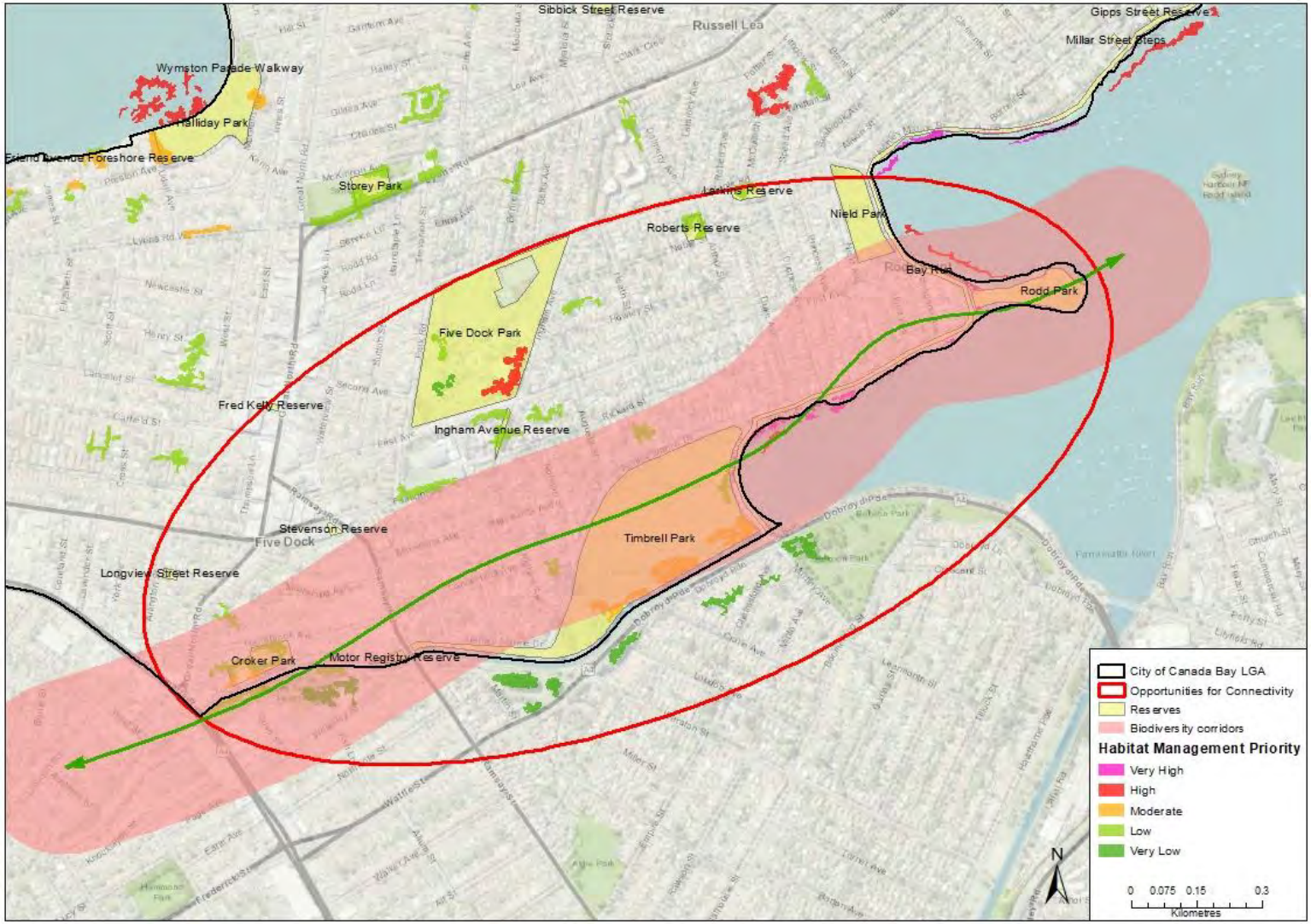

Figure 57: Priority Connectivity Area 6 - Iron Cove to Rodd Point

Table 20: Council reserves ranked in order of priority for management action

Management Action Priority	Council Reserve Name
Very High	Bay Run (includes Brett Park and Montague Park)*
	Bayview Park
	Edwin Street Reserve
	Foreshore Walk
	Homebush Bay Corso
	Howley Park
	John Whitton Reserve
	Majors Bay Reserve
	McIllwaine Park
	Northcote Street Reserve
	Powells Creek Reserve
	Rodd Park
	The Esplanade Foreshore Reserve
	Wymston Parade Walkway
	Younger Reserve
High	Brays Bay Reserve
	Cabarita Park
	Concord Golf Club
	Five Dock Park
	Halliday Park
	Prince Edward Park
	Quarantine Reserve
	Queen Elizabeth Park
	Rhodes Park
	Brett Park
Moderate	Abbotsford Cove Foreshore Park
	Allison Park
	Armitage Reserve
	Barnwell Park Golf Course
	Battersea Park
	Campbell Park
	Cary Street Reserve
	Charles Heath Reserve
	Cintra Park
	Cole Park

Management Action Priority	Council Reserve Name
Moderate	Concord Oval
	Croker Park
	Drummoyne Park/Oval
	Edwards Park
	Fig Tree Bay Reserve
	Henry Lawson Park
	Jesse Stewart Reserve
	Massey Park Golf course
	Mill Park
	Montrose Reserve
	Peppercorn Reserve
	Rothwell Park
	Russell Park
	Sanders Reserve
	St Luke's Park (incl Crane Street)
	Taplin Park
	Timbrell Park
	Uhrs Point Reserve
	Wangal Reserve
	Werrell Reserve
	Wire Mill Park
Low	Ada Street Closure
	Alexandra Street Reserve
	Apex Park
	Bob Smith Reserve
	Budd Lane Reserve
	Cambridge Road Reserve
	Central Park
	Chiswick Park
	Churchill Tucker Reserve
	Concord West Station Gardens
	Drummoyne Rowing Club
	Drummoyne Swimming Centre
	Edward Street Garden
	Goddard Park
	Henley Park

Management Action Priority	Council Reserve Name
Low	Howse Park
	Ingham Avenue Reserve
	Kendall Reserve
	King George V Reserve
	Larkins Reserve
	Mary Street Reserves
	North Strathfield Station Gardens
	Prince Henry Place Gardens
	Roberts Reserve
	Roseby Street Reserve
	Sibbick Street Reserve
	Storey Park
	Van Hee Street closures
	W A McInnes Reserve
	Warbrick Park

** Brett Park and Montague Park were manually added following GIS analysis of habitat rank as these reserves are located adjacent to Bay Run and are high priority for fauna*

Appendix I Plants Suitable for Corridors and Restoration Planting

Strata	Scientific Name	Common Name	Notes
Turpentine Ironbark Forest			
Trees	*Acacia parramattensis*	Parramatta Green Wattle	Grows in forest on shale derived soils (clay) but occasionally on sandstone. Attracts a wide variety of fauna.
	Allocasuarina torulosa	Forest Oak	As understorey in open forest to tall open forest. Usually on higher-nutrient soils and in moister situations than A. littoralis. Very long-lived.
	Angophora. costata	Sydney Red Gum	Locally abundant large tree, on deep sandy soils or shallow soils on sandstone or heavy clay soils.
	A. floribunda	Rough Barked Apple	Medium tree, usually on deep alluvial sandy soils or on clay. Common along river edges.
	Elaeocarpus reticulatus	Blueberry Ash	Small narrow tree, mostly in gullies or along watercourses, common in forest or near rainforest.
	Eucalyptus acmenoides	White Mahogany	Medium Eucalypt occurring on heavy soils.
	E. globoidea	White Stringybark	Medium Eucalypt in dry sclerophyll forest or woodland on well-watered sandy or alluvial soils of moderate fertility.
	E. paniculata	Grey Ironbark	Tall straight tree of forested areas on heavier soils
	E. resinifera	Red Mahogany	Medium to large Eucalypt; locally abundant in forest on deeper soils of medium to high fertility.
	Syncarpia glomulifera	Turpentine	Widespread medium to large long-lived tree in forests on heavier fertile soils. Reliable nectar producer every October.
Shrubs	*Acacia. implexa*	Hickory Wattle	Very common tall wattle on clay soils. Forms small suckering stands if disturbed.
	Ac. longifolia	Sydney Golden Wattle	Short lived fast growing large wattle. Common in either sandy or clay soils post fire.
	Ac. myrtifolia	Myrtle Wattle	Small rounded shrub common on sandstone ridgetops also occasionally on clay soils in forest
	Breynia oblongifolia	Coffee Bush	Common regrowth shrub in forest. Soft red or black oily berries.
	Bursaria spinosa	Blackthorn	Common spiky tall shrub which prefers clay soils.
	Daviesia ulicifolia	Native Gorse Pea	Small prickly foliaged shrub. Adapted to clay soils.
	Indigofera australis	Native Indigo	Common pea. Flowers abundantly in spring.
	Kunzea ambigua	Tick Bush	Very common regrowth shrub in sandy soils or margins of forests on clay soils. Forms dense thickets. Good nectar production for fauna in summer. Perfumed.

Strata	Scientific Name	Common Name	Notes
	Leucopogon juniperinus	Bearded Heath	Spiky small understorey shrub in forest on clay or enriched sandy soil.
	Myrsine variabilis	Muttonwood	Small tree from coastal areas and forest on sandy soils. Black fruit.
	Ozothamnus diosmifolium	White Everlasting	Fast growing daisy with abundant heads of small clustered white daisy flowers. Clay or sandstone. A common pioneer species.
	Pittosporum revolutum	Rough Fruited Pittosporum	Small shrub on clay or sandstone. Tolerates shade. May form suckering clumps.
Ground Layer	*Austrostipa pubescens*	Spear Grass	Tuff rigid grass with heavy open seed head. Very long lived. Common in clay and sandstone soils.
	Commelina cyanea	Scurvy Weed	Grows in moist forest or woodland; sometimes weedy.
	Dianella caerulea	Blue Flax Lily	Forests or woodland, all soil types heavy shade to full sun. Very tough.
	Dichondra repens	Kidney Weed	Grows in forest, woodland and grassland, and weed of lawns; widespread.
	Dodonaea triquetra	Large-leaf Hop-bush	Abundant medium shrub post fire disturbance. Short lived heavy seeder.
	Echinopogon caespitosus	Tufted Hedgehog Grass	Tall tufted grass. Winter growing.
	Entolasia marginata	Right Angle Grass	Sheltered forests on either clay or sandstone soils with moisture. All year growing.
	Ent. stricta	Wiry Panic	Narrow slender upright long-lived grass on either clay or sandstone soils. All year growing.
	Imperata cylindrica	Blady Grass	Competitive spreading grass which forms dense colonies in all soil types. Thicker growth in full sun. Summer growing.
	Lepidosperma laterale	Variable Swordsedge	Tufted plant with stiff upright seed heads. Forest and woodlands on sandy soils.
	Lomandra longifolia	Common Mat Rush	Grows in a variety of habitats; very tough and long lived.
	Microlaena stipoides	Weeping Grass	Spreading tufted grass. Number of specific forms Common in many environments. All year growing.
	Oplismenus aemulus	Basket Grass	Prostrate spreading grass very common in many situations. Grows quickly in warmer months.
	Poa affinis	Tussock Grass	Soft tufted grass which forms meadows. Shady sheltered conditions on clay or moist sandy soils. Winter growing.
	Pratia purpurascens	White Root	Spreading small groundcover with white flowers. Abundant underground spreading roots and shoots.
	Pseuderanthemum variabile	Pastel Flower	Tiny hardy plant with pretty lilac coloured flowers. Deep rooted.

Strata	Scientific Name	Common Name	Notes
	Themeda australis	Kangaroo Grass	Tufted grass, very common in clay soils. Seeds reliably early summer. Long lived. Summer growing.
	Zieria smithii	Sandfly Zieria	Small aromatic shrub preferring sheltered site on either clay derived soils or enriched sandstone soils.
Vines	*Billardiera scandens*	Apple Berry	Common in forest or woodland on either clay or sandstone soils
	Clematis glycinoides	Headache Vine	Common in forest on either clay or sandstone soils
	Hardenbergia violacea	Sarsparilla	Very common post fire disturbance on either clay or sandstone soils.
	Kennedia rubicunda	Dusky Coral Pea	Scrambling fast growing vine on either clay or sandstone soils
	Pandorea pandorana	Wonga Wonga Vine	Widespread in moist soils. White tubular flowers.
	Tylophora barbata	Bearded Tylophora	Sheltered Forests on clay soils. Small plant.
Coastal Saltmarsh, Mangrove Forest and Swamp Oak Woodland			
Trees	*Casuarina glauca*	Swamp Oak	Tall narrow tree, in brackish situations along coastal waterways. Often forming pure stands.
Shrubs	*Aegiceras corniculatum*	River Mangrove	Shrub or tree mangrove in coastal and estuarine areas
	Avicennia marina	Grey Mangrove	Intertidal zones of estuarine areas
	Goodenia ovata	Hop Goodenia	Common pioneer plant in both forest of saltwater margins and Turpentine Ironbark Forest.
Ground Layer	*Baumea rubiginosa*	Bare Twig Rush	Evergreen with strappy green-yellow leaves grows upright with rigid stems which produce red-brown spiklets of flowers. Ideal for planting around ponds and in coastal landscapes and in mass planting. Full sun.
	Ficinia nodosa	Knobby Club Rush	Tufted dark green rush which grows near salt water. Formerly known as *Isolepis nodosa.*
	Juncus kraussii	Sea Rush	Large upright tufted rush common near saltwater in salt marsh environments.
	Sporobolus virginicus	Marine Couch	Tufted or creeping perennial pioneer grass. Good for stabilizing sand. Salt resistant. Will grow on brackish flats
	Suaeda australis	Seablite	Edible plant with pale green leaves and pink clusters of flowers in summer. Full sun to partly shaded in moist soils.
	Triglochin striata	Streaked Arrowgrass	Tufted or creeping perennial pioneer grass. Good for stabilizing shifting sand or dunes. Salt resistant. Will grow on brackish flats

Strata	Scientific Name	Common Name	Notes
	Suaeda australis	Native Couch	Low growing perennial grass. Good for lawns, all soil types, sun or shade, can be mown to promote growth.
Coastal Enriched Sandstone Dry Forest			
Trees	*Allocasuarina littoralis*	Black Oak	In woodland or occasionally tall heath, on sandy or otherwise poor soils. Rarely on clay soils in forest.
	Angophora costata	Sydney Red Gum	Locally abundant large tree, on deep sandy soils or shallow soils on sandstone or heavy clay soils.
	Banksia serrata	Old Man Banksia	Common large Banksia which flowers heavily in summer. Long lived tree in sandstone soil.
	Ceratopetalum gummiferum	NSW Christmas Bush	Tall shrub or small tree which grows in moist sheltered positions in deeper sandy soils. Very long lived. Abundant red fruit in summer.
	Elaeocarpus reticulatus	Blueberry Ash	Small narrow tree, mostly in gullies or along watercourses, common in forest or near rainforest.
	Eucalyptus pilularis	Blackbutt	Very tall Eucalypt common on fertile moist sandy soils and clay soils. Suits deeper gullies.
	E. piperita	Sydney Peppermint	Medium tree in forest along sandstone water courses and drier woodland hillsides on sandstone derived soils.
	Syncarpia glomulifera	Turpentine	Widespread medium to large long-lived tree in forests on heavier fertile soils. Reliable nectar producer every October.
Shrubs	*Acacia ulicifolia*	Prickly Moses	Sharp prickly small wattle common in forest or woodland chiefly on sandstone but also on clay soils.
	Ac. suaveolens	Sweet Wattle	Abundant wattle in woodland following fire disturbance. Slender short-lived fast-growing plant. Perfumed.
	Ac. terminalis	Sunshine Wattle	Uncommon ferny leafed wattle growing in forest on sandstone soils.
	Dillwynia retorta	Parrot Pea	Common small shrub of sandstone areas. Flowers profusely in early spring.
	Dodonaea triquetra	Large-leaf Hop-bush	Abundant medium shrub post fire disturbance. Short lived heavy seeder.
	Grevillea buxifolia	Grey Spider Flower	Very common Grevillea in sandstone country- both heath and woodland.
	G. linearifolia	White Spider Flower	Common understorey plant in forest on sandstone soils. Mature plants develop a weeping habit.
	G. sericea	Pink Spider Flower	Common Grevillea in woodland and heath.
	Hakea sericea	Needle Bush	Densely spiky upright shrub with abundant white flowers in winter or early spring. Sandstone soils or transition areas into clay soils.

Strata	Scientific Name	Common Name	Notes
	Kunzea ambigua	Tick Bush	Very common regrowth shrub in sandy soils or margins of forests on clay soils. Forms dense thickets. Good nectar production for fauna in summer. Perfumed.
	Leptospermum trinervium	Flaky Barked Tea tree	Tall shrub with distinctive flaky trunk and sparse foliage. Long lived heavy flowerer in spring.
	Lomatia silaifolia	Crinkle Bush	Small low shrub which grows on sandstone soils. Deeply divided foliage.
	Pultenaea daphnoides	Daphne Leaved Bush Pea	Grows in heath to wet sclerophyll forest on sandy soils.
Ground Layer	*Dianella caerulea*	Blue Flax Lily	Forests or woodland, all soil types heavy shade to full sun. Very tough.
	Entolasia marginata	Right Angle Grass	Sheltered forests on either clay or sandstone soils with moisture. All year growing.
	Entolasia stricta	Wiry Panic	Narrow slender upright long-lived grass on either clay or sandstone soils. All year growing.
	Lomandra longifolia	Common Mat Rush	Grows in a variety of habitats; very tough and long lived.
Vines	*Billardiera scandens*	Apple Berry	Common in forest or woodland on either clay or sandstone soils
	Hardenbergia violacea	Sarsparilla	Very common post fire disturbance on either clay or sandstone soils.
	Kennedia rubicunda	Dusky Coral Pea	Scrambling fast growing vine on either clay or sandstone soils
	Pandorea pandorana	Wonga Wonga Vine	Widespread in moist soils. Big plant.

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