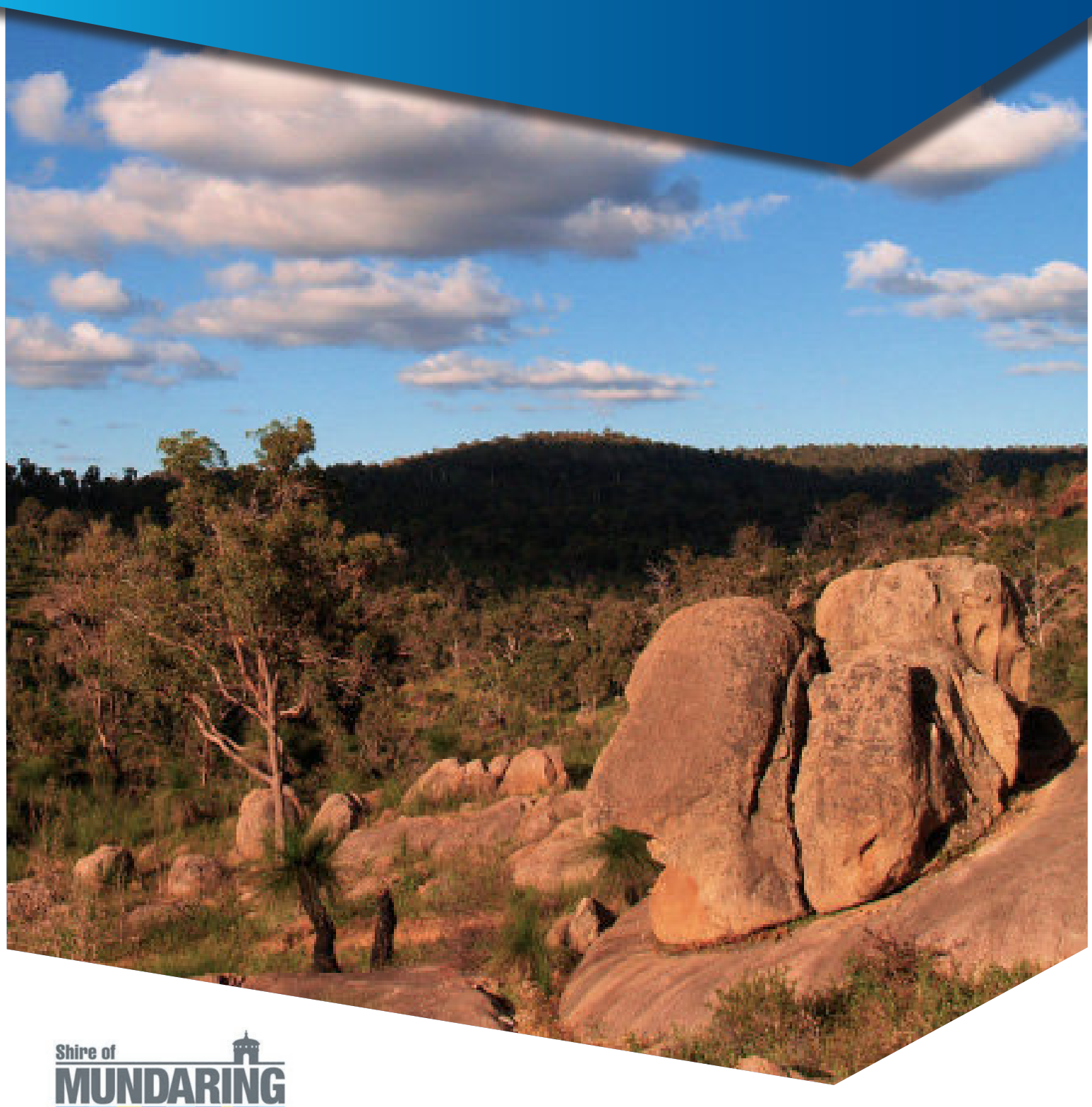
# Local Biodiversity Strategy 2023 - 2030



Shire of MUNDARING

# Acknowledgement of Country

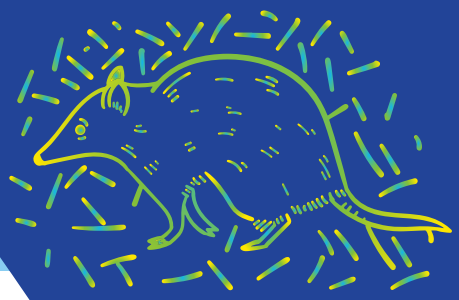
**Mundadjalina-k ngala kaditj Noongar moort nidja Wadjak boodjar-ak kalyakool moondang-ak kaaradj-midi. Ngala Noongar Moort wer baalabang moorditj kaadidjiny koota-djinanginy. Ngala Noongar wer Torres Strait Moort-al dandjoo koorliny kwaba-djinanginy. Koora, yeyi wer kalyakool, ngalak Aboriginal wer Torres Strait birdiya wer moort koota-djinanginy.**

Shire of Mundaring respectfully acknowledges the Whadjuk people of the Noongar Nation, who are the traditional custodians of this land. We acknowledge Elders past, present and emerging and respect their continuing culture and the contribution they make to the region.

**Images: Front cover: Title John Forrest Vista by Rene Baur**

**This page: Enchanted by Aaron Cuthbert**

# Foreword from Shire President



Biodiversity is the diversity of life on earth. Our local biodiversity is the Shire's living landscape, including all native plants and animals.

The health of the natural environment underpins the health and wellbeing of our community, and the strength of our local economy.

This Strategy identifies threats to our local biodiversity including clearing, dieback, invasive species and climate change.

It also identifies ways that the Shire and other custodians of natural areas can help protect our natural heritage for the future.

The Shire cares for important natural areas within local conservation reserves, but they will not be viable in the long term without strong connections to natural areas managed by individual landowners and the State Government.

An important element of this Strategy is the Wildlife Corridor Network which connects important local nature reserves with larger regional and national parks. The Wildlife Corridor Network includes major watercourses as well as local and regional ecological linkages.

These connections across the landscape provide for the continued movement of wildlife to maintain genetic diversity and re-colonise areas after fire, and also allow for pollination and seed dispersal to maintain plant diversity.

I would like to express my sincere gratitude to all community members who provided feedback on the draft Local Biodiversity Strategy. Your insights and ideas have been essential in informing many of the issues and actions addressed in this final document.

It is my great pleasure to present the Shire of Mundaring's Local Biodiversity Strategy 2023 - 2030.

Cr James Martin
**Shire President**

# Executive Summary

The Shire's Local Biodiversity Strategy maps a pathway for the Shire to tackle environmental threats, and celebrate and enhance our natural and cultural heritage.

Community surveys repeatedly raise environment as a key priority and this is reflected in the Shire's Community Strategic Plan. Council adopted as a 10 year priority, 'Shire-led conservation, protection and retention of natural areas' and the overall vision for the area as:

## 'A Place for Sustainable Living'

# Executive Summary

Whether it is promoting nature-based tourism or carefully managing bushfire risk to avoid catastrophic wildfires; the Shire's social and economic success is intrinsically linked to a well-managed environment.

The Shire's ability to undertake, assist and advocate for environmental management differs across reserves, verges and privately owned land. The Shire is directly responsible for managing 1,310 hectares of native vegetation, spread over many reserves of various sizes. Integrating bushfire and biodiversity management within our nature reserves provides an opportunity to lead by example and share management approaches with residents, who collectively manage another 6,130 hectares of natural areas on private property.

Maintaining biodiversity values on local reserves and private properties also helps maintain the important wildlife corridor network between national parks. There are 35,000 hectares of native vegetation within the Shire managed by the State Government (and Water Corporation) in national parks, state forests and water catchment.

The United Nations Decade of Ecosystem Restoration (2021 – 2030) aims to address the twin crises of climate change and biodiversity decline.

Many of our native species and ecosystems will also be increasingly affected by climate change over the coming decades. At a local level, custodianship of natural areas may include environmental restoration after fire, drought or heatwave impacts.

To add to the complexity, our natural areas are part of an intricate web of life that we are still learning about. It is likely there are still many small species that have not been identified and named, and relatively few have been studied well enough to understand their current habitat and conservation requirements.

The Shire can participate in research, or facilitate connections and sharing of knowledge for better biodiversity conservation.

The Shire's Environmental Advisory Committee assisted in developing this vision for the Shire's new Local Biodiversity Strategy:

**Biodiversity and natural areas are protected, connected and cared for through informed community stewardship and Shire leadership, empowering a strong culture of conservation.**

A deeper sense of custodianship of land and water will be required, as well as a willingness by all stakeholders to communicate, collaborate and continuously improve land management practices.

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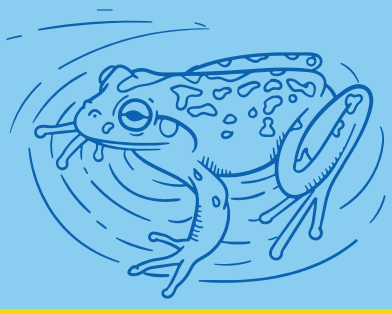
# Contents



# Introduction

The Shire of Mundaring is located within the south-west Western Australian 'global biodiversity hotspot'. This means that this region is biologically rich with diverse plants, animals and ecosystems, but also that they are under threat.

The Shire contains significant areas of forested national parks and protected water catchments. This provides important habitat for many native animals – but with a relatively small-dispersed population and rates base, also presents a challenge caring for parks and reserves over a large geographical area.

In most cases there is very limited knowledge of our native animal population, and scarce information about fungi (which play important roles in tree and forest health). By contrast there is extensive mapping of remnant native vegetation, so this is used as the foundation of biodiversity planning in the Perth Metropolitan Region.

## Traditional Owners

The traditional owners of most of the Shire area are the Whadjuk (Wajuk) Noongar people, with Aboriginal occupancy dating back tens of thousands of years. The north-east part of the Shire extends into Ballardong country. Evidence suggests that forests within the southwest of Western Australia were subject to cool mosaic burns by Noongar people, using fire to carefully shape the forest structure. It appears some areas were rarely burnt. Natural areas with a range of ages since fire provide more diverse habitats.

Colonisation removed Noongar people from their traditional lands and prevented the continuation and teaching of cultural practices, which has caused significant loss of knowledge of native plants, animals, and land management.


**The AIATSIS Map of Indigenous Australia – southwest Western Australia (from aiatsis.gov.au)**

# Introduction

## Historic Development

European settlement of the area increased from the 1840s. The colonial population was minimal until the 1880's, with small villages established mainly along the railway line and Great Eastern Highway (formerly the York Road). Significant growth came in the early 1900s, following the construction of the Mundaring Weir.

This continued well after the post-war years, particularly during the 1970s and 1980s.

Development and growth has had a significant impact on biodiversity values. During early settlement, natural biodiversity was treated as both a potential resource and an impediment to opening up productive rural land uses.

Historical aerial imagery from 1961 illustrates the legacy from early colonisation and government policy. When compared to 2020, vegetation canopy density has grown simultaneously as the population density increased. The Shire and other land managers are now left with complex land management issues.

**Lacey's 'Enterprise Saw Mill' at Sawyers Valley - 1890s. Photo courtesy of the State Library of WA**

The Shire now contains a combination of large areas of untouched or regrowth forest, amongst manicured gardens, lawn and introduced plants that have, in some cases, become invasive species.

Many residents of the Shire have either grown up in the area, or moved for lifestyle 'tree-change' reasons. This has also served to reinforce community values about the importance of the environment. Since early settlement, community attitudes have shifted away from exploitation towards celebrating nature and biodiversity.

As climate change intensifies and the threat of bushfire increases, the Shire must continue to reconcile necessary bushfire risk mitigation with biodiversity conservation.

# Introduction

Below are aerial images covering the Hovea/ Parkerville area, showing change and development over the past six decades. Watercourses are shown in blue as reference points.

Significant regrowth of native vegetation has occurred in some locations, while the density of settlement has increased significantly. The form of residential and semi-rural subdivision that occurred in past decades would not be permitted under current Western Australian Planning for Bushfire Protection Guidelines.

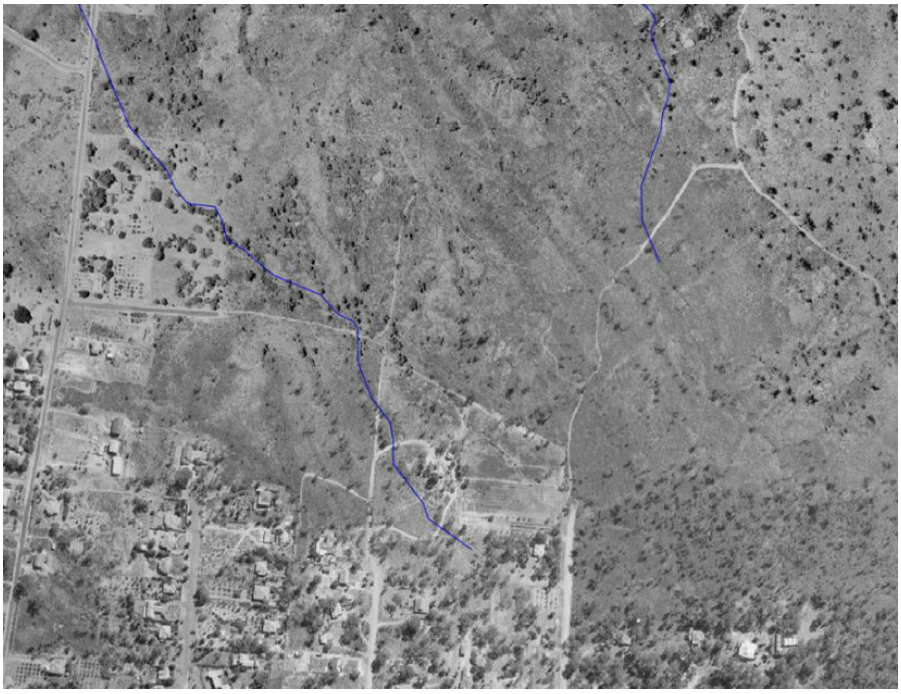
**1961 aerial photo - Hovea/Parkerville**

**2020 aerial photo - Hovea/Parkerville**

# Introduction

Below are aerial images covering part of the Swan View/Greenmount area, showing change and development of the past six decades. Watercourses are shown in blue as reference points.

Denser settlement has been possible on the coastal plain, where lots were connected to deep sewerage.



**1961 aerial photo - Swan View Brown Park to John Forrest National Park**

**2020 aerial photo - Swan View Brown Park to John Forrest National Park**

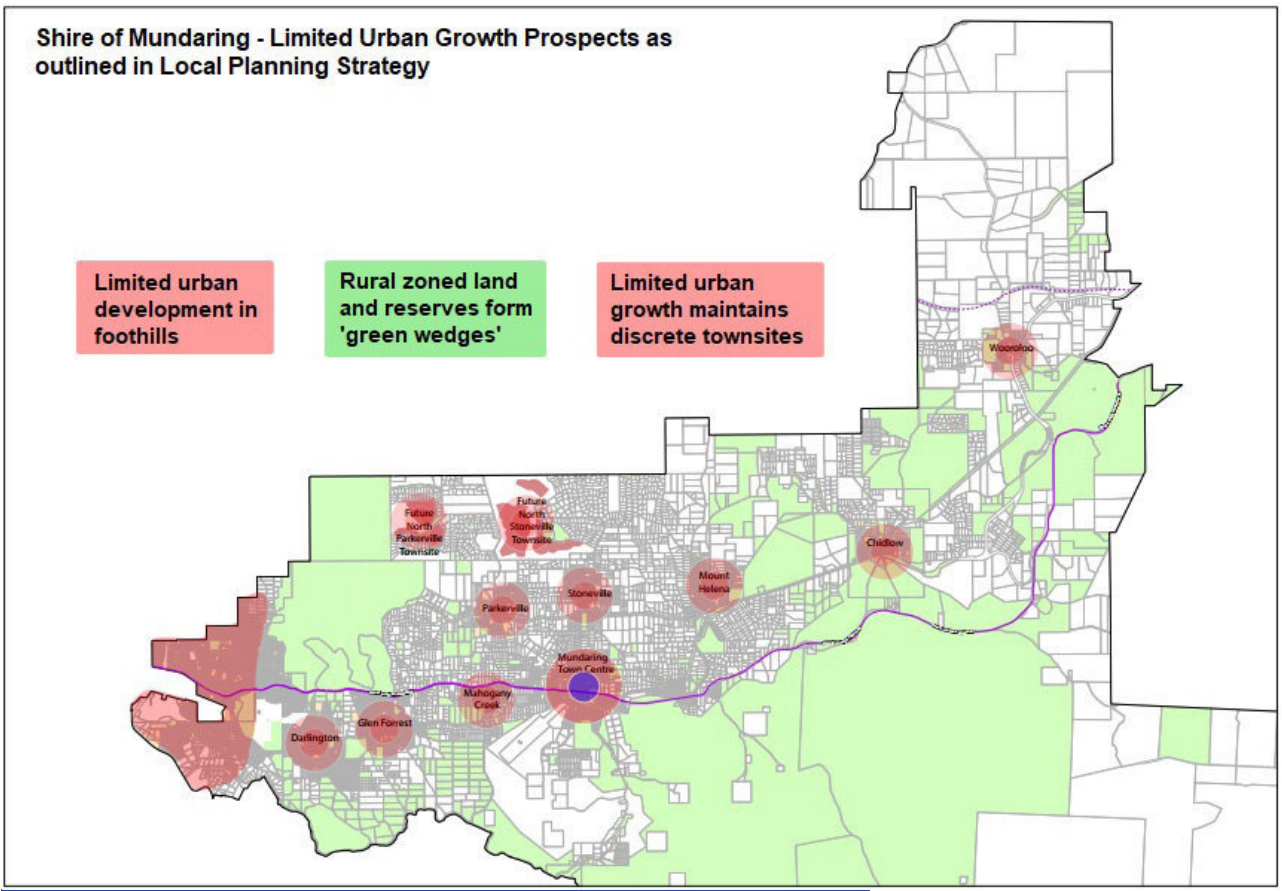
# Introduction

## Local Planning Strategy

The Shire's Local Planning Strategy (2013) recognised the historic growth pattern, current constraints and community aspirations and adopted:

- a low growth approach to account for the natural geophysical constraints (topography, soil, vegetation, bushfire) in the eastern portion of the Shire;
- limited growth in or near existing townsites where appropriate;
- two designated new townsites North Parkerville and North Stoneville, (that may or may not eventuate for the purposes of this strategy); and
- subdivision potential directed to infill in the existing foothills urban areas.

The rural wedges and natural spaces between nodes of existing local centres will continue to be the defining characteristic of the Shire.




**Spatial themes of the Local Planning Strategy**

The future of the North Parkerville and North Stoneville townsites is still somewhat unknown and ultimately rests with the State Government and/or the State Administrative Tribunal.

The Local Planning Strategy also introduced mapping and protection of Local Natural Areas based on the Local Biodiversity Strategy 2009, which are still in effect (and effective).

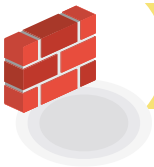
# Introduction

## Strategic Community Plan

The Strategic Community Plan (2020 - 2030) is a long-term guiding document for the Shire or Mundaring, developed following broad consultation about community values, concerns and vision for the future. Preparing an updated Local Biodiversity Strategy was an action identified within the Shire's Strategic Community Plan (SCP).

**Community** — Healthy, safe, sustainable and resilient community where businesses flourish and everyone belongs

**Natural environment** — A natural environment that is protected, sustainable and enjoyed



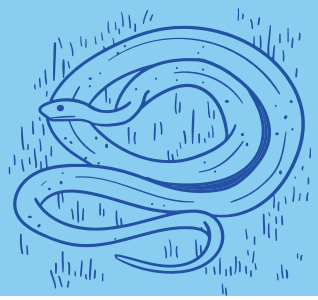
**Built Environment** — Transport, infrastructure and planning for liveable, connected communities

**Governance** — Trusted, leading and listening local government

Over the 10 year life of the SCP, a priority of the Council is 'Shire-led conservation, protection and retention of natural areas'.

To ensure this LBS is aligned with Community and Council expectations, it must seek to enhance environmental outcomes, amongst other goals and including the importance of measured and appropriate bushfire preparedness for community safety.

# Introduction



## Environmental Sustainability Policy

The Shire's Environmental Sustainability Policy was adopted in 2018. It consolidates the Shire's strategic position on key environmental issues and provides a basis for future environmental initiatives. Its purpose is:

**To establish a sustainable Shire that demonstrates our corporate and community commitment to the environment and reflects our responsibility to its natural assets for future generations. The Shire strives to be a leader in local government sustainability and environmental management.**

Although environmental management and sustainability at a global level are closely intertwined, the Shire's Local Biodiversity Strategy is intended to focus on the protection and management of the natural environment. A 'sustainability strategy' or similar may be prepared at some future point.

The following guiding principles of the Environmental Sustainability Policy were identified as particularly relevant in the preparation of this Local Biodiversity Strategy:

1.1. Biodiversity and watercourse integrity should be maintained and mitigation measures will be considered where the works cannot be designed or constructed to avoid impacts.

1.2. The Shire will strive to lead by example in balancing bushfire risk management with maintaining biodiversity and conservation of natural landscapes.

1.3. Allocation of Shire resources for natural area management will take into account social and ecological values and the nature of threatening processes.

1.4. Human induced climate change is recognised as a key threat to biodiversity, requiring mitigation action to reduce carbon emissions at all levels of government, and adaptation to local impacts.

3.1. The Shire recognises that healthy ecosystems and well-managed natural areas support the health and well-being of the community, and the Shire will strive to lead by example as a responsible custodian of public environmental assets.

4.2. The Shire will remain agile; learning and collaborating with community groups, research in stitutions and relevant government agencies to adapt best practice environmental management to fit the Shire's context.

# Consolidating Environmental Strategies

Over the past 25 years the Shire had developed a number of separate plans and strategies focussed on particular elements of the natural environment. These included a Wildlife Corridor Strategy (2000), Community Education Strategy (2002), Local Biodiversity Strategy (2009), Environmental Management Plan (2012) and Roadside Conservation Strategy (2016).

Each of these plans or strategies served a purpose at the time, and supported many Shire projects, successful grant applications, and collaboration with environmental volunteers and other organisations. However, continuing to create and update many discrete plans and strategies does not aid Shire staff and volunteers to understand and work together towards a common goal.

The Shire's Environmental Advisory Committee has agreed that it was advantageous for the Shire move to away from overlapping single issue strategies, and consolidate these into a discrete higher-level document with a clear line of sight to the Shire's Community Strategy Plan and Local Planning Strategy.

The original Local Biodiversity Strategy had a significant focus on identifying local natural areas on private land and adding protection from clearing through the local planning framework, informed by vegetation complex. This is outlined in Appendix 1.

The goals set in this regard have largely been met, and the success of the previous strategy is noted in Appendix 1. An update on the extent remaining in different vegetation complexes is provided in Appendix 2.

This Local Biodiversity Strategy now seeks to draw together and consolidate actions to protect the natural environment into a single document that more clearly states the Shire's intent and guides staff efforts.

A review of implementation of the actions under previous strategies was undertaken by Shire staff, followed by a peer review by an environmental consultancy including a previous employee of the Shire (past Coordinator of Environment). The plans reviewed were:

- Local Biodiversity Strategy
- Roadside Conservation Strategy
- Wildlife Corridor Strategy
- Private Land Conservation Strategy
- Community Education Strategy
- Environmental Management Plan
- Local Climate Change Adaptation Action Plan (actions relevant to biodiversity)
- Local Planning Strategy (actions relevant to biodiversity)
- Eastern Region Catchment Management Plan

This review found that, of 530 actions across nine plans and strategies, just over 50% had been fully completed. Nearly 20% of actions were considered partially complete or 'ongoing'. Some actions were noted to now be the responsibility of other organisations, or established as business as usual for the Shire.  Overall 14% were assessed as no longer relevant. Some duplicationof similar actions was also noted across thenine documents, supporting the approach to consolidate strategies relating to the natural environment.

# Consolidating Environmental Strategies

The reviewers noted that implementation of Local Biodiversity Strategies and overall pursuit of the Community Strategic Plan vision, 'A place for sustainable living', will require a holistic approach. A number of themes were identified relevant to environmental management and the consolidated Local Biodiversity Strategy, including training, education, volunteer engagement, mapping, funding, advocacy and research.

Bushfire risk and implementing bushfire mitigation for community safety whilst protecting, conserving, and enhancing biodiversity was noted as one of the biggest challenges. Both planned fire and wildfire can have impacts on native species, and different species have different requirements. Fire mitigation works can also provide opportunities for significant weed control and can coordinate with actions that support biodiversity conservation on both public and private land.

The review also noted that available staff and resources will limit the implementation of any plan or strategy. In this regard the reviewers suggested additional staffing resources be acquired.

These suggestions were provided from assessing the actions not completed and summarising the gaps and/or workload associated with the implementation.

Suggestions included:

- a stewardship officer to assist with private land conservation, education and training;
- a strategic environmental officer to assist with data (mapping), research, advocacy, funding and implementation of strategic objectives of the LBS;
- a reserve management officer or fire ecologist helps with environmental reserve management including a strong fire education background; and
- further bolstering the area of catchment support and volunteers within the friends group framework may require an additional resource/partnership.

Previous strategies had recommended the creation of a part time Stewardship Officer position and a Reserve Management Officer.

Rather than create a new and separate position of Stewardship Officer, this Strategy has recommended an increase to the capacity of existing part time Environmental Officers.

Business cases will be required as part of the annual Council budget process for future creation of new environmental positions, or further increases to part time positions.

# Opportunities

Biodiversity is defined in Australia's Strategy for Nature 2019-2030:

**Biodiversity is the variety of all life forms on earth — the different plants, animals and micro-organisms and the ecosystems of which they are a part.**

There is State and Commonwealth Government legislation that provides for protection of biodiversity, listing of threatened species and ecosystems, and approval processes for actions that may impact on biodiversity. The key legislation is:

- *Environment Protection and Biodiversity Conservation Act 1999 (National)*
- *Biodiversity Conservation Act 2016 (WA)*
- *Environmental Protection Act 1986 (WA)*
- *Conservation and Land Management Act 1984 (WA)*
- *Planning and Development Act 2005 (WA)*

The Shire of Mundaring is located within the South West Australia Ecoregion which is Australia's only Global Biodiversity Hotspot. Although this Ecoregion only covers 5% of Australia, it contains about 8,000 plant species, which is more than one-third of Australia's known flowering plants. The Ecoregion is also home to many unique fauna and it is designated as a 'Hotspot' because its rich biodiversity is under threat.

## Protection of Local Biodiversity

Shire of Mundaring has a range of advantages and opportunities to conserve biodiversity. First and foremost, the Shire has retained a far greater extent of remnant native vegetation and natural watercourses than most local government areas within the Perth Metropolitan Region.

This means that there are native plants and animals still in functioning ecosystems and natural areas, including the great diversity of life underground. Fungi and micro-organisms within the soil are an invisible but essential part of natural ecosystems and support forest health.

Clearing of native vegetation is primarily governed by the Department of Water and Environmental Regulation clearing permit process under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004.*

Through the *Planning and Development Act 2005*, the Shire provides some additional protection of native vegetation through provisions in the Local Planning Scheme No. 4.

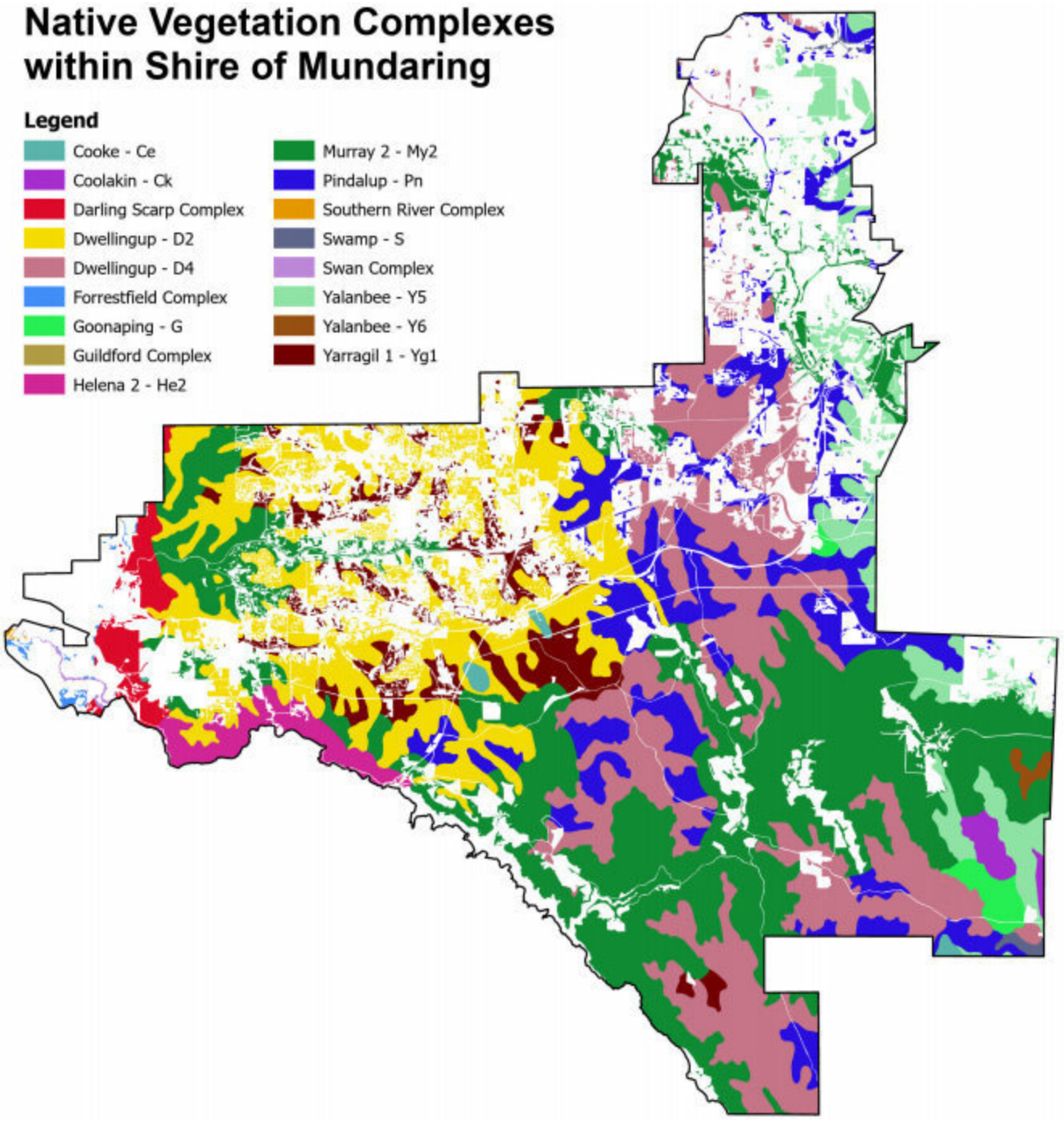
However, there are also specific exemptions in recognition of existing property rights and bushfire safety requirements.

The additional protection through Local Planning Scheme No. 4 is based on the mapping and prioritisation of remnant vegetation following the Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region (2004).

The Guidelines provide for biodiversity planning using vegetation complexes as a proxy for ecological diversity. This is a pragmatic approach given the many knowledge gaps for particular species and ecosystems.

# Opportunities

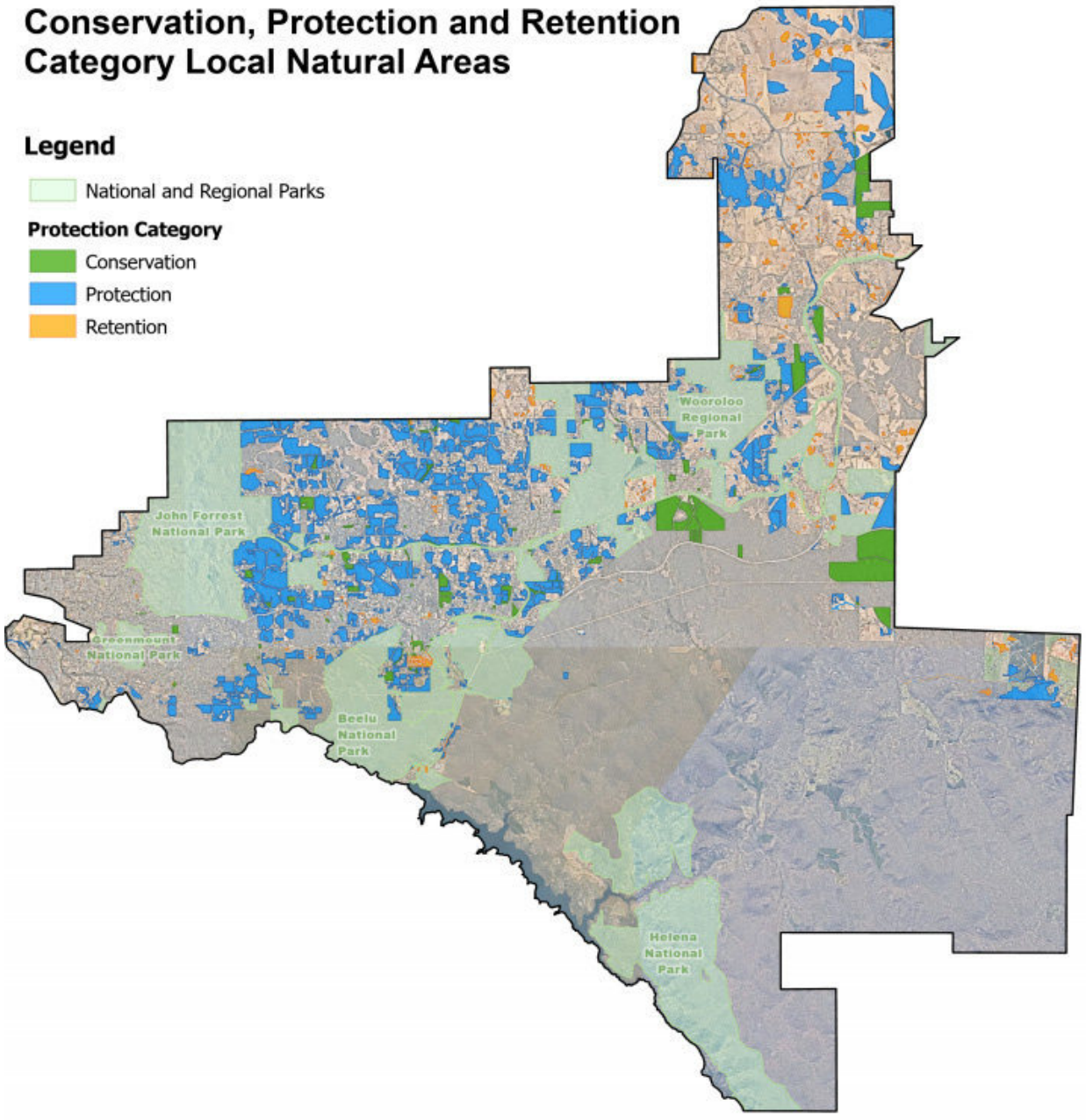
The extent of remnant vegetation in the Shire is shown below by vegetation complex. This mapping was undertaken by the Western Australian Local Government Association (WALGA) in 2020 through its now-ceased Environmental Planning Tool (LG Maps) service, using data provided by State Government agencies.




**Native Vegetation Extent by Vegetation Complex in Shire of Mundaring (2020)**

# Opportunities

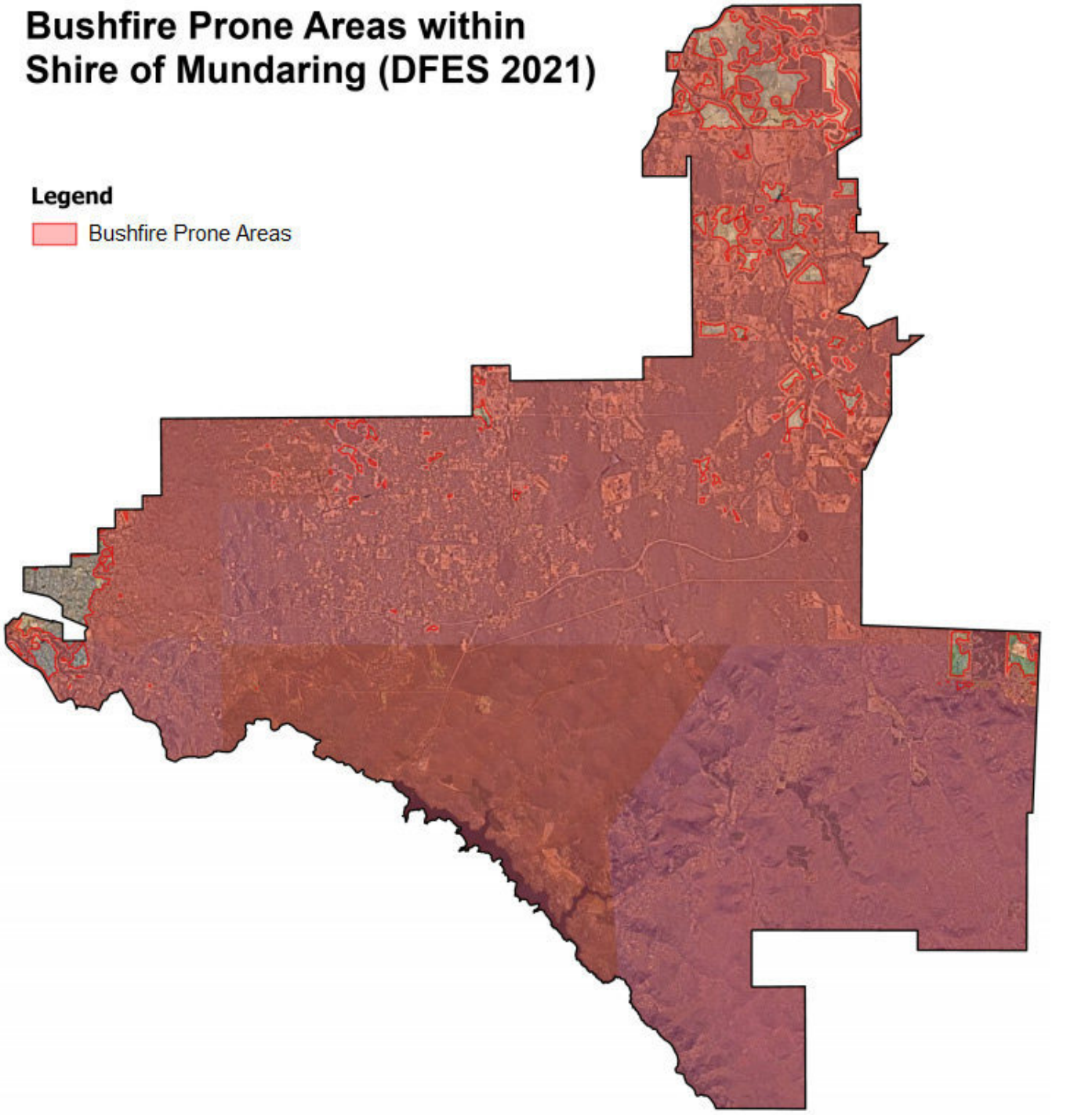
Mapping and prioritisation of remnant native vegetation outside of the State's conservation estate was completed in developing the Local Biodiversity Strategy 2009. This was given effect through inclusion of Local Natural Area (LNA) mapping in the Local Planning Strategy and specific clauses in Local Planning Scheme No. 4 (see Appendix 1). Areas of LNA shown below have been classified as Conservation, Protection or Retention, while other LNA that has limited protection due to the zoning and existing development rights will be retained where possible.




**Protected Local Natural Areas and National and Regional Parks**

# Opportunities

The Local Planning Strategy and Local Planning Scheme No. 4 also included provisions regarding bushfire risk, which sought to balance environmental protection with protection of human life and property.




**Fire and Emergency Services Commissioner Designated Bushfire Prone Areas**

# Opportunities

The designation of areas of intact native vegetation as 'Local Natural Areas' provides a trigger for a planning application and local environmental assessment where clearing is proposed. This includes clearing that is required to address bushfire risk under the State Guidelines for Planning in Bushfire Prone Areas. DFES has encouraged the Shire to consider refusing or objecting to proposals where biodiversity and bushfire matters cannot be reconciled, rather than providing for or recommending conditional approval.

While the native vegetation protection provisions in Local Planning Scheme No. 4 do not protect all native vegetation (particularly on smaller, residential lots) they do provide more extensive environmental protection than many equivalent local planning schemes and have been regarded as best practice in WA.

Local Planning Scheme No. 4 also provides for additional protection of watercourses and riparian vegetation. This is in addition to the requirements for permits from the Department of Water and Environmental Regulation for permits to interfere with the beds and banks of a watercourse.

The Watercourse Hierarchy Strategy that was prepared concurrently with this Local Biodiversity Strategy assessed the health of watercourses within the Shire and the adequacy of provisions within the local planning framework. Watercourses naturally form an integral component of wildlife corridor networks. They will become increasingly important as water sources and refuges in a changing climate.

Implementation of recommendations within the Watercourse Hierarchy Strategy will also help protect biodiversity through protecting riparian areas from inappropriate development, and managing stormwater flows to retain more water in the landscape while preventing erosion.

## Valuing the Natural Environment

Many residents are already actively involved in caring for the natural environment, whether on their own property or as a volunteer. People take pride and joy in establishing wildlife friendly gardens and seeing native species breed in nest boxes they have installed.

**Forest Red-tailed Black Cockatoo Chick in Nest Box (Photo courtesy of Simon Cherriman)**

# Opportunities

The importance of biodiversity and benefits of time in nature for human health and well-being is increasingly well recognised. Our natural landscapes and biodiversity are also central to the character and identity of the Shire, and celebrated in works by local artists.

Protection of the Shire's natural assets also supports aspirations of the Shire's Tourism and Economic Development Strategy to capitalise on and enhance the Shire's natural assets without compromising its highly valued and unique natural environment. The combination of proximity to greater Perth and an attractive, biodiverse landscape will continue to provide tourism and economic opportunities.

## Partnerships and Collaborations

Native species, pests and environmental issues cross boundaries. The Shire has a history of collaborating with neighbouring local governments and regional organisations for successful environmental initiatives. This includes support for Friends Groups and Catchment Groups through the long-running Eastern Region Catchment Management Program.

There may be new opportunities to improve biodiversity conservation through participating in trials or adapting environmental management based on new environmental research; improving use of remote monitoring technology, and better mapping and sharing of spatial information.

There may also be opportunities to participate in environmental offsets, carbon sequestration and biodiversity certification initiatives of the State and Commonwealth Governments.

The Department of Biodiversity, Conservation and Attractions is a significant land manager within the Shire. A collaborative approach would assist in the coordinated management of local and State Government managed lands and biodiversity values.

This may include initiatives to prevent illegal clearing; carefully reducing bushfire risks; and tackling threats to the State forest, national parks and nature reserves caused by illegal off-road vehicles, feral animals, firewood collection and rubbish dumping. New technologies such as drones may provide new and safer opportunities to identify environmental damage and those responsible.

New opportunities for collaboration will arise from the transfer of lands to the Noongar Boodja Trust. The South West Native Title Settlement represents the most significant Native Title agreement in Australian history.

In essence, it recognises the Noongar people as the Traditional Owners of the South West and creates a "Noongar Land Estate." The Shire recognises this important settlement as a state response to longstanding Aboriginal land rights matters that can provide further cultural, social and economic opportunities for Aboriginal and Torres Strait Islander people.

It is understood up to 2.523 hectares of unallocated land/reserves within the Shire may ultimately fall under the control of the Noongar Boodja Trust. The South West Native Title Settlement will introduce new stakeholder/s to manage currently unmanaged Crown land in the Shire e.g. for ecological restoration and bushfire risk, as well as supporting the economy and Noongar culture.

# Opportunities

Council endorsed the Shire's Reconciliation Plan at its meeting February 2022 Ordinary Council meeting with the recommendation:

**"Support land transfers as recommended by State decision making processes."**

IA key principle of the agreement and ultimately land portfolio across the South-West is to ensure self-sustaining assets and responsible management regimes are in place.

The Trustee for the Noongar Boodja Trust (Trustee) and the associated Noongar Boodja Land Sub Pty Ltd (Land Sub) are the landholding bodies for the entirety of the Noongar Land Estate. The Trustee was appointed on 29 March 2021 and is Perpetual Trustees Ltd., a professional property management trustee with a global land portfolio.

The Noongar Boodja Trust (the central corporate body of the 6 ILUAs – Indigenous Land Use Agreements) can apply to use Noongar Land Estate to:

**…provide significant opportunities for the Noongar community to achieve sustainable economic, social and cultural outcomes (SWALSC website).**

Consideration of land for inclusion in the Noongar Land Estate and associated use/development is anticipated to occur incrementally over several years. The Shire will treat planning matters that arise like any other; acknowledging also that any land transfers that materialise have come about as a result of a State-led modern treaty and ultimately State decisions about Crown land.

Skill sharing and community development with the Noongar community in relation to environmental and bushfire management represents a significant opportunity.

In the meantime and when necessary, the Shire will express its land management expectations in relation to community safety (Bushfire Risk Management Plan) and environmental protection to any new parties taking over unallocated bush reserves – ensuring they are aware of the recurring management obligations and costs.

Opportunities to engage and collaborate with Aboriginal Corporations and coordinate and enhance land management practices will be pursued. One opportunity may be to extend an invitation to local representatives to nominate for membership or otherwise participate in the Shire's Environmental Advisory Committee meetings.

# The Challenges Ahead

In addition to harnessing the opportunities there are many and varied environmental challenges before the Shire. Some are ongoing and well-known threats to biodiversity including weed invasion, feral animals, and clearing.

Other challenges are contextual; meaning they either are a threat multiplier or are unavoidable organisational realities. For the Shire, these contextual challenges include climate change, bushfire, development pressure, fragmented land management, lack of knowledge, and available resources. Threatening processes interact, and unfortunately, many are likely to be accelerated or worsened by climate change.

## Future Development & Growth

Given environmental limitations as well as lack of sewerage and bushfire risk, the Shire will remain a 'low growth' area of the Perth Metropolitan Area. This likely future both helps and hinders the Shire's ability to respond and sustain environmental initiatives.

It helps by reducing the immediate threat to biodiversity from clearing for development; but also hinders, because development can also enable the dedication of new conservation reserves, and additional rates revenue could support improved environmental services.

While growth is limited, there are other development and State policy trends that influence the retention of vegetation in the Shire.

Firstly, community aspirations and general prosperity is resulting in a building trend across Australia for larger dwellings. Larger houses require more clearing to build and establish 'bushfire asset protection zones'.

Compact well-designed dwellings are generally more energy efficient and cost effective and should be encouraged by the future LPS4 scheme requirements.

Since the WA Bushfire Guidelines were introduced in 2015, there have been regular updates. In some instances these have increased the local vegetation modification requirements.

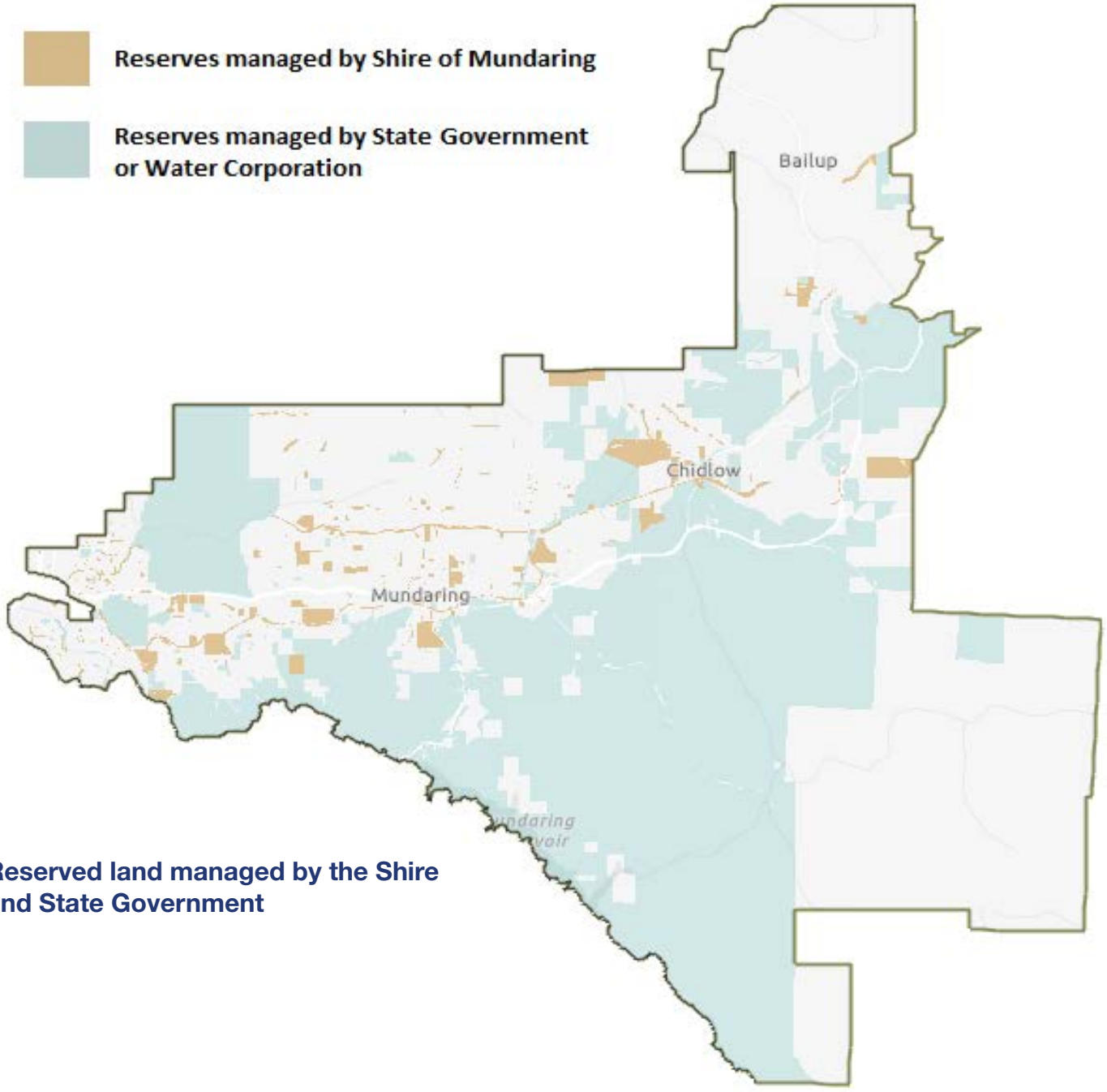
Requirements for clearing within asset protection zones are now embedded in the State planning framework and building regulations. They may be reviewed and adjusted over time but are not expected to be withdrawn.

The Shire can exercise a degree of autonomy in setting local standards through the Fire Load and Fire Break Notice (Sec.33 Notice) for established dwellings. The Shire continues to participate in and monitor State policy and regulation to ensure reasonable and appropriate local standards remain.

# The Challenges Ahead

## Scale and Resources

The Shire is responsible for managing native vegetation and natural areas over a very large area. The Shire manages 12,000ha of land including parks and nature reserves, 2,168 hectares of road reserve and 20ha of drainage reserves, with relatively few staff. In total, 584 parcels of Crown land are vested to the Shire for its care, control and management.



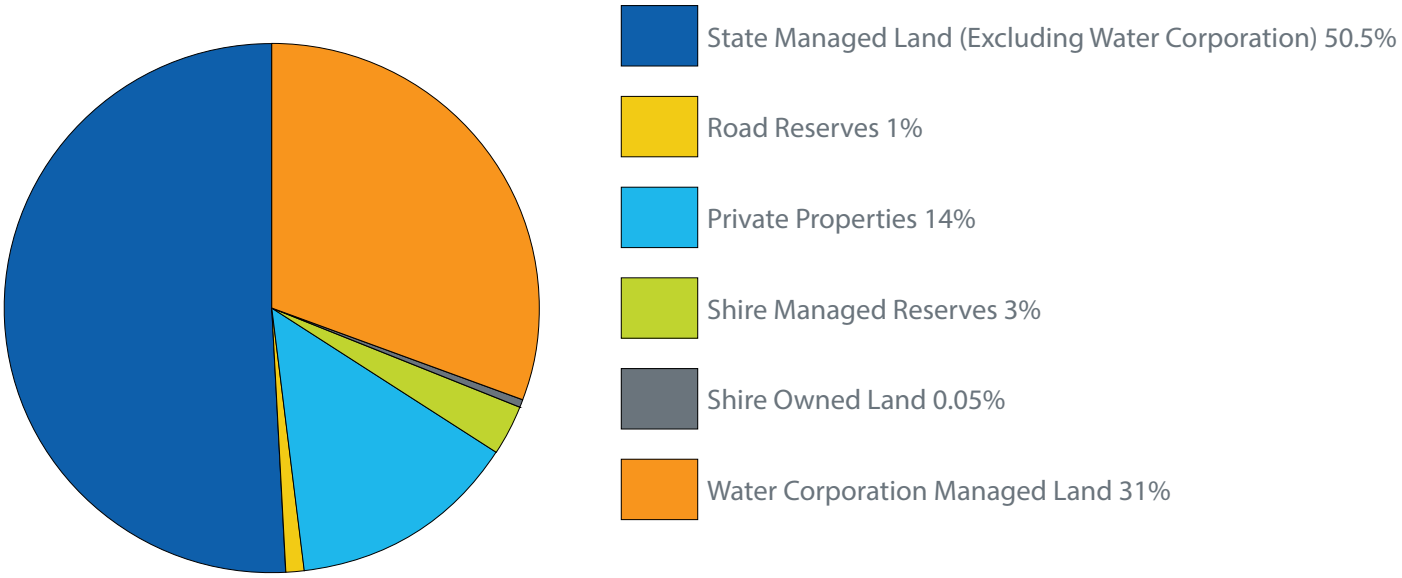

**Reserved land managed by the Shire and State Government**

# The Challenges Ahead

## Percentage of Remaining Native Vegetation per Land Manager

Native vegetation extent for this region was last mapped by the Department of Primary Industries and Regional Development (DPIRD) in 2020. DPIRD has now discontinued production of this dataset and an alternative State Government agency may continue or develop an alternative dataset.

Using the 2020 native vegetation extent as the most recent available information, the percentage of natural area (using native vegetation) in each land management category has been calculated.




Important State managed reserves include John Forrest National Park, Greenmount National Park, Wooroloo Regional Park, Helena National Park and Beelu National Park. The Helena and Beelu National Parks include forested catchment areas of the Helena River, which is in relatively good condition compared to other rivers in the Perth Metropolitan Area.

There are many parks and reserves that contain only degraded areas of native vegetation. Some of these have limited recreational value as well as low ecological values. Visitation and use of parks has changed over time with social and technological changes including declining household size, availability of home playground equipment, and the growth of online/electronic recreation.

Shire resources are spread thin over a large number of reserves, which reduces the management effort on more significant parks and natural areas.

# The Challenges Ahead

## Nature Reserves Managed by the Shire

Ovals and landscaped parks require more intensive management but nature reserves represent a significant responsibility for the Shire, where obligations to maintain community safety meet obligations to maintain natural heritage and biodiversity as well as allow recreational access.

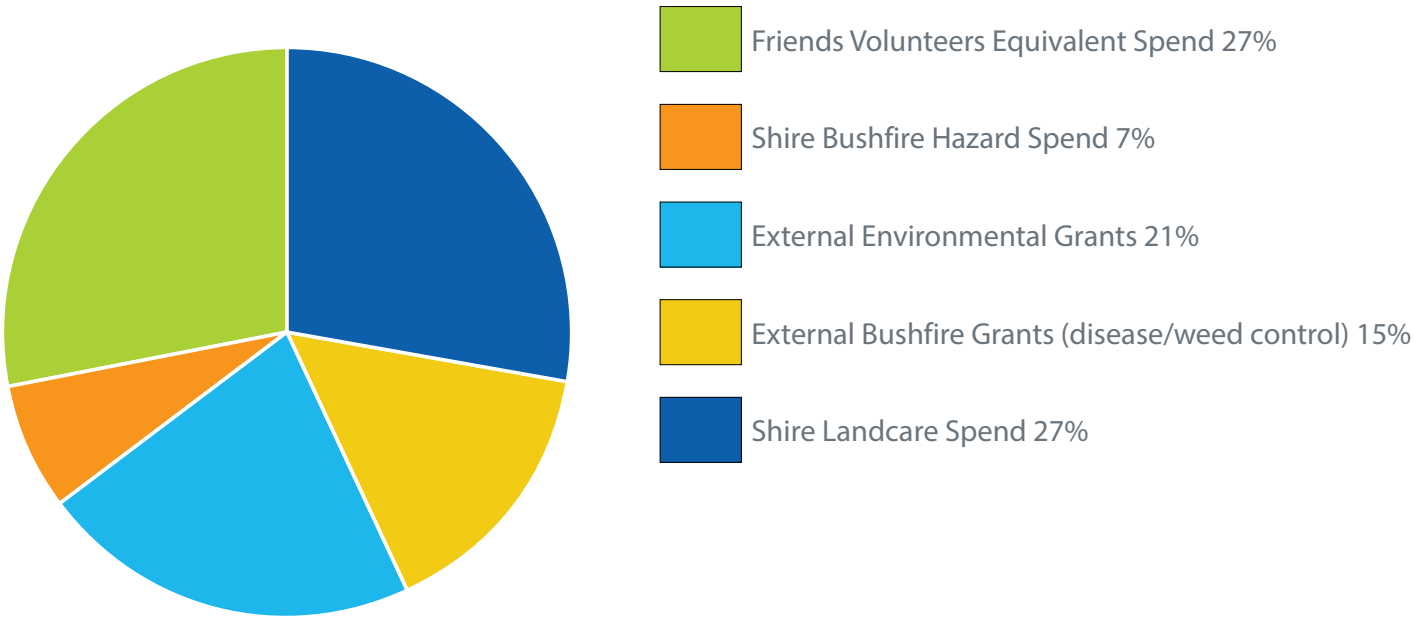
Management occurs through a combination of Shire emergency management and fire protection staff, landcare staff and volunteers. Since 2019-20 the Shire has been receiving annual Bushfire Mitigation Funding from the Department of Fire and Emergency Services (DFES), with a significant portion of that funding directed to weed control and completing works that improve bushfire safety, but also reduce dieback spread.

The chart below illustrates the proportionate spending on nature reserves. In recent years:

- The Shire's direct contribution to landcare matches Friends Group contribution (when valuing volunteer effort at $50 per hour); and

- Bushfire mitigation funding has effectively doubled the Shire's external funding for activities that can improve biodiversity outcomes (most notably weed control).

While bushfire mitigation works will continue to have an immediate environmental and visual impact and need to be implemented with care, the funding has also made a substantial contribution to reduce weeds and bring reserves up to a more manageable state; reducing the risk of catastrophic landscape fires. Implementing smaller planned burns allows for greater opportunity for native animals to move out of the burn area, and a finer mosaic of fuel ages.



# The Challenges Ahead

Seedlings for Landcare has supported Friends Group revegetation projects

Ultimately, the Shire's ability to manage these natural areas is significantly enhanced by the efforts of environmental volunteers, who as Friends Groups or Catchment Groups may also be eligible for funding that the Shire itself is not eligible to obtain. By way of example, in the 2021/22 financial year, 3,964 hours contributed by 72 Friends of the Reserves Groups with a replacement cost of $190,311.64.

The role of a Friends Group is to help safely maintain and enhance the environmental values of bushland areas.

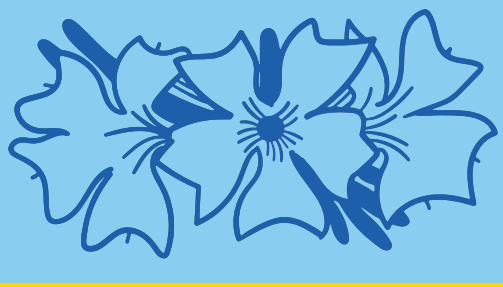
Friends Group volunteers collectively have made a noticeable difference to our environment over the years, and Shire of Mundaring is committed and proud to support our Friends Groups with access to support, training, expert advice, and assistance by contractors and the Shire Landcare team.

Friends Groups have undertaken substantial revegetation and rehabilitation works within their adopted reserves, often making use of native seedlings provided by the Shire through the Seedlings for Landcare program (formerly Tree Canopy and Understorey Program). They are often supported by Catchment Groups that work to coordinate environmental restoration over a broader area and improve the health of our rivers and watercourses.

**To tackle the scale of the environmental management tasks across the shire, it is clear the Shire needs to continue to foster and nurture a strong volunteer network.**

Collaborations with neighbouring councils and participation in regional initiatives can provide learning and networking opportunities between volunteers. They also provide opportunities for coordinated efforts to tackle threats across catchments and pursue larger regional scale restoration projects.

# The Challenges Ahead



## Road Reserves and Verges

There are 2,168 hectares of road reserve within the Shire.

Road reserves are multi-purpose corridors for transport, drainage, utilities and telecommunications infrastructure, and trees and vegetation. The Shire of Mundaring retains native vegetation within road reserves where practical, but is not able to actively manage roadsides for environmental enhancement due to resource constraints.

Instead, the Shire focuses on maintaining safety issues such as clearing sightlines, removing fallen trees, reducing fuel loads, clearing vegetation along footpaths, weed spray along kerb lines and hardstand areas, targeted removal of priority weed species, and maintaining drainage infrastructure by removing weeds or upgrading drains. Naturally occurring native trees and shrubs under powerlines are pruned by Western Power to meet their clearance requirements.

Verges are an area of shared responsibility between the Shire and the adjacent landowner. The Shire encourages residents to maintain verges adjacent to their private property. In many cases written Shire approval is required for landowners to either plant or remove vegetation within the verge under the Activities on Thoroughfares and Trading in Thoroughfares and Public Places Local Law (2004).

Native vegetation, weeds and fuel loads on verges are frequently raised by residents as concerns given that verges are highly visible to the community, and are critical for safe movement day-to-day traffic and as escape routes in a bushfire.

The Shire's Roadside Conservation Policy adopted in 2017 outlines the Shire's position in relation to retention of native vegetation within its verges. A range of actions are recommended within this Strategy to continue to maintain biodiversity values within road reserves where possible.

## Drainage Reserves

There are 20.6 hectares of drainage reserves, which is a small area relative to other types of reserves that the Shire manages. Drainage reserves can include sections of natural watercourses as well as constructed drains and detention basins. The drainage network is critical in safely managing stormwater runoff, as well as maintaining flows into natural watercourses where possible.

Often creeks and drains traverse other government and private land, making it difficult to ensure consistent management. These corridors, basins and creeklines are critical to maintaining a health ecosystem, and managing flood and other public health matters such as mosquitoes.

Currently, the Shire has a limited budget for improvements to this infrastructure beyond maintaining drainage function; and undertaking sporadic management depending on resident requests, and resource commitments.

Growth and development combined with the compaction of laterite soils has created more water runoff and fundamentally altered water flow. In comparison to the Swan Coastal Plain, where significant effort is directed at reducing nutrient loading and maintaining water quality, the Shire's primary challenges relate to managing water quantity and velocity.

# The Challenges Ahead

To address this, the Shire's draft Watercourse Hierarchy Strategy (developed concurrently) has identified the potential for the Shire to retrofit existing drainage infrastructure higher in the catchment. Seeking out low-cost retrofit works to manage peak flows, slow runoff to better manage erosion, sedimentation issues is recommended. Identifying opportunities to retain water that corresponds with the wildlife corridor network will be important.

Drainage reserves offer an important opportunity for the Shire to strategically intervene and better manage water resources in a drying climate.

## Fragmented Land Management

Connections between nature reserves and other natural areas are essential for movement of wildlife to maintain genetic diversity, adapt to a changing climate, and recolonise after fire. Wildlife corridors do not have to be continuous ribbons of bushland and in a modified landscape, can include a network of smaller stepping stones between larger natural areas.

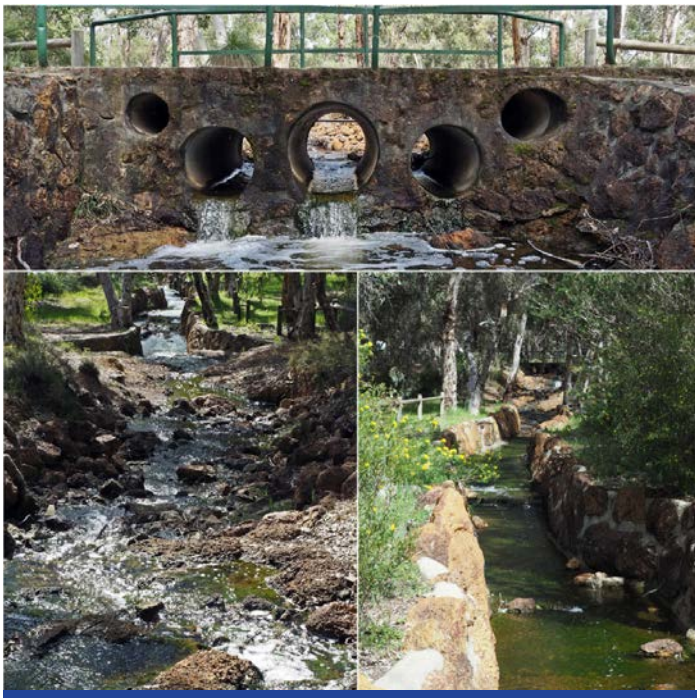
Maintaining populations of native fauna is important to maintain overall ecosystem functions, as the play key roles in pollination, seed dispersal, and movement of fungi that support vegetation health and the breakdown of leaf litter.

Within the Shire, there is a wide variety of land managers, with different approaches, priorities and budgets to vegetation management. By way of example, community concerns have been raised about the approach and method of burning regimes across State agencies. Coming to a common understanding of the most suitable management regime for local vegetation complexes and then achieving a coordinated approach presents a significant challenge.

The Shire only manages 5% of the reserves within the Shire, with the vast majority of reserved land falling under State agency or Water Corporation control.

Outside of reserves, an estimated 14% of all the remnant vegetation in the Shire exists on private properties.

Further, 40% percent of the Shire's watercourses are within or close to areas of freehold ownership. Although there is a level of protection and guidance through the Shire's
planning scheme and environmental controls, it highlights the challenge of coordinating land management practices across the Shire.



**Drains and waterways (photo courtesy of A. Lebel)**

# The Challenges Ahead

Cool burn to reduce surface fuel loads

## Fire

Colonisation disrupted traditional owner management practices for the land and forests around Perth which included regular use of fire. Along with logging, weed invasion and reduced numbers of native animals, the loss of traditional burning is thought to have contributed to increased fuel loads and changed forest structure.

The vegetation of the region is adapted to fire. Some plant species need fire (or smoke) for seeds to germinate. However, altered fire regimes can favour weeds and impact on biodiversity through loss of plant species. Different species have different tolerance for fire frequency and intensity and may be advantaged or disadvantaged by fire in different seasons.

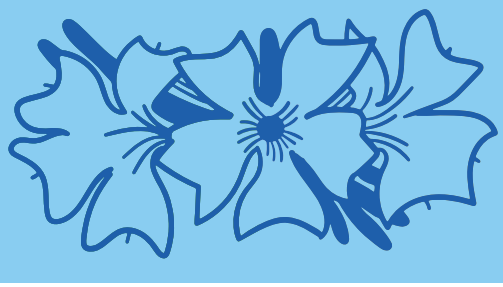
The environment is now different; however the original custodians' invaluable knowledge of native species and fire management should be combined with scientific research findings to inform modern practice. The full range of impacts of different types of fire on soil, air quality and biodiversity is not yet known and requires further research.

Planned burns and fire mitigation works can protect native species and natural areas from the adverse impacts of intense wildfires, as well as protecting human life and property.

There is no single ideal time or way to burn that is optimal for all species, and a patchwork 'fine mosaic' of vegetation at different times since fire provides for a broader range of habitats. Pursuing a mosaic of fuel ages within natural areas enables native animals to take refuge from planned burns, and provides areas of lower fire intensity where they have more chance to survive in the event of wildfire.

Habitat trees and other sensitive environmental features will require additional preparation beforehand, and monitoring to protect them during cool burns. Fire mitigation works and planned burns, coordinated with other landcare work, can contribute significantly to weed control efforts. However, without coordinated weed control there is a risk of weed encroachment after both planned burns and wildfire.

# The Challenges Ahead



The Shire's bushfire mitigation efforts focus on community safety, but are undertaken carefully to minimise environmental impacts and draw from traditional burning practices. Using a mixture of permanent firebreaks and temporary mulched tracks to undertake mosaic burning provides for smaller burn cells, and greater opportunity for wildlife to move within larger reserves. Permanent firebreaks that are maintained to a good standard also provide for landcare access and recreational uses including walking and cycling. They also reduce the likelihood of the hurried and destructive bulldozing of large tracks as part of a wildfire response.

Management of Shire reserves is important in its own right, but these can also function as demonstration sites and locations for sharing knowledge with residents and others. Inappropriate fire regimes are recognised nationally as a threat to biodiversity, so improving bushfire mitigation practices on private land can direct residents' efforts to work that has greater bushfire safety results and lower environmental impacts. With a large number of land managers across the landscape, managing bushfire risks consistently is a critical challenge.

The increase in bushfire risk must also influence the way that regeneration and revegetation are pursued. For example, watercourses and wildlife corridors benefit from more continuous vegetation, but all revegetation must now be planned with bushfire risk in mind.

The maintenance and improvement of wildlife corridors must be a compromise between providing strong connections linking natural areas, and protecting those natural areas and the human landscape around them from wildfire. Maps showing the Wildlife Corridor Network are in Appendix 3. A list of local, threatened fauna is in Appendix 4.

Maintaining a balance between bushfire mitigation and biodiversity improvements requires first reducing fuel loads from weeds; then selecting more firewise species and planting densities for replacements. Revegetation of riparian zones around watercourses has additional benefits in slowing stormwater, increasing infiltration, reducing erosion, sedimentation and reducing flood risk downstream.

In some locations continuous corridors are not possible or appropriate and improvements will focus on 'stepping stones' and consider new approaches such as 'Miyawaki forest' patches. Small areas of dense, diverse plantings called Miyawaki forests can grow quickly, absorbing carbon dioxide more rapidly and providing wildlife refuges, but will need to be assessed for bushfire risk implications before being recommended in bushfire prone areas.

Interactions between biodiversity, wildfire, planned fire and other fire mitigation actions are complicated and some of the issues are outlined in Appendix 5.

# The Challenges Ahead

## Knowledge

This strategy builds upon existing knowledge and information. However, there are many unknowns, and native species that have not been studied to know their habitat requirements or interactions within the ecosystem. Some of the least studied organisms, including fungi, insects and other invertebrates, play critical roles in maintaining pollination and supporting plant and forest health.

As expressed within the Shire's Environmental Sustainability policy, the Shire must remain agile and open to continuous improvement. The strategic outlook must embrace the need for the Shire to participate in research initiatives.

The Shire has opportunities to contribute to filling knowledge gaps in biodiversity and land management, which will lead to adjustments and improvements in practice in response to new information and insights.

An area of particular importance will be emerging science for bushfire risk mitigation and local native species responses to fire.

Most research into fire mitigation has been conducted outside of Western Australia, and it is difficult to reconcile the range of expert opinions into practical local action.

The Shire will continue to monitor research in this area, and test and challenge State requirements that are not necessarily aligned with our specific vegetation complexes.

The Shire is well placed to play an important role in continuing to question, and seek to enhance performance within the bushfire planning industry and relevant stakeholders.

Improving mapping and monitoring of responses to bushfire mitigation and planned burns within Shire managed reserves will also help inform improvements to bushfire and biodiversity advice provided to other land managers.

## Future Threats

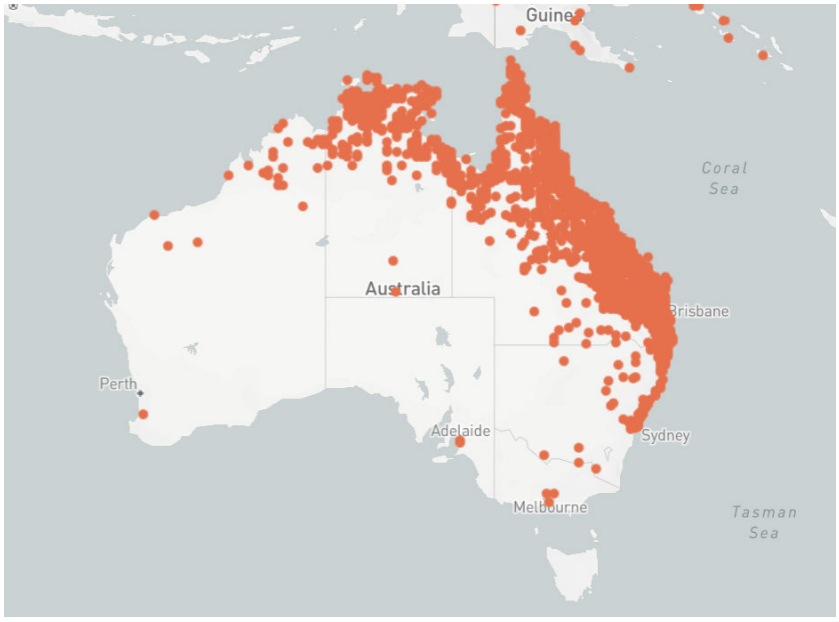
There are some potentially significant threats on the horizon but not currently present within the Shire. The full impact on biodiversity of the arrival of new pests and diseases is difficult to predict. Some of these potential future threats which require monitoring are noted below.

# The Challenges Ahead

**Cane Toads**

*(Rhinella marina)* impact many native species through competition for food and habitat, predation, and poisoning. They have been in Western Australia since 2009 when they entered the Kimberley from the Northern Territory, and are currently estimated to be spreading at around 50km per year. Faster spread is possible through 'hitchhikers' and while the climate within the Perth hills is not currently mapped as suitable for cane toads, the climate is changing and cane toads are proving adaptable in the north of the state. Eradication of small populations would be possible ahead of the main front.

1




2

[1]Cane toad detection (Australian Museum, 2020) [2] Cane Toad courtesy ABC News

# The Challenges Ahead

**Herbicide resistant weeds** may emerge from agricultural regions. These may also include genetically modified crops (such as canola) which have been developed to be resistant to particular herbicides. Weeds resistant to one herbicide will usually still be susceptible to other herbicides, although multiple herbicide resistance can occur. Demand from the agricultural sector can be expected to support the development of alternative products and approaches if significant herbicide resistant weeds develop.

**Myrtle rust** (Austropuccinia psidii) is a fungus from South America, where the native Myrtaceae species have evolved a natural resistance to it. It spreads by tiny yellow spores and attacks the leaves, stems and flowers of susceptible plants (including Eucalypts), affecting seed production.  Since 2010 it has infected forests in New South Wales, Queensland, Victoria, the Northern Territory, Tasmania. It has been detected within the Kimberley in 2022 and has potential to devastate many ecosystems by preventing seed production if it spreads within southwest Western Australia. Myrtle rust can be controlled in garden or horticultural settings using chemicals, but chemical control is not a viable option across large areas including native forests.

**Myrtle rust fungus affects plants from the Myrtacea family, including leaves, stems and shoots (DPIRD).**

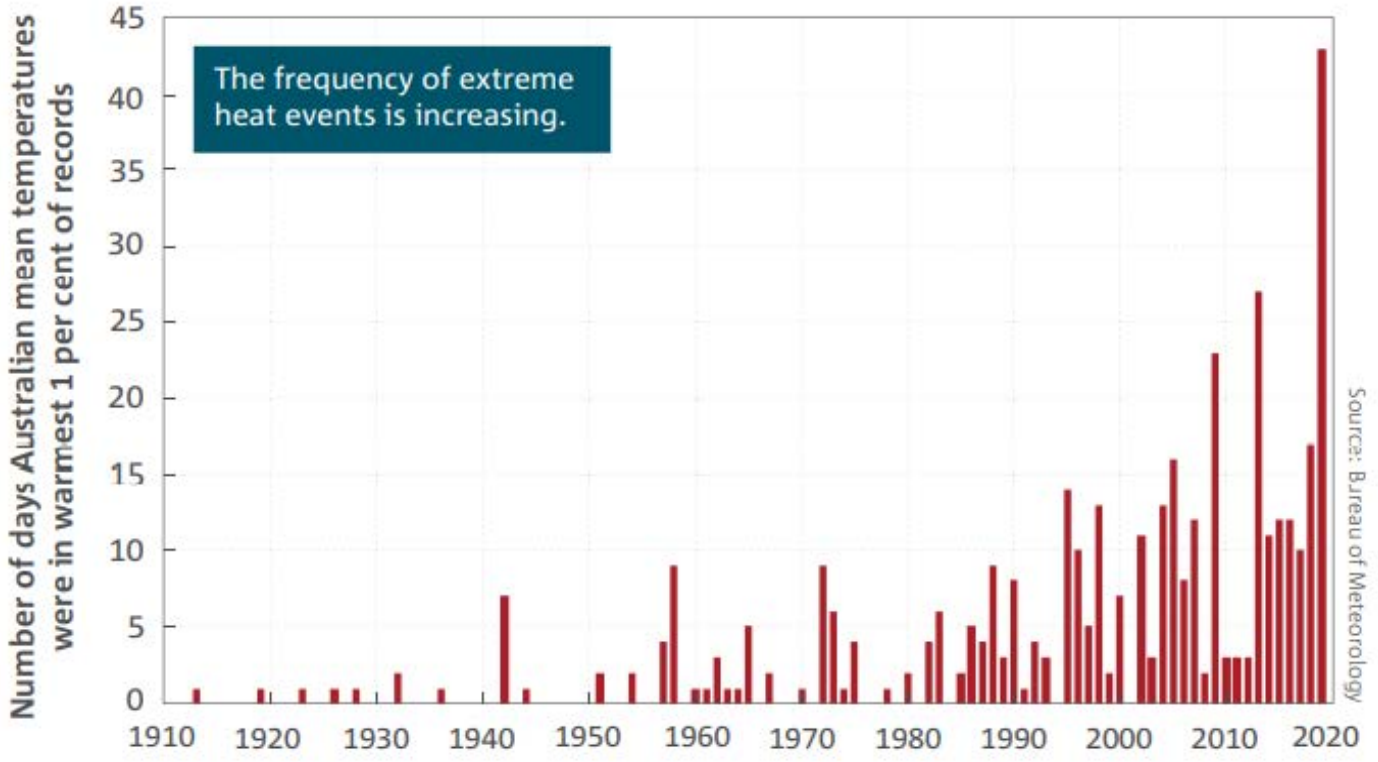
# The Challenges Ahead

## Climate Change

The most wide-ranging threat is climate disruption from global warming, caused by increased greenhouse gases in the atmosphere. While the climate has changed in the past, the current rate of change has been accelerated by the burning of fossil fuels, and is faster than many plants and animals will be able to move or adapt. Climate change will also have a multiplier effect, increasing the negative impacts of other threatening processes and particularly in this region, fire.

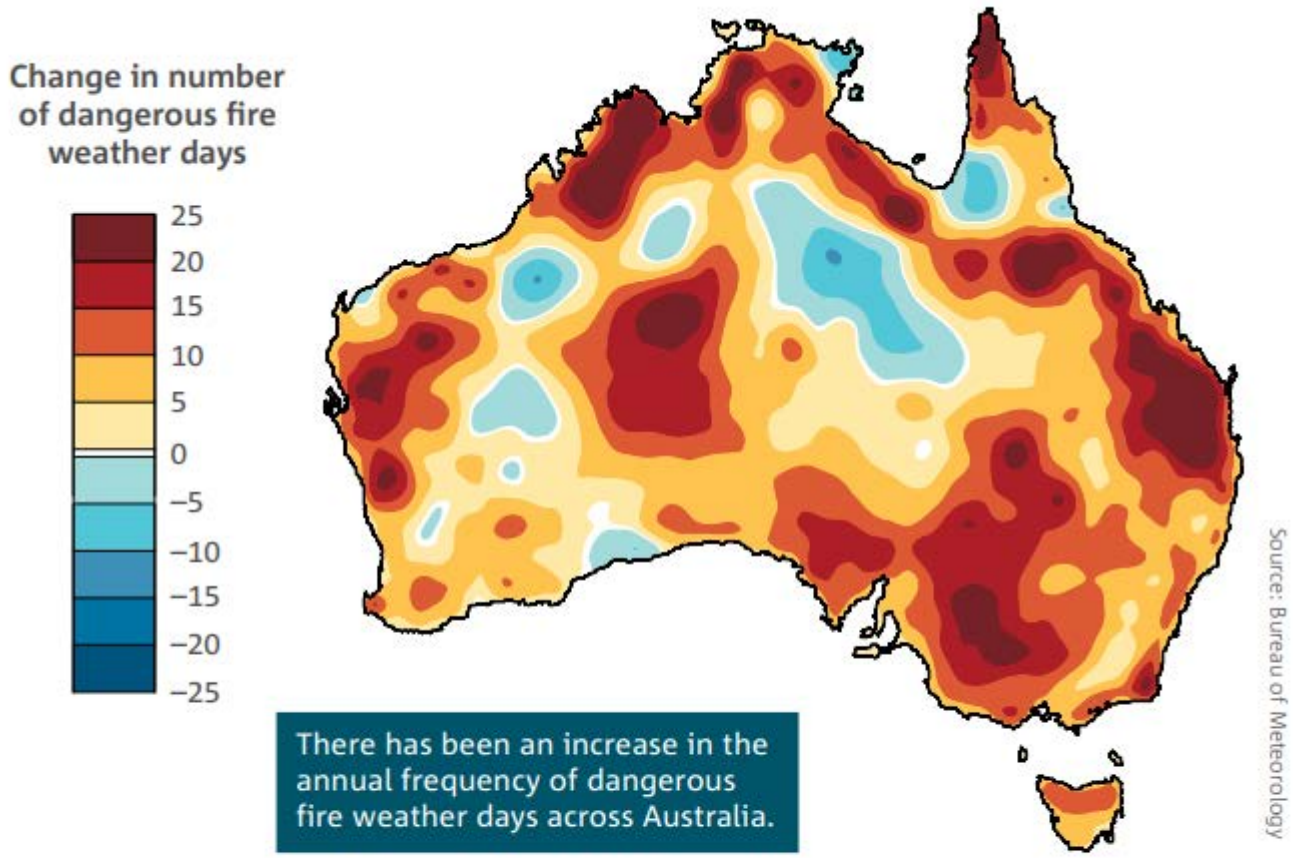
The full extent of climate change experienced over the next century will depend on action to reduce the production of greenhouse gases and absorb carbon dioxide. (Shire actions to reduce emissions are the focus of a separate Energy and Emissions Reduction Strategy.) Past emissions have already 'locked in' additional warming for the next few decades. The frequency of hot days, heatwaves, and dangerous bushfire weather have all been increasing and expected to continue.

CSIRO and the Bureau of Meteorology produce regular 'State of the Climate' reports, summarising what has been observed and what is expected for Australia. The images below are from the 2020 report:




Number of days each year where the Australian area-averaged daily mean temperature for each month is extreme. Extreme daily mean temperatures are the warmest 1 per cent of days for each month, calculated for the period from 1910 to 2019.

# The Challenges Ahead



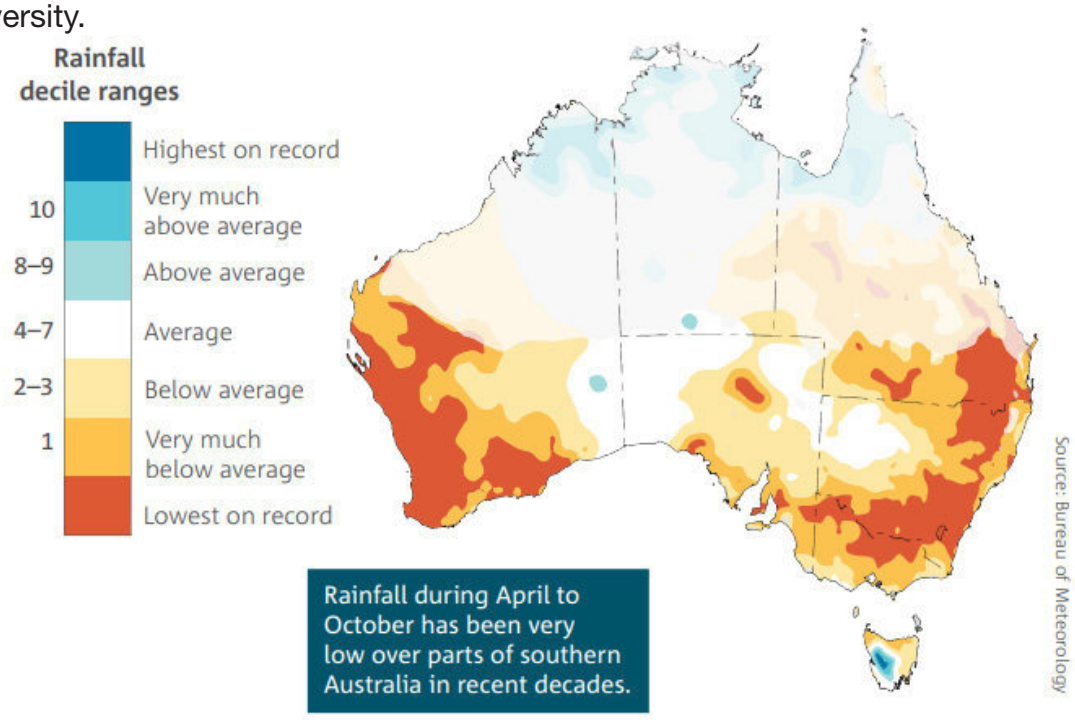

There has been an increase in the number of days with dangerous weather conditions for bushfires. This is based on the change in the annual (July to June) number of days between the two periods: July 1950 – June 1985 and July 1985 – June 2020 that the Forest Fire Danger Index exceeds its 90th percentile, which is an indicator of dangerous fire weather conditions for a given location.

The broad trends observed in the south-west of Western Australia are higher annual temperatures, longer bushfire seasons and disrupted rainfall patterns, including both periods of drought and the likelihood of lower annual rainfall but more frequent flooding events.

The range of impacts on the natural environment from those changes include pressure on vulnerable species particularly during drought and heatwaves, erosion issues along watercourses, reduction in permanent water bodies, and general destruction from more intense bushfires (including loss of the soil seed bank).

# The Challenges Ahead

Drier conditions combined with the increasing frequency of dangerous fire weather make it more likely that wildfires will spread quickly. Although there is less rainfall overall, more of it is falling in storms. Where there is significant rain and flooding following a bushfire (such as the Wooroloo Fire) this can 'compound' or multiply the impacts of both, resulting in increased loss of topsoil and biodiversity.




April to October rainfall deciles for the last 20 years (2000–19). A decile map shows where rainfall is above average, average or below average for the recent period, in comparison with the entire rainfall record from 1900. Areas across northern and central Australia that receive less than 40 per cent of their annual rainfall during April to October are faded.

The United Nations' Intergovernmental Panel on Climate Change has identified the Northern Jarrah Forest as one of the Australian ecosystems most at risk due to climate change. There is a significant risk of areas of ecosystem 'transition' or 'collapse' as a result of mass tree deaths in a hotter and drier climate.

Some species and ecosystems may prove more resilient than others. Where there are signs of ecosystem failure, more active intervention may be required, either to attempt to regenerate the previous ecosystem or to take a stewardship approach to development of a novel ecosystem based on the changed climatic conditions. Cost effective and broad-scale vegetation health monitoring would be an important asset to detecting and responding to climate change pressures.

The Department of Water and Environmental Regulation 'Climate Science Initiative' is undertaking detailed modelling for Western Australia and is expected to deliver regional climate projections in 2024. Some actions and priorities identified within this strategy may need to be revisited at that stage, or in the next scheduled review. It is hoped that much more guidance will become available from State Government agencies in the next decade, to assist all landowners and managers with locally appropriate adaptation.

# Local Environmental Threats

In relation to locally specific and relevant environmental challenges, the threats faced by our native species and ecosystems are varied and significant. These include land clearing, dieback, invasive weeds, introduced predators, and climate change reducing local streamflow and increasing bushfire risks.

The stability of natural ecosystems including our jarrah forests depends on many species. The loss of particular species, such as specialised native pollinators, can cause additional losses from species that depended on them. Targeted actions will be required to address local threats, minimise local extinctions and reduce the risk of ecological collapse.

## Dieback and Disease

Phytophthora Dieback is a root rotting plant disease, caused by introduced water moulds such as Phytophthora cinnamomi. A water mould is similar to a fungus and it lives in soil and plant tissue. After it attacks the roots, many plants will quickly die off as they are unable to take up water and nutrients. While other plant diseases such as marri canker can also impact forest health, dieback is considered the most serious since it affects so many different plant species.

Once plants and soil are infected the disease can be treated but not cured. Without treatment, susceptible plants (nearly half of local plant species) will die and the ecological and habitat values of the area will be permanently reduced, which is why dieback is called the 'biological bulldozer'. More information on dieback impacts and management is included in Appendix 6.

Some plant species or individual plants are much more resistant than others and can survive in dieback infested areas. Shire reserves are part of a research project to test plant species dieback susceptibility in the Perth hills. Environmental science PhD students have been working on a multi year study to recommend species and methods to rehabilitate dieback affected areas.

**Loss of habitat in dieback free jarrah forest (left) compared to dieback affected forest (right)**

# Local Environmental Threats

## Clearing

Loss of native vegetation and reduced connections between natural areas removes habitat for wildlife and limits their ability to move and reproduce. This fragmentation can also reduce pollination of plants, resulting in a slow decline in plant diversity.

The most common reason for clearing is for development at varying scales – for subdivision, for building a house, or adding pools, sheds and carports.

Clearing of native vegetation may require local, state or federal approval depending on the scale and location. The *Environmental Protection Act 1986* is the primary legislation protecting native vegetation in WA. Clearing permits are required from the Department of Water and Environmental Regulation, unless specific listed exemption applies.

There are specific listed exemptions from requiring a state clearing permit and most clearing is not at a scale that requires federal approval.

There are notable exceptions including habitat for listed threatened or endangered species, such as black-cockatoo species.

Significant clearing can occur where subdivision and development is approved by the Western Australian Planning Commission (WAPC). Shire Planning and Environmental Officers review proposals and seek to influence the WAPC decision by providing recommendations and requesting conditions to prevent or minimise environmental impacts.

For existing private properties, the vegetation protection provisions within the local planning framework provide for Shire planning and environmental staff to review proposed development including clearing and reduce the impacts where possible.

While less vegetation can typically be retained within Residential zoned properties, important environmental features including habitat trees and riparian vegetation along watercourses are protected where possible.

Clearing is an important contributing factor for erosion and sedimentation of watercourses, which is magnified by the increased discharge of stormwater from buildings and paved or hardstand areas. Protection of existing vegetation along watercourses is the most effective option but where revegetation is required, this should mimic the natural form and structure of riparian vegetation to maximise biodiversity benefits.

Much more fuel reduction and vegetation clearing is now required around new houses, to meet bushfire guidelines and achieve an acceptable bushfire attack level (BAL), than was the case in past decades. Owners of houses built before December 2015 when current BAL requirements came into effect are also permitted to clear more of their Asset Protection Zones (APZ) according to the Fire and Emergency Services Commissioner's Standards.

It is possible that the State Government may further expand exemptions from clearing permits and local government planning approval in bushfire prone areas in the future, particularly within Asset Protection Zones.

While most people will agree on the need for fire mitigation actions, there are a wide range of views about what is effective and necessary. Excessive clearing or too-frequent burning can encourage weed growth and have negative environmental outcomes without improving bushfire safety.

# Local Environmental Threats

## Illegal Logging

The removal of vegetation from Shire land, dead or alive, is prohibited under Shire of Mundaring Local Property Law and the *Environmental Protection Act 1986*. Illegal logging for firewood collection is an ongoing issue that affects Shire conservation reserves, National Parks, regional nature reserves, and water catchment areas.

Illegal logging has an immediate environmental impact through the removal of habitat, but also unregulated access can spread dieback or other plant diseases and result in longer-term loss of biodiversity.

Anecdotal advice from Shire staff in the field is that most of this activity occurs on land managed by agencies other than the Shire, and appears to be driven by collection of firewood to sell, rather than for household heating or timber products. Unauthorised logging is a state-wide issue requiring a coordinated approach across multiple State Agencies.

Investigating unauthorised logging faces many challenges across different land tenures. Shire attempts to engage and encourage greater State intervention and compliance/enforcement has not been effective.

The frequency of patrolling reserves and/or surveillance needs to be increased and on a larger scale to catch unlawful clearing offences.

State agencies do not appear to be coordinated or adequately resourced to act on illegal logging offences. With the prospect of previously unallocated crown land transferring to control by Aboriginal Corporations, there is the potential for improvements to management in this regard.

In 2021 the State Government announced that south-west native forests are to be protected from commercial logging from 2023. However, damage from illegal logging will continue unless agencies have the on ground resources to investigate and collaborate with local government and other land managers to prosecute offences.

There are also opportunities for the State to take coordinated action to reduce the demand for illegally harvested firewood, by increasing options for legal firewood collection. There may be locations where regrowth from past logging has resulted in a much higher tree density than in old growth forests, and selective harvesting could potentially address forest structure and fire risk, at the same time as providing an alternative to illegally collected firewood.

Early consultation documents for the 2024-2033 Forest Management Plan released by the Department of Biodiversity, Conservation and Attractions provide an overview on ecological thinning in the south-west forest.

# Local Environmental Threats

Ecological thinning is the partial reduction of overstorey stand density to improve ecological values in a forest. The benefits of carefully implemented strategic thinning can include improved forest health, with more resilient forests not under stress and competition for water.

This type of active forest management can also address bushfire risk. Thinning can promote growth of the remaining trees, better mimicking the form of old growth forests, and increasing fire resilience by reducing the potential for crown fires in heavily stocked regrowth stands. This can also enable lower intensity planned burns with reduced risk of tree death and damage.

The Shire can advocate for the State to develop detailed plans and set limits for ecological thinning in timber reserves. These should address how much vegetation can be removed, how often and where thinning would be most effective to achieve the best results. Only regrowth from past logging should be considered for thinning, to ensure habitat trees are undisturbed, and areas considered protectable from dieback should be excluded.

The Shire can also advocate for actions that reduce the demand for firewood altogether (such as incentivising or subsidising conversions to efficient electric heating), which would provide a more permanent solution to illegal firewood harvesting, and also have air quality benefits in the cooler months.

## Weeds

Weeds are introduced plants that affect bushfire fuel loads and amenity as well as negative impacts on the natural environment. Weed control is a shared responsibility across all land owners and managers.

Within nature reserves the Shire generally follows the ‘Bradley method’ of bush regeneration. This prioritises work in the areas that are in the most natural, undisturbed state, to maintain high conservation values.

It is impossible to eradicate all weed species. Shire resources and weed control efforts must be directed to weeds that have worse impacts (such as rapid spreading, or increased bushfire risk). The Shire has developed a Priority Weeds List, informed by declared Weeds of National Significance, Declared Plants in WA, Swan Region invasiveness ratings, and the local knowledge and experience of Shire staff. The Priority Weeds list is included in Appendix 7.

Shire staff in the Community Safety and Emergency Management Service undertake weed control as part of reducing bushfire hazard within Shire reserves. Their efforts are focussed on weed species that can contribute significantly to bushfire fuel loads, rather than environmental or aesthetic weed issues. Their efforts are also focussed on the reserves, or parts of reserves, that are closest to residential areas. Controlled burns can contribute to weed control within natural areas, and provide an opportunity to target emergent weeds in the year after fire.

Rapid weed growth is a known problem after both bushfires and controlled burns, and can add to subsequent fuel loads and fires if not managed.

There is often financial assistance from the State Government for bushfire recovery but the funding terms may prevent effort to control weed growth, if this is seen only as an environmental issue. Weed growth after fire is also a future fire risk and can be a cause of stress for fire affected residents, in addition to impacts on biodiversity.

# Local Environmental Threats

## Introduced Animals

Livestock, domestic pets and feral animals all put pressure on local native species.

The direct impacts of feral predators such as cats and foxes are well known but other introduced animals can also have impacts via eating or trampling important native vegetation, competing for nest hollows and habitat, or spreading parasites and disease.

**Livestock**

The keeping of livestock, such as horses, sheep, cows, goats and alpaca, is a common land use for many rural lifestyle and general agriculture properties that have been historically cleared of native vegetation.

Livestock can put pressure on local native species through their impacts on the land and vegetation. The intention of the current planning controls is to manage and promote the sustainable keeping of stock on land within the Shire, in a way that preserves and enhances the rural lifestyle and amenity of the area and protects environmental assets.

The Shire's Keeping of Stock guidelines are used to assess stock management, stocking rates, pasture cover and exclusion of stock from native bushland areas and watercourses.

Overgrazing and trampling from stock causes land degradation, erosion of topsoil and loss of habitat for native animals. Many rural lifestyle properties rely on groundwater bores to irrigate their pasture in the drier seasons and to maximise the number of stock they can have on their property, however this approach needs to be reconsidered when keeping in mind the drying climate and reduction in rainfall. It is vital that we promote responsible and sustainable stock management into the future.

**Pest and Feral Animals**

There are a range of feral animals within the shire, and generally poor information about their numbers and location. There are efforts to remove feral pigs from state managed lands. Feral deer are an established and serious feral pest in some parts of Australia but currently occur within the shire in low numbers.

Cats are instinctive hunters that have contributed to the extinction and decline of many native animals. Both domestic and feral cats threaten the survival of small birds, mammals and reptiles. Control of domestic cats is the responsibility of cat owners.

Trapping and removal of feral cats is undertaken by the Shire's Community Safety and Emergency Management Service. The Shire of Mundaring Keeping of Cats Local Law is limited in scope to the matters permitted by the state *Cat Act 2011*, which currently does not permit local laws to require cats to be contained within the owner's property.

# Local Environmental Threats

Fox with prey, Glen Forrest

Foxes can have a large hunting territory that includes many native animals, supplemented by domestic poultry and pet food.

Information on the fox population within the Perth Hills is very limited and fox control can be difficult to undertake, however it is critical to ensure the survival of native species within natural areas.

Conservation areas with feral animal exclusion fencing have demonstrated the benefits for fauna recovery. However, this fencing is costly and would be very difficult to install and maintain within Shire managed conservation reserves,which also allow for recreational use and access.

While conservation organisations can maintain dedicated on site staff (including ecologists) for wildlife sanctuaries such as Karakamia, the Shire has a small number of staff managing a large number of reserves. There is also a risk of the fencing becoming a barrier to wildlife escaping a wildfire and therefore no feral animal exclusion fencing is recommended for reserves managed by the Shire.

## Poison and Pollution

Careless use and storage of chemicals can result in pollution of soil, groundwater or watercourses.

Chemical spills can also occur from road accidents during transport and enter the drainage system, leading to watercourses downstream. This can cause water quality issues and cause poisoning of wildlife.

One more direct source of poisoning is through use of baits and particularly, rodenticides. Any baits or poisons have a risk of being eaten by native animals if not managed carefully.

Many poisons that are available at retail outlets for rodent control have an additional risk of ‘secondary poisoning’, which occurs when owls, birds of prey or other native animals eat poisoned rats and mice.

The most harmful poisons are slow acting, Second Generation Anticoagulant Rodenticides (SGARs). Rodents can eat multiple baits before dying, then native predators can eat the more heavily poisoned rodents. Some insecticides can also result in secondary poisoning.

Air pollution can also impact on native plants and animals but local governments have an extremely limited role in monitoring or protecting air quality. This is the jurisdiction of the Department of Water and Environmental Regulation and the shire will primarily pass concerns about pollution to the appropriate agency for investigation.

# Rising to the Challenge

Retaining at least 30% of the original (pre-colonisation) extent of each ecological community is recommended to prevent an exponential loss of local species and risk of ecosystem failures. Many local government areas within the south-west of Western Australia have already crossed these thresholds in terms of keeping enough of each vegetation complex, used as a proxy for ecosystem diversity. Shire of Mundaring is unique within the Perth Metropolitan Region in its opportunities to retain biodiversity for future generations to enjoy.

In addition to the Shire's natural assets, the community already places a high value on the natural environment. While there may be substantial landowner succession ahead, as long term residents can no longer safely manage their long held properties and downsize, new residents are also likely to choose to live in the shire for its natural beauty and opportunities to be close to nature.

While the threats facing our native species are serious, there are many opportunities to help them survive. New scientific research about our native species, better mapping and monitoring technology, and national carbon sequestration and biodiversity certification programs will all provide significant opportunities to improve conservation outcomes.

## Vision

Community members from the Shire's Environmental Advisory Committee helped develop a long term vision for biodiversity within the Shire of Mundaring:

**Biodiversity and natural areas are protected, connected and cared for through informed community stewardship and Shire leadership, empowering a strong culture of conservation.**

The Shire has a significant role to play but cannot achieve this vision alone. To work towards it, Shire staff must seek collaborative partnerships, empower environmental volunteers, and support landowner conservation efforts.

Key principles have been identified that will guide efforts to protect and care for our natural heritage, and inform actions by Shire staff over the coming decade.

# Rising to the Challenge

Group activities and enjoyment of the outdoors creates social harmony and a sense of wellbeing

## Principles

### Celebrate Nature

Caring for nature grows from understanding and connecting with nature. Shire residents should have a range of opportunities to learn about and celebrate their connections to nature. This will help foster a shared sense of custodianship of the natural environment and promote a culture that supports biodiversity conservation.

There is a significant body of research demonstrating the benefits of access to nature for individual health and wellbeing, beyond the benefits of exercise in more modified or artificial public spaces.

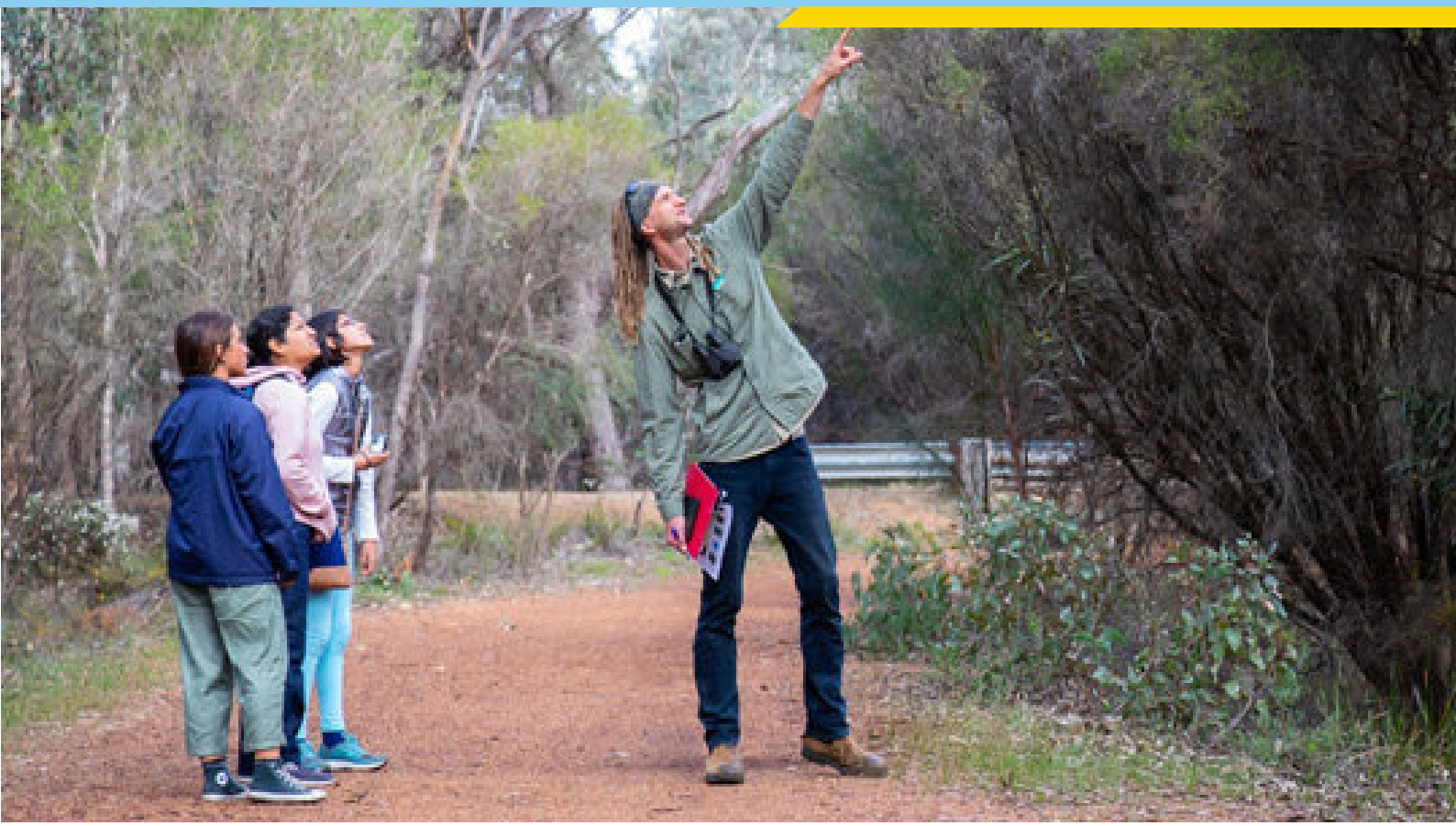
Childhood experiences in nature help to develop understanding of local biodiversity and connections to the natural world. Paths, trails and nature play areas allow for engagement with nature and can contribute to both physical and mental health.

Environmental art can generate individual and collective emotions that strengthen appreciation and connection to our natural heritage. Improving the visibility of our landscapes and native species within public art such as murals, or the Shire's art collection, will help promote knowledge and a culture of custodianship.

Celebrating nature will include:

- Developing or participating in citizen science opportunities to help fill gaps in knowledge of our natural environment
- Expanding free Shire online material and publications to include more information about native animals;
- Maintaining partnerships to deliver environmental education opportunities, such as Environmental Art Project with Mundaring Arts Centre;
- Encouraging or developing public artwork celebrating local native plants, animals and cultural heritage; and
- Managing Lake Leschenaultia for a balance of recreation and conservation use, with enhanced environmental education opportunities around the Lake.

# Rising to the Challenge



## Expand and Support Volunteer Network

One of the Shire's great strengths is the extensive and dedicated network of environmental volunteers that undertake bushland conservation and environmental management activities within the Shire's natural areas. The Shire has many volunteers in Friends Groups and broader Catchment Groups that undertake bushcare activities in reserves.

The role of a Friends Group is to help safely maintain and enhance the environmental values of bushland areas. Friends Group volunteers collectively have made a significant difference to our environment over the years, and Shire of Mundaring is committed and proud to support our Friends Groups with access to support, training, expert advice and assistance by contractors and the Shire Landcare team.

Friends Groups / Catchment Groups can also be eligible for assistance or grant funding opportunities that the Shire alone cannot access.

Through the compilation and review of the Friends Group Manual, Shire of Mundaring continues to assist and improve outcomes for our environment.

Volunteers and the grants obtained in collaboration with volunteer groups represent 48% of the spending on nature reserves within the Shire. Environmental volunteers are therefore critical to the Shire tackling the challenges ahead.

# Rising to the Challenge

Some relevant observations about volunteering trends and the Shire's current approach to Friends Groups include:

- 19% decrease recorded in people doing voluntary work in Australia from 2016 to 2021. In Shire of Mundaring the decrease was around 11%;
- Friends Groups have a long history since 1989 (33 years) and not all works completed have been recorded / collated and there is likely a wealth of local knowledge to be shared;
- The majority of members are in their 60's or above, with some younger members.
- Of the 70 registered Friends Groups in the shire, only 8 Friends Groups and one Catchment Group have received funding over the last 5 years to complete work in Shire reserves;
- Grants have been sought where volunteers are active. This does not always correlate with the location the Shire's highest priority reserves.
    - Black Cockatoo Reserves (Priority 7) – Funding sought for dieback treatment. This is the best example of funding being sought in a high priority reserve.
    - Falls Road Reserve (Priority 8) – Funding sought for minimal work in reserve. Most funding is being spent on upstream private land adjoining the reserve.
    - Boya Trail – Southern Railway Heritage Trail – Boya to Mundaring (Priority 20) – Funding is utilised on the adjoining DBCA land, rather than along the trail itself.
    - Other grants are not for reserves listed in the priority reserves report.
- Most of the top 10 priority reserves do have a registered Friends Group but with varying numbers of volunteers and levels of activity.

It is clear that we need to foster and nurture a strong volunteer network to tackle the scale of the environmental management tasks across the shire. Friends Groups also provide important opportunities to share and develop landcare skills that can be applied to natural areas on private properties.

# Rising to the Challenge


**Work Health and Safety Act 2020**
Recent changes to the *Work Health and Safety Act 2020* have increased the potential penalties to staff and volunteer coordinators if an injury occurs. Providing a safe workplace continues to be a high priority of the Shire, and this extends to the safety of volunteers working in reserves.

The Shire will continue to update its Friends Group Manual to help:

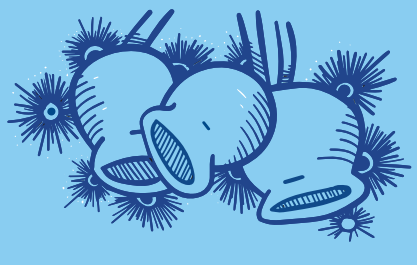
- reduce risk to volunteers by restricting the use of mechanical equipment and weed control chemicals
- improve safety procedures; and
- provide updated information regarding fire management, grants and Aboriginal Heritage.

Further professional and pragmatic risk management advice would be beneficial in informing a volunteer model moving forward.

Survey results and staff observations confirm there are often unregistered contributors, who may not be covered by Shire insurance for volunteers. As well as volunteer coordinators being exposed to significant work safe risks in these instances, the removal and or planting of vegetation within reserves without permission (or without being a registered Friends Group member) could technically represent a breach of the Shire's Property Local Law.

There is more "generosity of time and spirit" from the volunteers than there are staff to monitor its application, which is a good problem to have. Given the significant contributions volunteers make, supporting volunteers and guiding and assisting them to safely undertake appropriate works is important.

# Rising to the Challenge



Friends Groups have  and will continue to work in their own time, at their own pace. However, in the interests of all parties, Shire must ensure all volunteers are registered and work plans are prepared; for their own continued safety, to reduce exposure to workplace safety issues, and to ensure the Shire and volunteers coordinate effort to best effect.

Every reserve is different and requires different treatment. To protect life and property from bushfire events as well as maintain biodiversity, Friends Groups and the Shire must also pursue 'balanced' outcomes. Engagement with Friends Groups will be guided by and continue to respect the wealth of local knowledge volunteers can share about their reserve.

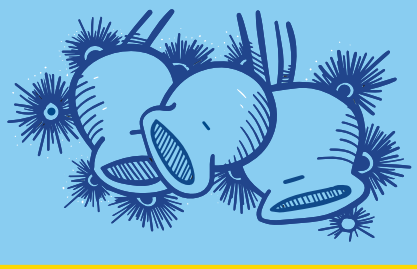
The Shire has limited resources and does not have enough staff to comprehensively manage all nature reserves. The Friends Groups continue to provide significant support to maintain the environmental values of nature reserves. However it is also acknowledged that, due to broader social changes, there is a need to adapt and provide different opportunities for more options for volunteers to contribute. Friends Group members have often raised difficulty of recruiting new volunteers and aging of existing volunteers as issues of concern to their group.

Exploring new innovative programs and ways to engage and genuinely empower volunteers will be critical moving forward. Existing and potential volunteers should also be afforded an opportunity to inform and define their own role in relation to volunteering.  New groups should also be encouraged to form around high priority nature reserves.

A range of low cost, low risk trials could be undertaken to test ideas to attract new volunteers. The trials could be monitored and feedback and improvement suggestions requested from attendees. Time should be afforded to a trial period for two years to allow sufficient community participation and feedback. This investment should help inform the Shire's longer-term approach, which may require an increase in budgets for reserve management staff or contractors if trials to recruit more volunteers are unsuccessful.

While the numbers of volunteers will fluctuate over time, the Shire will continue supporting and collaborating with Friends Groups. An important component to improving coordination will be seeking to improve mapping, planning and communication for reserves through more formalised Fire and Environmental Work Plans.

# Rising to the Challenge



## Enhance Reserve Management and Coordination

An opportunity exists to use the Shire's Geographic Information System (GIS) as a spatial information hub to coordinate and record observations and activities by various stakeholders.

Where management plans have been prepared these should also be noted and linked within the GIS. More technical capacity is required moving forward. It is not feasible to prepare comprehensive management plans for all nature reserves managed by the Shire. It is recommended that management plans should be prepared or updated for the ten highest priority nature reserves, based on a 2018 ecological assessment of over 50 nature reserves (nearly 900 hectares). While Lake Leschenaultia was not included in that 2018 assessment due to its separate management as a tourism and recreational site, it should obviously be included in that list for its ecological values, as well as its social and recreational significance.

The ten reserves recommended to have management plans prepared are:

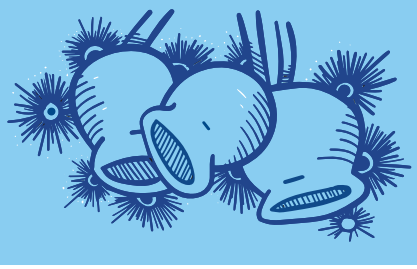
- Lake Leschenaultia, Chidlow (Res. 23165)
- Alps Street Reserve, Mount Helena (Res. 34103)
- Strettle Road Reserve (Res. 32727)
- Pindalup Reserve, Wooroloo (Res. 39853)
- Superblock Reserve, Glen Forrest (Res. 50018)
- North Darlington Reserves, including Nan Macmillan (Res. 6922)
- Black Cockatoo Reserves, Mundaring (Res. 20990 & 12422)
- Falls Road Reserve, Hovea (Res. 12453)
- Hovea Conservation Park, Hovea/ Parkerville (Res. 14163)
- Callan Road Reserve, Hovea (Res. 38224)

Due to its environmental values, high visitation and bushfire risk, Lake Leschenaultia will require a more comprehensive plan to protect the Lake itself and its natural surroundings while allowing for safe and appropriate recreational uses.

However, other nature reserves containing more than two hectares of native vegetation are also recommended to have shorter, more action based Fire and Environmental Work Plans prepared to better coordinate effort between the Emergency Management, Parks Teams, and Friends Groups. Priority for preparation of these Plans will be reserves with registered Friends Groups where bushfire mitigation works are planned soon.

A Fire and Environmental Work Plan may be used as an interim plan, to inform preparation of a full management plan when possible.

# Rising to the Challenge



Plans will be reserves with registered Friends Groups where bushfire mitigation works are planned soon. A Fire and Environmental Work Plan may be used as an interim plan, to inform preparation of a full management plan when possible.

Currently the Shire does not have resources to prepare management plans in-house. A business case is recommended for external consultants to prepare a management plan for Lake Leschenaultia. For other reserves, a business case is recommended to employ additional staff to map and monitor the condition of nature reserves, develop and implement plans, and coordinate weed control efforts and conservation activities with bushfire mitigation actions.

The most significant and reliable external funding for nature reserve management is from the DFES Mitigation Action Fund. Investments in weed control to address bushfire fuel loads have biodiversity and community co-benefits, but not all weeds will be eligible for treatment under MAF. Coordination of fire mitigation works with Parks staff and Friends Group effort will achieve greater results across the range of priority weed species. Targeted training and engagement in research efforts would assist by enhancing the environmental science knowledge base of staff involved in reserve management.

Some fire mitigation works, including firebreak installation and planned burns, have potential to conflict with volunteer efforts. Improving monitoring of environmental values following planned burns will help to continuously improve Shire fire mitigation work on reserves, but also inform better advice from the Fire and Environmental staff to landowners managing the much larger sum of natural areas.

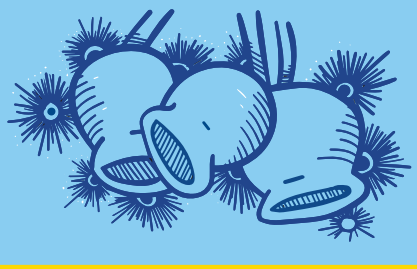
Where there is potential for conflicting advice to be provided on biodiversity conservation efforts and bushfire safety requirements, it is important that a coordinated approach with consistent advice is developed and delivered to residents.

Given that management for bushfire risk is likely to be the primary driver for management of local natural areas across all land managers, integrating biodiversity conservation with fire mitigation is one of the most significant directions of this Local Biodiversity Strategy. However, this requires intensive, ongoing environmental staff involvement with the planning and implementation of fire mitigation works and advice to residents both generally and on a property by property basis. To achieve this there are options to locate additional environmental staff in different service areas (Parks; Planning & Environment; Emergency Management).

These would be developed in more detail in the forthcoming business case but it is anticipated that the most effective arrangement may be a fire ecologist or environmental fire officer, embedded within the Emergency Management team, to help shape both Shire fire mitigation actions within reserves and broader community practices on private land. The opportunity for Indigenous Ranger or Fire Management trainees should also be explored.

Over time, a reserve rationalisation initiative could identify reserves with low social and ecological values that may be more suited to alternative uses. In most cases the reserves are Crown land and the sale or lease of land by the State does not generate any income for the Shire. However, a reduction in the total number of reserves would enable the Shire's staff and resources to be focussed on more significant areas for greater community benefit.

# Rising to the Challenge



## Support Conservation on Private Land

Private landowners manage far more land and natural areas in total than the Shire. The long term viability of conservation reserves also depends on the retention and management of natural areas on the land around them.

While revegetated areas can eventually develop into important habitat, retaining existing natural areas it is far more effective and will conserve a wider range of species. Protections for local natural areas were embedded into the Local Planning Strategy and Local Planning Scheme No. 4 based on the Local Biodiversity Strategy 2009, and will continue under the new Strategy.

Protection through the planning framework can prevent inappropriate clearing, but usually cannot mandate active care or mandate ongoing management to tackle threatening processes.

Support for landowners to undertake active management and enhance biodiversity can include general information, tailored advice, and opportunities to participate in local or regional projects.

Some direct assistance may be available for certain initiatives (particularly where grant funding has been obtained) for landowners who are custodians of important habitat and watercourses. In many cases the first step will be improving the information available to landholders. This can be supported by semi-automated reports about the potential environmental values, but mapping is a tool that needs to be complemented by site visits to more accurately understand and communicate biodiversity values.

The Shire's innovative Environmental Asset Inspections service was developed to help landowners achieve more balanced bushfire and environmental outcomes through early intervention, often meeting landowners and bushfire consultants on site before plans have been drawn up. The initiative was recognised in 2018-2019 at a State and National level as best practice. Importantly, the service was only possible through reallocation of Environmental Officer time earlier into the development process and a partial offset of costs through a minor fee for the service.

The Environmental Asset Inspections have generally only been suggested to landowners seeking to build or subdivide on land containing mapped Local Natural Areas (LNA). Environmental Officer time is limited and effort has been prioritised towards landowners who are actively pursuing development, where there is a risk of environmental damage. However, the service is valued and positive feedback has received such as:

*A) I am more than happy to provide feedback on the EAI service and advise which the Shire has provided to date.*

*As never having undertaken this type of project before I have been very grateful for the Shire's willingness to explain and advise regarding the different aspects and processes. In addition the cooperation with the site visit with all parties was exceptionally beneficial to all. For your information the planning consultant and the bushfire planning consultant both commented on how well it was articulated. Many thanks.*

# Rising to the Challenge

Shire Staff can map and mark habitat trees for retention during site visits

*B) ...The inspection was a very positive experience, with our own knowledge being much expanded by the detailed (and impressive) knowledge that you brought to bear on our piece of land.*

*We were also very struck by the speed with which you grasped the details of the block layout, potential plans for the site and the issues involved. We have recommended the process to others in our area. It was also very heartening to find how well our values and those of the Shire aligned, the preservation of the unique features of local natural wildlife and the enhancement of local fire safety measures.*

A modified version of the Environmental Asset Inspection service should be developed which provides landowners with a basic map of natural features, to support conservation initiatives rather than development. The map and planned revegetation or other works would also need to have regard to fire safety and careful fuel load management.

This service can also link landowners to other support including the ReWild initiative from Perth NRM and the Department of Biodiversity, Conservation and Attractions 'Land for Wildlife' program.

It should be noted that the Land for Wildlife program has an online presence and maintains advisory material, but does not currently have adequate staff and resources to provide for site visits, advice or assistance to residents.

The Shire can advocate for increased funding to improve this important conservation initiative. In addition the Shire can seek to develop or adapt local 'Land for Wildlife' material to encourage residents to undertake active management to maintain biodiversity.

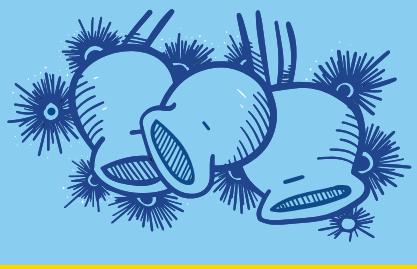
New resources may become available through national or state initiatives to sequester carbon through revegetation. While it is possible that initiatives on local government managed land may be eligible for support, the greatest opportunity is likely to be for larger landholders - particularly in agricultural zones (including areas affected by salinity).

The Shire can play a key role in collating and sharing accurate information about biodiversity certificates and carbon credit programs with potential participants.

While conservation efforts on larger landholdings can have greater impact on biodiversity at the landscape scale, every resident has some opportunity to support biodiversity conservation.

Landscaping features and gardens of all sizes within the urban landscape also have an important role to play in the sustainability of biodiversity. Native gardens and verges can contribute important food sources, water and shelter for pollinators and wildlife, and can increase the viability of nearby local natural areas through reduced weed invasion.

# Rising to the Challenge



## Strengthen Wildlife Corridor Network

Watercourses are important environmental features, linked strongly to the community's sense of place and wellbeing. They have multiple functions including important recreational areas, historical, spiritual and cultural values, and supporting native flora and fauna populations.

The Shire's original Wildlife Corridor Strategy approach in 2000 adapted State Government watercourse mapping, to designate all watercourses within the Shire as wildlife corridors.

Using watercourses as wildlife corridors has merit due to importance of water availability and riparian habitat for many species, and the increased protection of vegetation along watercourses through the planning system.

However, designation of all watercourses as wildlife corridors meant that highly modified drainage systems in urban areas were also included, and no terrestrial corridors were identified through native vegetation separate to watercourses.

In 2004 the Perth Biodiversity Project (hosted by the Western Australian Local Government Association) mapped Regional Ecological Linkages across the Perth Metropolitan Region.

These Regional Ecological Linkages are 500m wide and aim to connect regionally significant natural areas, such as national and regional parks, including local nature reserves and other remnant vegetation as stepping stones. The aim was to maintain the ecological viability of those regionally significant natural areas by maintaining landscape level connections between them, allowing for the continued movement of wildlife, which also allows for pollination and seed dispersal to maintain plant biodiversity.

The process used to identify the Regional Ecological Linkages deliberately targeted connections following more secure areas of native vegetation, including reserves. Location within a Regional Ecological Linkage informed the prioritisation of Local Natural Areas for protection in the Shire's 2009 Local Biodiversity Strategy, which was then given effect through the update of the Local Planning Strategy and gazettal of Local Planning Scheme No. 4 in 2014.

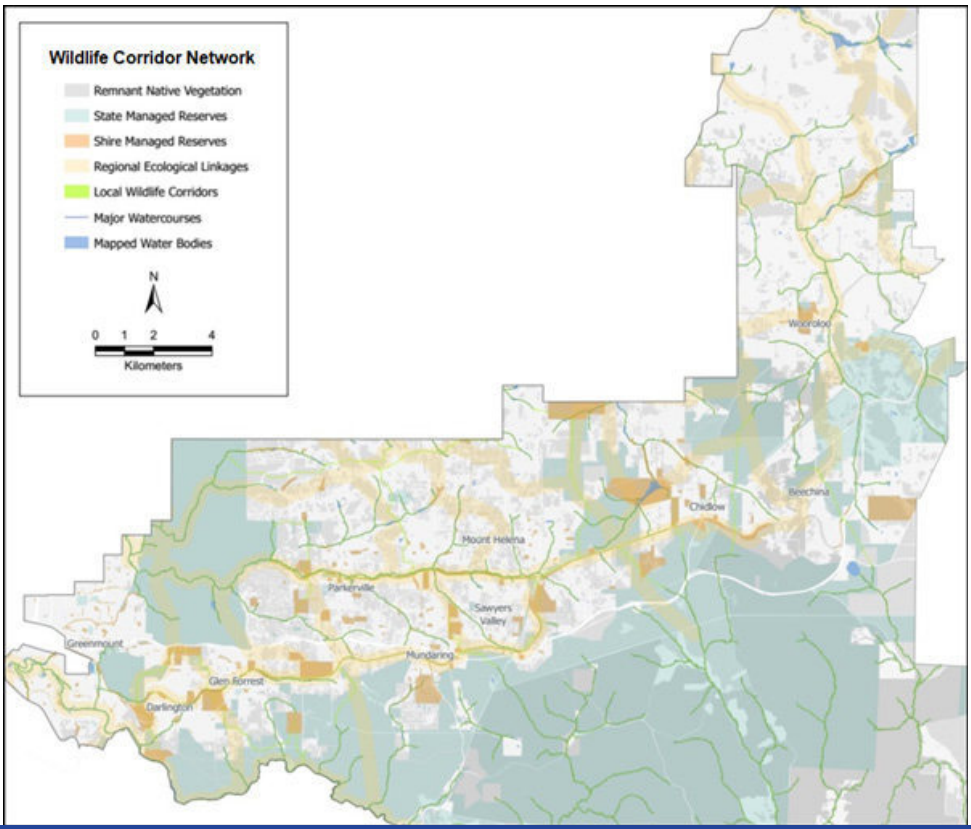
In 2021, staff of the Western Australian Local Government Association advised that the Regional Ecological Linkages had been reviewed, were still considered current, and not proposed to be updated. Subsequent review by Shire staff has confirmed that these Linkages are well located and still valid, and should be considered as wildlife corridors under the revised Local Biodiversity Strategy. However there was a need for additional, local level wildlife corridors to form a 'web' of finer scale connections between the Shire's significant local reserves and regionally significant natural areas.

In 2021 consultants were engaged by the Shire to review available spatial datasets and methodologies and produce updated local wildlife corridor mapping. A hybrid model was devised, which included the higher order watercourses produced during development of the Watercourse Hierarchy Strategy as well as connections between high priority local nature reserves and regional ecological linkages. The Watercourse Hierarchy Strategy has been prepared concurrently by the Shire with a focus on identifying stormwater management and development standards based on watercourse characteristics. The wildlife corridor mapping and more information about the process are included in Appendix 3.

It must be emphasised that there are important habitats and areas of wildlife movement that are outside of the Regional Ecological Linkages and mapped local wildlife corridors. Any remaining natural area within the Shire will be, in some way, part of a wildlife movement network. An aim of both the Linkages and local corridors is to prioritise effort and resource allocation to specific areas that have greater potential to influence the viability of surrounding natural areas and maintain landscape connections and biodiversity long term.

The term 'wildlife corridor network' within this strategy refers to the network of Regional Ecological Linkages and local wildlife corridors. Strengthening the wildlife corridor network will include:

- Developing new initiatives to manage introduced pests and increase habitat values within or adjacent to mapped corridors;
- Where appropriate, targeting acquisition of public open space and new conservation reserves to support wildlife corridors; and
- Promoting Land for Wildlife initiatives and prioritising environmental advice to landowners who are custodians of sections of wildlife corridors.




Overview of Corridor Network: Local Wildlife Corridors with Regional Ecological Linkages

It is important to note that there are many multi-use corridors within the wildlife corridor network, which can include footpaths, cycle ways, and bridle trails. Identification of a wildlife corridor does not prevent continued diverse uses but will require more careful management and planning of infrastructure upgrades.

# Rising to the Challenge

## Improving Animal Management

Introduced animals have a range of impacts on native species and natural areas. This includes predation and injury caused by household pets; land degradation and loss of habitat due to horses and livestock; and predation and habitat disruption by feral animals.

Planning controls on keeping of horses and livestock help preserve local natural areas and avoid land degradation. These are already established within the Shire's Local Planning Scheme No. 4 and Shire Guidelines for Keeping of Stock are regularly reviewed to reflect current stocking rates and other recommendations from the Department of Primary Industries and Regional Development. The Shire should continue to draw upon expert agricultural science to inform stocking rates.

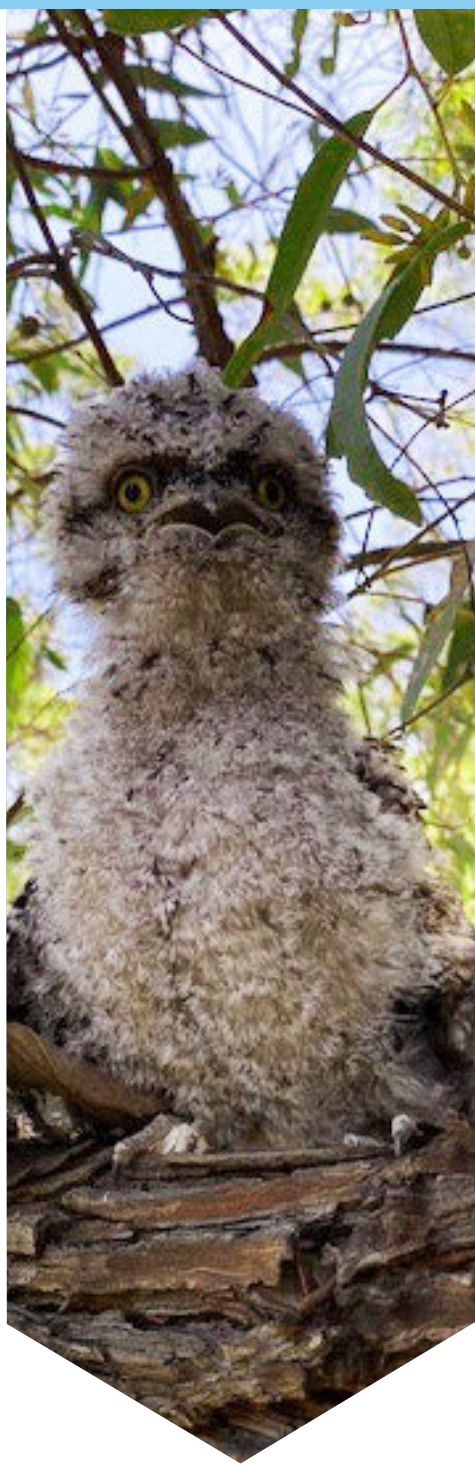
Domestic pets including cats and dogs can have significant impacts on wildlife on or near their owner's property. The keeping of cats and dogs is governed by State legislation that provides for local governments to make corresponding local laws.

While dogs can be required to be contained on the owner's property with adequate fencing, currently the State legislation does not allow for a local law to require the same of cats. Advocacy for an amendment to the *Cat Act 2011* is recommended to allow for better containment of pet cats to reduce their impacts on native animals.

Feral animals including cats, pigs and foxes can range across State, Shire, and privately owned land. Pest birds including rainbow lorikeets, corella species and pink and grey galahs can compete aggressively for resources and nesting hollows, threatening the breeding success of local native species. Advocacy is recommended for greater effort and coordination of feral animal control within the very large areas of State managed land within the Shire, including National Parks and water catchment areas.

The Shire's Community Safety rangers assist residents with the trapping and removal of feral cats. There is currently no equivalent program for foxes or other feral animals. A previous initiative to loan large cage traps to residents was ended due to the extremely low fox

# Rising to the Challenge



Trapping of foxes on reserves carries risks of harm to other animals, particularly where surrounding pets are not adequately contained, or warning signs to keep dogs on leashes are ignored. Trapping of foxes on private land reduces the risk of capturing dogs, but is expensive for individual landowners to engage contractors if they are not prepared to handle the trapping and euthanasia themselves. Further investigation of options, partnerships and other support for feral animal control is required.

Smaller feral animals including rabbits and rodents can directly compete with native animals for resources. Chemical baits and rodenticides used to target pest species can be eaten by other animals, including wildlife. For rabbits there is an alternative available which is a rabbit-specific virus, which has been released nationally since 2017 to aid in rabbit control. Residents are able to undertake online training through the Department of Primary Industries and Regional Development on how to conduct their own virus release where rabbit numbers are high.

For rodents there are a range of traps available, as well as different kinds of bait that will reduce the risks of secondary poisoning.

While there are also risks to other animals including reptiles and other birds of prey, declaring the Shire of Mundaring as an 'Owl Friendly' area would build on an established secondary poisoning awareness raising initiative that has been successful elsewhere in Western Australia.

Improving animal management will include:

- Promoting responsible pet ownership and livestock management
- Advocating for effective control of feral animals within State Government lands
- Controlling feral animals within Shire managed reserves;
- Seeking or providing feral animal control assistance for residents;
- Raising community awareness of the risks of baits and of secondary poisoning to promote safer use.

Declaring the Shire to be 'Owl Friendly' provides an opportunity to quickly draw attention to the issue of secondary poisoning from rodenticides and encourage residents to immediately change pest management practices, as review of the issue by the federal regulator (Australian Pesticides and Veterinary Medicines Authority) will take time.

# Rising to the Challenge

## Provide Water for Wildlife

Climate change has already reduced the amount of rainfall received within the Shire, as well as altered annual patterns and increased the likelihood of weather extremes. Because the soil is dryer and evaporation is higher, the reduction in streamflow is larger than the reduction in rainfall.

Maintaining water for wildlife will include:

- Leading by example through installing more watering stations within Shire managed reserves;
- Encouraging more residents and schools to add water into gardens, including bird baths and ground level water dishes;
- Rehabilitation of priority watercourses within Shire managed reserves; and
- Revising guidelines for dams to recognise that retaining water in the landscape can provide critical habitat in a drying climate, and recommend practical improvements to dams to improve habitat values and water retention.

Increasing the availability of water in the landscape will make a significant difference to the survival of wildlife in drought and heatwaves.

## Support Artificial Habitats

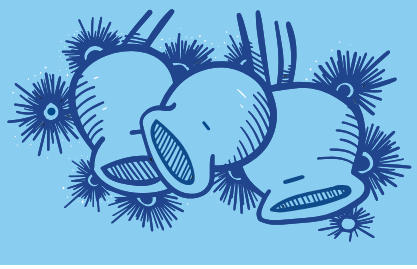
The survival of some species may be supported by the provision of artificial nest boxes and other habitat features. While they should never be seen as a full substitute for the original habitat tree or natural area, they are still an important way for residents to support 'backyard biodiversity'.

Supporting artificial habitats will include:

- Making information on native animals and their habitat requirements easier to access;
- Encouraging and supporting residents to install nest boxes and other helpful habitat structures in locations that can support a range of species;
- Installing and monitoring more nest boxes within Shire managed reserves; and
- Mapping and temporarily marking trees with nest boxes for additional precautions before planned burns.

In many cases more research will be needed to determine what the most appropriate structures or features to support particular species.

# Rising to the Challenge



## Knowledge and Research

Given the landscape scale issues faced by the Shire, broad scale monitoring using remote data must form part of the approach moving forward. The Shire recently acquired detailed LiDAR mapping, used to create a digital elevation model (DEM) to inform stream network mapping. This data, combined with other sources, has other potential uses, from detailed slope analysis for fire mitigation planning, to improved vegetation mapping. The full benefit of this data is yet to be realised due to resourcing issues.

There is uncertainty whether the State Government will improve the collection and sharing of remotely collected data, which could reduce costs, duplication of effort and inconsistent collection between local governments.

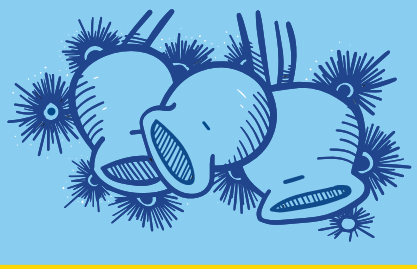
Greater investment in the Shire's mapping capabilities, in a manner that improves land management practices is an opportunity requiring further resources and time.

There are opportunities to significantly improve local mapping of environmental assets and issues and better share information between Shire staff, residents and volunteers. The need for a system that provides for a two-way flow of information has been noted during consultation with catchment groups.

As noted elsewhere in this Strategy, there are many knowledge gaps in terms of how native species currently interact in their ecosystems as well as how this may alter due to climate change. The Shire will rarely be the best candidate to lead a research project but can be a collaborator, contributor and distributor of useful findings.

Opportunities for Shire staff, residents and environmental volunteers to participate in citizen science projects can yield significant new data and observations. Partnerships with research institutions, not-for-profit organisations and other land managers should be considered where they can lead to improved land management and biodiversity

# Rising to the Challenge



## Limit Disease and Dieback Spread

Phytophthora Dieback is a deadly introduced plant disease that is a major threat to local native plants and animals. It is a tiny water mould that attacks the roots of plants and causes them to rot. It lives in soil and infected plant tissue, and over 40% of WA native plant species can be killed or badly weakened by the Phytophthora cinnamomi (and to some extent, other introduced Phytophthora species).

The movement of infected soil, plant material or water containing dieback spores can spread Dieback into new areas and cause trees and bushland to die off. Native animals can then be affected if they are reliant on susceptible plant species for their food sources and habitat.

Unfortunately Phytophthora Dieback is already found in many areas of the Shire including road verges, bushland and gardens. A mapping project that took samples from conservation reserves for laboratory testing has confirmed that many of our reserves are partly infested and the disease will continue to slowly spread downhill with water movement.

Uninfested areas that are still protectable from Phytophthora Dieback are therefore a conservation priority. In areas free of Dieback, the vulnerable plant species can continue to thrive, providing opportunities for seed collection and providing habitat for native fauna.

Limiting dieback spread will include:

- Developing training and induction materials for Shire staff;
- Improving supervision of contractors working on Shire reserves or road reserves
- Planning works to minimise risk including machinery clean down areas, and working in dieback free areas first;

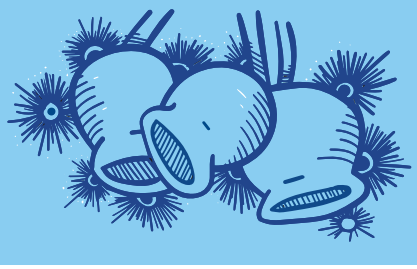
- Maintaining Dieback status guide posts in reserves to indicating Dieback Free and Dieback Infested Areas; and
- Improving information available about Dieback and practical measures to avoid introducing or spreading it.

Hygiene measures for Dieback will also help to minimise spread of other soil based diseases. Emerging threats such as myrtle rust fungus (Austropuccinia psidii) may be more difficult to control if it reaches the south-west of Western Australia. In each case, maintaining forest health may include revegetating affected areas with more resistant plants.

This will usually mean using seed from naturally resistant individual plants, but further research will be required to inform these approaches. There is more information about Dieback in Appendix 6.

Dieback Panorama Alps Street Reserve Terratree 2020

# Rising to the Challenge



## Integrating Conservation with Bushfire Mitigation

Protecting life and property is paramount within State and Local Government bushfire mitigation plans but protecting the natural environment is also a consideration. Intense landscape-scale wildfires are devastating to wildlife as well as humans. Bushfire preparedness is therefore critical to sustain the Shire's biodiversity as well as protect residents and communities.

The Shire fulfils three key functions in relation to bushfire preparedness, which provide three opportunities to demonstrate or advocate for integrating biodiversity conservation with fire mitigation:

- Statutory and Advisory Roles (for private land, including local implementation of *Planning and Development Act 2005, Bushfires Act 1954*, and *Emergency Management Act 2005* and hazard plans such as State Hazard Plan - Fire)
- Land Manager (for Shire owned land and Shire managed reserves, as per Bushfire Risk Management Plan)
- Advocate (for State owned land and State managed reserves, as per Bushfire Risk Management Plan).

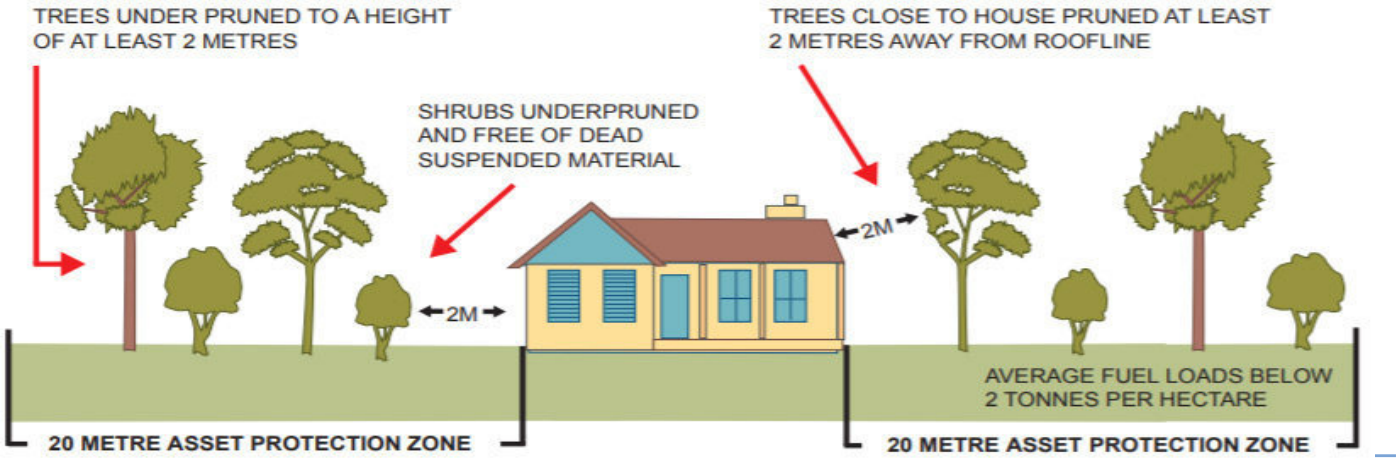
**Statutory and Advisory Roles**

The Shire oversees consideration of approximately 500 planning applications and makes recommendations on approximately 50 subdivision applications per year. Local Planning Scheme No. 4 provides for consideration of both environmental protection and bushfire safety in decisions for development in bushfire prone areas.

The Shire also advises residents on bushfire safety and enforces requirements for preparation in accordance with the annual Firebreak and Fuel Loads Notice.

Both Planning and Emergency Management staff follow advice from DFES, including the Planning for Bushfire Protection Guidelines. This provides for more intensive fuel load management in the area immediately surrounding a house or habitable building (at least 20m, but can be further depending on slope).

The Shire's Firebreak and Fuel Load Notice emphasises the importance of managing ground and mid-storey 'ladder' fuels. Ideally, application fuel reduction standards would be simple and consistent across development proposals through the planning system and the Shire's annual FFL Notice.



# Rising to the Challenge

State government support for local government-wide variation or standards differs across agencies. Given the gravity of risks, solid evidence based research is required for the Shire to confidently recalibrate the 'bar' within the planning system to better align with the Perth hills vegetation types and community expectations.

The FFL notice already enables a degree of autonomy in setting standards. Since this matter was highlighted by the Shire, it is noted the Bushfire Centre of Excellence has been created, with the aim to improve the collective understanding of fire management in the Western Australian vegetation complexes, geology and conditions. Extension of policy approaches developed in other states with other types of vegetation has been a critical barrier to informing a more nuanced approach to bushfire planning policy in WA.

As the State planning bushfire framework continues to evolve and be reviewed, the Shire will continue to actively participate and advocate for requirements that align with local vegetation types, geography and compliance regimes.

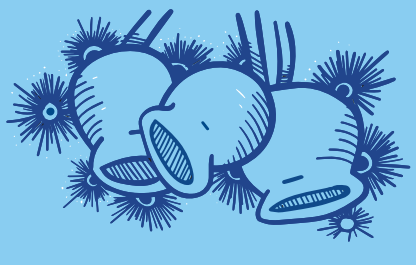
**Land Manager & Advocate - BRMP**

The State's introduction of the Bushfire Risk Management Framework and Mitigation Activity Fund has increased the Shire's capacity to manage fuel reduction and other mitigation activities. It has also heightened understanding of risks across all tenures.

The Shire's Bushfire Risk Management Plan (BRMP) has been approved by the Office of Bushfire Risk Management and adopted by Council. It sets out a five year plan of firebreak improvements and fuel reduction works to protect critical infrastructure, particularly urban settlements, infrastructure and sensitive land uses.

Significantly, the total expenditure on Shire reserves from the Mitigation Activity Fund for last 3 years has reached $1,778,270. A large portion (estimated at $687,857) has been directed to fuel reduction via weed control over the last three years. This represents 38% of the total MAFS expenditure, and weed control will continue to be a significant element of fuel load reduction and fire mitigation works each year. The application of MAFS funding to weed control and other work that offers co-benefits for bushfire preparedness but also biodiversity conservation should continue.

# Rising to the Challenge



**Advocacy using BRMP**

The Shire also has an obligation to advise other landowners and managers, including State agencies, of their obligations under the endorsed BRMP. As has been noted, the largest land managers within the Shire are State agencies. These  often have different budgets and targets for annual fuel reduction, risk appetites and awareness of local issues.

The BRMP, as a State endorsed mechanism, enables the Shire to be in a strong position to advocate for particular outcomes and careful mitigation work with State agencies. Continued communication, collaboration and learning across stakeholders is critical to both bushfire preparedness and biodiversity outcomes. There are opportunities to draw together information from a range of sources to continue to improve land management for both.

Two-way science refers to the process of sharing and integrating Aboriginal traditional ecological knowledge with current scientific research. Some elements of traditional fire management have already been adopted by Shire staff undertaking bushfire risk mitigation work within reserves.

These include mosaic burning, cool burns, and removing the fuel around important trees before burning. Further guidance is expected to be developed by the Bushfire Centre of Excellence.

The South West Native Title Settlement process will result in the transfer of significant areas of land into the care of the Noongar Boodja Trust. This may provide more opportunities to share knowledge between Shire staff, bushfire researchers, and Noongar Corporations that are established to manage different lands.

Over the last decade there has been a significant increase in research and scientific understanding of bushfire behaviour and effectiveness of mitigation measures. However, there are still many questions that require further investigation, particularly in Western Australian forests and taking into account accelerating climate change.

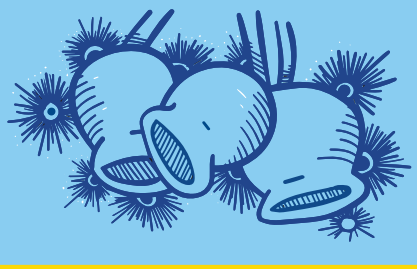
The Shire engaged consultants in 2021 to prepare a summary of ecological fire management based on current scientific understanding and used the Glen Forrest Superblock as a case study. This is summarised in Appendix 5.

Using two-way science to inform bushfire mitigation will include:

- Seeking to learn from both past Aboriginal burning practices and current research to continuously improve the Shire practices;
- Facilitating knowledge sharing between bushfire researchers, practitioners, residents, and traditional owners; and
- Directing efforts toward bushfire mitigation actions that will have the greatest bushfire safety benefits for the community with the least environmental impact.

The landscape has changed through settlement, logging, weed invasion and now climate change, but there are still important elements from traditional fire management that will align closely with the science and should be used to inform fire mitigation in a custodianship approach.

# Rising to the Challenge



## Shire's Role Moving Forward

The previous biodiversity strategy achieved significant improvements to the Shire's planning and environmental regulatory framework, particularly vegetation protection provisions on private land. Given the extent of natural areas remaining on private land, continuation of this approach to planning and development will continue to be a priority.

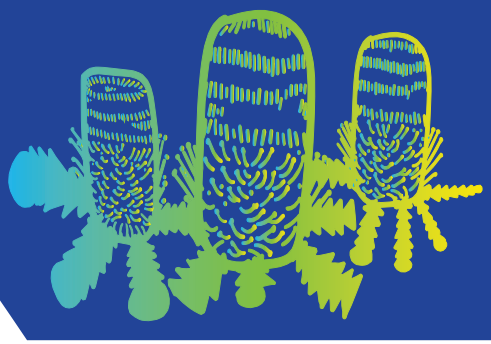
However, a regulatory approach can only go so far and is framed to prevent the worst of environmental outcomes. Regulation and rule setting to prevent clearing does not empower landowners to actively manage for biodiversity conservation or automatically develop a deeper sense of custodianship.

A suite of other initiatives are required, including careful integration with fire mitigation.

The Shire's capacity to undertake, intervene or guide natural area management varies depending on the ownership or land tenure. The Shire needs to advocate, collate information and help induce commitment and appropriate action from various landowners and stakeholders.

Harnessing significant insights and observations from volunteers and residents will be critical to improving knowledge and future management. Improving biodiversity outcomes across this landscape therefore requires sustained and simultaneous investment across the Shire's various roles and responsibilities.

# Actions to Protect our Biodiversity



The approaches and principles outlined above have been addressed across different land tenures, where the Shire has different opportunities to promote biodiversity conservation. Nature reserves that the Shire manages directly are important, but they will not be viable long term if they are not connected to a surrounding network of natural areas on State Government and private land.

Objectives and achievable actions have been identified to support private landowners in responsible custodianship of natural areas (including verges), improve Shire management of nature reserves, and advocate for effective biodiversity conservation measures on State Government lands. These are listed in tables below with the timeframe indicated as:

Short: 2023 - 2025 | Medium: 2025 - 2027 | Long: 2027 - 2030

Actions listed as 'Ongoing' represent a continuation of a current service level. Actions listed with a 'Short' timeframe are logical extensions to the current service level, or high priority actions relating to strategic needs (such as integrating conservation and fire mitigation). Highest priority actions which will increase staff for environmental management are marked *.

This Strategy should be subject to a major review in 2030, with a midway update to mapping and review of listed actions planned for 2026/2027.

## Table 1 Actions relating to Shire managed nature reserves

**Managing Nature Reserves**
Objective: Improve management of nature reserves to address threatening processes and maintain habitat values.

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 1.1 | Continue to target priority weed species following the 'Bradley Method' of bush regeneration, along with opportunistic weed control. | Ongoing | Parks |
| 1.2 | Maintain Landcare Team support, access to native seedlings, training and networking opportunities for Friends Groups. | Ongoing | Parks |
| 1.3 | Continue annual surveys and requests for annual work plans from Friends Groups, to help identify potential grant applications and avoid conflict with Shire works. | Ongoing | Parks |

# Actions to Protect our Biodiversity

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 1.4 | Provide guidance and practical support for Friends Groups and Catchment Groups applying for grant funding for environmental restoration works, with effort prioritised based on conservation values and likely outcomes. | Ongoing | Parks |
| 1.5 | Continue to recommend protection of environmental features and watercourse restoration as conditions of subdivision and development, and where necessary require a maintenance period in addition for land to be ceded as Public Open Space/ Drainage. | Ongoing | Planning & Environment |
| 1.6 | Continue to enhance bushfire risk mitigation approaches and activities, including strategic burning that provides for a range of habitat / fuel ages within conservation reserves. | Ongoing | Emergency Management |
| 1.7 | Advocate for state bushfire mitigation funding to be allocated based on risk, and specifically permitted to be used on weed control, which reduces ongoing fuel loads as well as supporting biodiversity outcomes. | Short | Emergency Management |
| 1.8 | Develop a template and begin preparing Fire and Environmental Work Plans with input from adjoining residents and the relevant Friends Group to map significant environmental features, better coordinate pre-fire preparation and post-fire weed control, and reduce potential for conflict between landcare / revegetation efforts and bushfire mitigation activities. | Short | Emergency Management; Parks |
| 1.9 | Develop a process to review work plans prepared by Friends Groups for annual revegetation using Seedlings for Landcare program, and proposed grant applications, to ensure they will not conflict with planned parks or bushfire mitigation works (or Fire and Environmental Work Plans, where prepared). | Short | Parks; Emergency Management |
| 1.10 | Review practices for managing contractors and supporting environmental volunteers working on reserves to address implications of the *Work Health and Safety Act 2020.* | Short | Parks |
| 1.11 | Review opportunities for regional programs with Perth NRM and other Local Governments, such as Eastern Region Catchment Management Program. [Business Case may be required.] | Short | Parks; Planning & Environment |
| 1.12 | Improve Shire mapping of reserves and investigate options to provide or improve community reporting tools for invasive weed infestations, feral animals, erosion and other issues of concern in a way that supports a two-way flow of information. | Short | Planning & Environment; Parks |

# Actions to Protect our Biodiversity

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 1.13 | Identify biodiverse reference sites within reserves that can be visited by Friends Groups and residents to help plan rehabilitation of similar areas. | Short | Planning & Environment; Parks |
| 1.14 | Trial Friends Group Reserve signage to signify a Friends Group reserve and promote volunteerism. | Short | Parks |
| 1.15 | Hold novel events and undertake low risk trial activities to explore new ways to attract environmental volunteers, with outcomes to inform the Shire's environmental volunteer engagement model and an update of the Friends Group Manual. | Short | Parks |
| 1.16 | Revise priority weeds list based on changes to state and national pest plant listings and observations of volunteers and shire staff working on reserves. | Short | Parks; Emergency Management |
| 1.17 | Develop a business case for recurring dieback treatment and mapping to maintain ecological values in priority reserves. | Short | Parks; Planning & Environment |
| 1.18 | Engage consultants to develop a comprehensive Lake Leschenaultia Management Plan to protect and enhance the Lake's environmental values whilst allowing for a range of nature-based recreational activities. | Short | Recreation & Leisure; Planning & Environment |
| 1.19 | Develop a low cost annual program to monitor surface water quality within Jane Brook, Susannah Brook, Wooroloo Brook, Woodbridge Creek and the Helena River in consultation with Catchment Groups and relevant State Government agencies. | Short | Parks |
| 1.20 | Develop nature play areas, interpretive signage and activities to enhance the environmental education opportunities at Lake Leschenaultia. | Short | Recreation & Leisure; Planning & Environment |
| 1.21 * | Develop a business case to provide additional resources (which may include a fire ecologist or similar) to map and monitor condition of nature reserves, develop and implement plans for priority reserves, and coordinate weed control efforts and conservation activities with bushfire mitigation actions. | Short | Planning & Environment; Parks; Emergency Management |
| 1.22 * | Increase on-ground resources for Shire management of natural areas and support for environmental volunteers. [Business case required.] | Short | Parks |
| 1.23 | Outline the Shire's intent within the Public Open Space (POS) Strategy to use POS developer contributions to enhance social and ecological functions, including upgrading or establishing multi-purpose access trails, installing nature play areas and sculptural water stations within reserves. | Medium | Planning & Environment |
| 1.24 | Seek funding to install wildlife watering stations in locations that also will provide environmental education and bird watching opportunities. | Medium | Parks |

# Actions to Protect our Biodiversity

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 1.25 | Develop or adapt a citizen science program to map orchids within nature reserves to inform Shire management actions and Friends Group activities. | Medium | Parks; Planning & Environment |
| 1.26 | Develop or update Reserve Management Plans for the ten highest priority conservation reserves with areas considered protectable from dieback long term – including:<br><br>Lake Leschenaultia, Chidlow (Res. 23165)<br>Alps Street Reserve, Mount Helena (Res. 34103)<br>Strettle Road Reserve (Res. 32727)<br>Pindalup Reserve, Wooroloo (Res. 39853)<br>Superblock Reserve, Glen Forrest (Res. 50018)<br>North Darlington Reserves, incl. Nan Macmillan (Res. 6922)<br>Black Cockatoo Reserves, Mundaring (Res. 20990 & 12422)<br>Falls Road Reserve, Hovea (Res. 12453)<br>Hovea Conservation Park, Hovea/Parkerville (Res. 14163)<br>Callan Road Reserve, Hovea (Res. 38224) | Medium/ Long | Parks; Emergency Management |
| 1.27 | Trial use of QR codes on signage at selected reserves to connect Friends Group members, residents and visitors to online information about the site (such as natural features, recreational opportunities, park infrastructure, dieback hygiene, and potential hazards). | Medium | Parks; Recreation & Leisure |
| 1.28 | Improve signage in natural areas within reserves, particularly Lake Leschenaultia and the Railway Reserves Heritage Trail. | Medium | Parks; Recreation & Leisure |
| 1.29 | To better direct management effort and resources towards areas of greater conservation value, review reserves under 0.5 hectares and identify land with low ecological and recreational values, to consider for rezoning or alternate land uses (subject to community consultation). | Medium | Parks; Planning & Environment |
| 1.30 | Monitor opportunities for research, partnerships and funding for climate adaptation planting initiatives based on projected mid-century climatic conditions, including targeted seed collection. | Medium/ Long | Planning & Environment; Parks |
| 1.31 | Develop proposals for alternate land uses for reserves identified as having low ecological and recreational values, enabling resources to be redirected towards remaining reserves. | Long | Planning & Environment |
| 1.32 | Explore potential for a portion of Quail Street Reserve to be incorporated into the Karakamia Wildlife Sanctuary, managed by the Australian Wildlife Conservancy with feral predator exclusion fencing. | Long | Parks; Emergency Management |
| 1.33 | Review resources required for effective ongoing management of conservation reserves following reserve rationalisation, ceding of new public open space through subdivision, and changes to environmental volunteering and grant programs. | Long | Parks; Emergency Management |

## Table 2 Actions relating to private land and custodianship

**Custodianship of Natural Assets**
Objective: Protect natural areas and encourage their responsible use and enjoyment; provide a range of opportunities to learn about nature; and foster a culture of conservation and custodianship.

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 2.1 | Improve mapping and delineation of watercourses and Local Natural Areas within the local planning framework, including updating of maps as better information becomes available. | Ongoing | Planning & Environment |
| 2.2 | Maintain Environmental Asset Inspection Service and Environmental Officer capacity to advise on development proposals to retain and enhance natural features where possible. | Ongoing | Planning & Environment |
| 2.3 | Maintain Seedlings for Landcare Program which supports rehabilitation efforts on rural zoned land and schools, as well as volunteers working on Shire managed reserves. | Ongoing | Parks |
| 2.4 | Continually review bushfire mitigation advice services for residents including workshops on how to plan mosaic burning, conduct cool burns to minimise environmental damage, and manage weeds pre and post burn. | Ongoing | Emergency Management |
| 2.5 | Maintain and regularly update print materials including brochures, information sheets and free booklets that help residents understand and care for the natural environment. | Ongoing | Planning & Environment |
| 2.6 | Maintain environmental education initiatives including Six Seasons newsletter, talks and workshops, development of video and online content, and Environmental Art Project. | Ongoing | Planning & Environment |
| 2.7 | Increase capacity of Environmental Service to provide site visits and advice to residents about managing their local natural areas, restoration of watercourses and wildlife corridors, weed control, nest boxes and other habitat enhancement options. | Short | Planning & Environment |
| 2.8 | Maintain protection of local natural areas and seek opportunities for further integration of this Local Biodiversity Strategy and the Watercourse Hierarchy Strategy into the Local Planning Scheme and Local Planning Strategy when these documents are reviewed. | Short | Planning & Environment |

# Actions to Protect our Biodiversity

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 2.9 | Advocacy to the State and Commonwealth Governments for stronger environmental protection legislation and more funding for science-based environmental restoration programs. | Short | Planning & Environment |
| 2.10 | Ensure linkages identified within the wildlife corridor network are considered and protected where possible through land use planning and other mechanisms. | Short | Planning & Environment; Parks |
| 2.11 | Advocate for improved funding and capability for the Land for Wildlife program hosted by Department of Biodiversity, Conservation and Attractions. | Short | Planning & Environment |
| 2.12 | Develop a local Land for Wildlife service to provide environmental site visits and advice, promote directly to residents who are custodians of mapped wildlife corridors, and prioritise requests based on conservation values and opportunities. | Short | Planning & Environment |
| 2.13 | Develop new resources (including web content, brochures and free booklets) and conservation action kits for local native animals – available to all residents but promoted directly to residents who are custodians of mapped wildlife corridors. | Short | Planning & Environment |
| 2.14 | Source or develop web content and supporting citizen science materials to encourage residents and volunteers to record species sightings through national citizen science platforms including iNaturalist, FrogID, Birdata and the Atlas of Living Australia. | Short | Planning & Environment |
| 2.15 | Seek partnerships and funding for citizen science initiatives to improve knowledge of native animals, plants and fungi. | Short | Planning & Environment |
| 2.16 | Declare the Shire of Mundaring to be Owl Friendly and provide promotional and educational material about the harm of secondary poisoning to pets and wildlife from some rodenticides. | Short | Planning & Environment |
| 2.17 | Revise guidelines for dams to promote features that improve habitat values, and recognise that retaining water in the landscape can provide critical habitat in a drying climate. | Short | Planning & Environment |
| 2.18 | Prepare or promote information about the responsible use and storage of chemicals to prevent watercourse and groundwater pollution. | Short | Planning & Environment |
| 2.19 | Continue to promote responsible cat ownership and outdoor cat runs to limit impacts on native animals. | Short | Community Safety |

# Actions to Protect our Biodiversity

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 2.20 | Advocate to the State Government to amend the *Cat Act 2011*, enabling the Shire to amend its Local Law to restrict cats to a property and increase penalties. | Short | Community Safety |
| 2.21 | Investigate options and develop a service or program that supports control of feral animals on private land. | Short | Planning & Environment |
| 2.22 | Seek opportunities to exchange information and collaborate with traditional owners managing conservation lands as part of Noongar Land Estate. | Short | Planning & Environment |
| 2.23 | Invite traditional owners managing lands within the Shire as part of the Noongar Land Estate to nominate for Environmental Advisory Committee membership, and/or nominate their preferred engagement method. | Short | Planning & Environment |
| 2.24 | Collaborate with Department of Biodiversity, Conservation and Attractions, traditional owners, Catchment Groups and other stakeholders to support Helena River restoration works. | Short/ Medium | Parks |
| 2.25 | Consider amendment to Art Collection Policy (OR-09) to include works that celebrate the natural landscape and native species found within the Shire. | Medium | Community Engagement |
| 2.26 | Seek partnerships and funding for murals and public art projects that incorporate local native species and landscapes. | Medium | Community Engagement |
| 2.27 | Seek partnerships and funding to deliver an event/s that supports nature based tourism and celebrates the natural beauty of the Shire, raises awareness of native plants and animals, encourages responsible pet and livestock ownership, and promotes sustainable and self-sufficient lifestyles. | Medium | Recreation & Leisure; Planning & Environment |
| 2.28 | Seek partnerships and funding to deliver a program that helps residents access seeds / seedlings of firewise native plants that are suited to residential gardens and provide important resources for native bees. | Medium | Planning & Environment |
| 2.29 | Seek partnerships and funding to deliver a conference that brings together bushfire and biodiversity researchers and practitioners to inform future natural area management and bushfire mitigation practices. | Medium | Planning & Environment |
| 2.30 | Investigate options to develop or adapt material that supports residents in using principles of traditional burning practices appropriate for our landscape. | Medium | Community Safety |

# Actions to Protect our Biodiversity

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 2.31 | Review the Local Emergency Management Arrangements Recovery sub-plan for environmental bushfire recovery to seek more funding and better support residents dealing with post-bushfire issues including weed growth. | Medium | Planning & Environment; Emergency Management |
| 2.32 | Produce watercourse restoration guidelines based on Watercourse Hierarchy Strategy recommendations and link to species available through the Seedlings for Landcare program. | Medium | Parks; Planning & Environment |
| 2.33 | Seek partnerships and funding to investigate use of Miyawaki forest patches for carbon sequestration, biodiversity refuges and 'stepping stones' enabling wildlife movement in bushfire prone areas. | Medium | Planning & Environment |
| 2.34 | Investigate options for establishing a community based Landcare Centre, modelled on successful organisations such as SERCUL, Landcare SJ, and Chittering Landcare Centre. | Long | Planning & Environment |
| 2.35 | Engage with all local schools to canvas use of environmental education support generally and initiate programs or projects to fill identified gaps. | Long | Planning & Environment; Parks |


Annual Environmental Art Project encourages primary school children to creatively engage with local and global environmental issues

## Table 3 Actions relating to road reserves

**Verges and Roadside Conservation**
Objective: Maintain native vegetation within road reserves where safe and practical, to maintain biodiversity conservation values and local landscape character and amenity.

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 3.1 | Plan and conduct works within road reserves with the aim to minimise impacts on watercourses and native vegetation. | Ongoing | Infrastructure Design |
| 3.2 | Prioritise retention of mature trees and native vegetation in new road reserves in accordance with Street Tree Policy provisions for subdivision. | Ongoing | Planning & Environment |
| 3.3 | Continue to review landowner applications for crossovers and other proposals that include clearing of the verge in accordance with Roadside Conservation Policy. | Ongoing | Infrastructure Design |
| 3.4 | Continue to assess proposed works for telecommunications and utilities in accordance with Roadside Conservation Policy and encourage dieback hygiene measures. | Ongoing | Infrastructure Design |
| 3.5 | Maintain Roadside Vegetation Management team efforts focussed on priority weed species and recognised Flora Roads (e.g. Bailup Road). | Ongoing | Parks |
| 3.6 | Purchase additional Green Spot signs and continue to relocate on an annual basis based on community nominations of fauna movement hotspots. | Ongoing | Planning & Environment; Operations |
| 3.7 | Improve understanding of seasonal animal behaviour and investigate options for verge adjustments or temporary signage in locations where there are significant wildlife movements and/or injuries, such as known turtle crossings. | Short | Parks; Operations |
| 3.8 | Advocate for review of traffic management requirements for roadside weed control, to enable safe work to address priority weeds on verges without excessive traffic management costs. | Short | Parks; Operations |
| 3.9 | Incorporate follow-up weed control, and revegetation where required into planning and budgets for Shire works on roads and roadside infrastructure. | Short | Operations; Emergency Management |
| 3.10 | Improve mapping of priority weed species within road reserves, recording of control efforts and monitoring of results to better plan and refine control measures. | Short | Parks |
| 3.11 | Continue to encourage landowners to improve bush verges adjacent to their property by undertaking weed control, which also reduces fuel loads. | Short | Emergency Management |

# Actions to Protect our Biodiversity

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 3.12 | Preparation and implementation of a Works Environmental Checklist for planning and management of works within bush verges to minimise dieback risk and environmental impacts. | Short | Planning & Environment; Parks; Emergency Management |
| 3.13 | Undertake stormwater intervention review and implement recommendations from the adopted Watercourse Hierarchy Strategy relating to drainage and stormwater management within road reserves. | Short | Infrastructure Design; Operations |
| 3.14 | Improve protection of native vegetation through reviews of relevant local laws. | Short | Governance |
| 3.15 | Develop dieback awareness training and induction material for Shire staff working within road reserves. | Short | Planning & Environment; Operations |
| 3.16 | Investigate naming of roads to include local native plants and animals, including traditional Noongar names (following consultation). | Medium | Planning & Environment |
| 3.17 | Review Street Trees Policy and Street Tree Guidelines, updating species list to remove trees that will be more susceptible to projected climate by 2050. | Medium | Planning & Environment; Parks |
| 3.18 | Review plans for future major road construction and widening and identify potential sites on adjacent properties, to establish compensatory planting prior to clearing within the road reserve. | Medium | Planning & Environment, Infrastructure Design |
| 3.19 | Investigate options to map habitat trees located within road reserves and schedule recurring dieback treatment for significant trees at risk from dieback infestations. | Medium | Parks |
| 3.20 | Develop seed collection guidelines to harvest seed from native plants required to be cleared for works within road reserves, where feasible. | Medium | Parks |
| 3.21 | Develop a Street Tree Masterplan to include a biodiverse selection of resilient, firewise tree species to address urban heat island issues in the foothills and within townsites in the hills. | Medium / Long | Parks |

## Table 4 Actions relating to State managed lands

**Advocacy for State Managed Lands**
Objective: Encourage effective biodiversity conservation initiatives and management of State Government lands and reserves.

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 4.1 | Continue to monitor bushfire risk and research findings and advocate for careful implementation of bushfire risk mitigation activities to maintain biodiversity values on State Government managed lands. | Ongoing | Emergency Management |
| 4.2 | Continue to lodge objections to mining tenements. | Ongoing | Planning & Environment |
| 4.3 | Advocate for Main Roads WA to improve weed control along highways and within regional road reserves. | Ongoing | Infrastructure; Emergency Management |
| 4.4 | Share information and encourage public participation in review of the Forest Management Plan for native forests. | Short | Planning & Environment |
| 4.5 | Advocate for more active, coordinated and effective control of weeds and feral animals in national parks, regional parks, and Water Corporation managed lands. | Short | Planning & Environment |
| 4.6 | Advocate for greater environmental flows into the Helena River from Water Corporation dams. | Short | Planning & Environment |
| 4.7 | Advocate for improved collection and sharing of biodiversity information and mapping (across all land tenures) by State Government. | Short | Planning & Environment |
| 4.8 | Advocate for greater investment in national parks and regional parks within the Shire to enhance recreational use of trails and enjoyment of natural areas. | Short | Planning & Environment |
| 4.9 | To help address illegal firewood collection, advocate for an incentive program to assist residents to replace wood fires with electric heating, which would improve air quality as well as reduce demand for firewood that is driving illegal logging in both state and local government managed reserves. | Short | Planning & Environment |
| 4.10 | Advocate for more effective planning and monitoring of firewood and timber harvesting to reduce negative impacts of illegal logging. | Short | Planning & Environment |

# Actions to Protect our Biodiversity

| No. | Action | Timeframe | Key Service |
|---|---|---|---|
| 4.11 | Advocate for investigation of the potential for strategic thinning of regrowth areas in timber reserves to better mimic the structure of old growth forests, in a way that may also address bushfire risk and illegal logging. | Short/ Medium | Planning & Environment; Emergency Management |
| 4.12 | Advocate for positive environmental outcomes in relation to the planning of Eastlink. | Medium | Planning & Environment |
| 4.13 | Advocate for State agencies to incorporate climate adaptation principles into management of State forest and national parks. | Medium | Planning & Environment |
| 4.14 | Encourage sustainable nature based tourism initiatives and attractions within State Government managed lands. | Medium | Planning & Environment |
| 4.15 | Encourage public participation in consultation processes for mining proposals and advocate for protection of native forests within the Shire as an important ecological, cultural and recreational asset for the Perth region. | Long | Planning & Environment |

Photo: A. Lebel

## Actions Requiring Business Cases

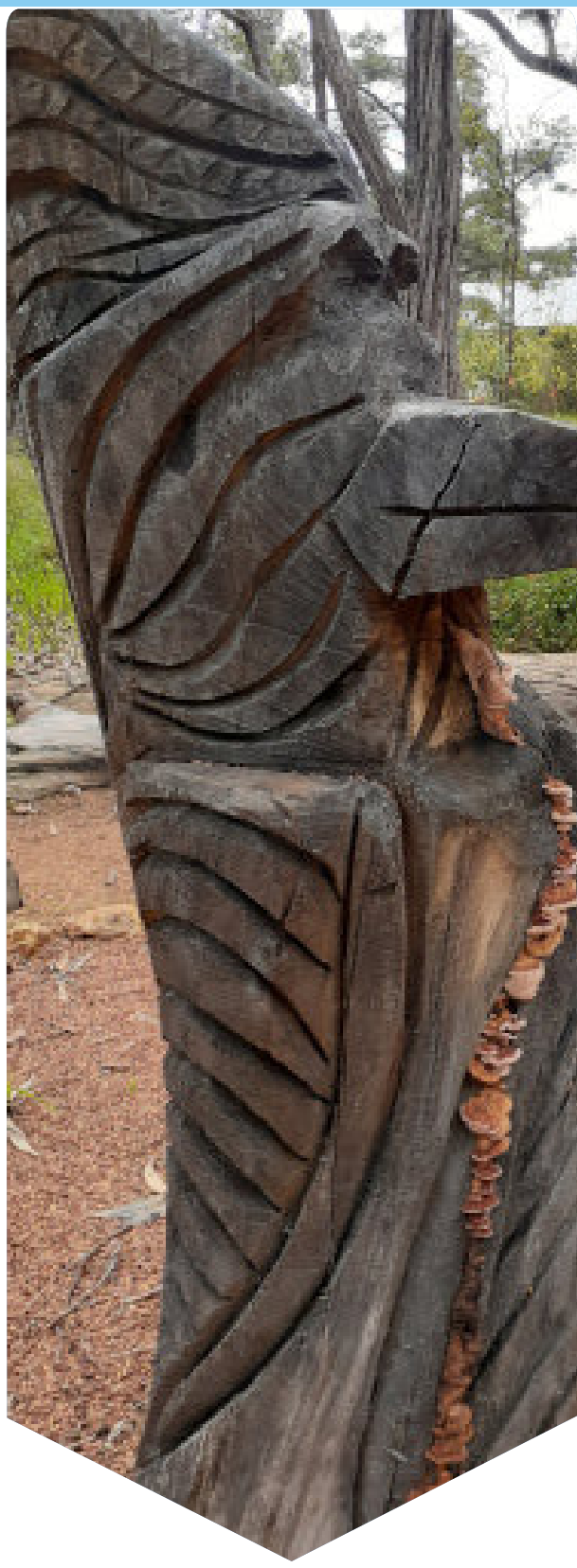
Most actions reflect a recalibration of existing staff and budget allocations. The review has highlighted areas requiring greater intervention and prioritisation that require business cases to be developed for additional funding allocations.

The table below lists specific actions requiring business cases to be developed to request funding allocations. It should be noted that the success of other actions that depend on the provision of staff and resources will be affected by the outcomes of the budget process and decisions on these business cases.

### Table 5 Actions requiring new business cases and funding decisions

| Action | Estimated Cost | Likely Year |
|---|---|---|
| Hold novel events and undertake low risk trial activities to explore new ways to attract environmental volunteers, with outcomes to inform the Shire's environmental volunteer engagement model and an update of the Friends Group Manual. | $15,000 per annum for two years | 2023/2024 |
| Develop a comprehensive Lake Leschenaultia Management Plan to protect and enhance the Lake's environmental values whilst allowing for a range of nature-based recreational activities. | $60,000 | 2023/2024 or 2024/2025 |
| Undertake recurring dieback treatment to maintain ecological values in priority reserves. | $15,000 to $20,000 per annum | 2023/2024 |
| Develop a business case to employ additional staff (which may include a fire ecologist or similar) to map and monitor condition of nature reserves, develop and implement plans for priority reserves, and coordinate weed control efforts and conservation activities with bushfire mitigation actions. | $90,000 to $160,000 per annum | 2023/2024 or 2024/2025 |
| Review opportunities for regional programs with Perth NRM and other Local Governments, such as Eastern Region Catchment Management Program. | $20,000 - $40,000 per annum | 2024/2025 |
| Update mapping of environmental features and Local Natural Areas using aerial photography and other remotely collected spatial data. | Assess options and costs in 2025 | 2026/2027 |

# Actions to Protect our Biodiversity



## Reporting and Review

The following indicators have been selected to provide an annual snapshot of progress, to be reported to Council.

- Number of properties supported as part of new Land for Wildlife service
- Number of nature-based talks, videos (views), workshops and events held for residents
- Number of native seedlings distributed to residents, schools and Friends Groups
- Number of Environmental Asset Inspections by Environmental Officers
- Number of feral animals removed from natural areas
- Number of registered Friends Group volunteers
- Number of reserves with Fire and Environmental Work Plans
- Number of reserves with Reserve Management Plans less than ten years old
- Hectares of dieback treatment undertaken
- Changes to mapped extent of native vegetation or Local Natural Area
- Changes to mapped condition of native vegetation (if available).

Updating of mapping for native vegetation extent and Local Natural Areas will likely continue to depend on State Government remote data collection. If the relevant mapping is updated biannually or less often, then the Shire's annual reporting will be based on the most recent available dataset. If the State Government does not continue to collect and provide these datasets then alternative indicators may be required (which may not be as accurate due to the cost of remote data collection and processing).

This Strategy should be subject to a major review in 2030, with a midway update to mapping and review of listed actions planned for 2026/2027.

# Appendix 1: Achievement of Local Biodiversity Strategy Goals

The Local Biodiversity Strategy adopted by Council in 2009 had a strong focus on prioritising natural areas at risk and protecting them through the local planning framework. The Strategy was developed using mapping (2008), funding, and methodology provided by the Perth Biodiversity Project, hosted by the Western Australian Local Government Association (WALGA).

This model, developed by the Perth Biodiversity Project, used mapped native vegetation complexes to represent ecosystems and a threshold of less than 30% remaining to prioritise certain complexes for protection. This model also recognised the constraints of the planning system and established development rights of private landholders, marking areas already zoned for more intensive development as committed by zoning.

The Local Biodiversity Strategy 2009 followed processes and adopted definitions from the 'Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region'. These Guidelines and the related mapping provided Local Governments with an understanding of the values of biodiversity in the Perth Metropolitan Region, and a methodology for preparing and implementing Local Biodiversity Strategies.The four key features of a Local Biodiversity Strategy prepared following the Guidelines are mechanisms to protect local natural areas, support for private land conservation, bushland sensitive land development, and improving management of nature reserves.

Attention was focussed on the areas where local governments could influence outcomes using a definition (and remnant native vegetation mapping) of 'Local Natural Areas' or LNA, being 'the natural areas that are not currently protected in the public conservation estate or included within state forests, water catchment areas or Bush Forever sites.'

The difficulty of retaining LNA on land with existing development rights (such as residential or commercial zones) was recognised with a classification of 'Limited Protection/Committed by Zoning'. Other definitions were introduced to classify LNA for Conservation, Protection or Retention (below) on Shire managed reserves or rural zoned land. These have since been embedded in the Shire's Local Planning Strategy and Local Planning Scheme No. 4.

*Conservation means vesting of Crown Land for a conservation purpose; inclusion in a proposed Local Reserve for Conservation in Local Planning Scheme No. 4; or inclusion in a Conservation Covenant.*

*Protection means that the natural area is identified as such in the Shire's Local Planning Strategy, is given additional protection under the Scheme and is a high priority for on-ground management. There is a very strong presumption against clearing natural areas identified as 'Protection', or allowing rezoning which would threaten the ecological value of these natural areas.*

*Areas identified with a 'Retention' status, whilst usually being of lower conservation priority than the above natural areas, are still proposed to receive additional protection under the Scheme and will need to be retained to maintain the Shire's current levels of biodiversity. There is generally a very strong presumption against allowing the clearing of areas identified as 'retention'. And whilst these areas are a lower priority for active management, landowners should still be encouraged to manage and restore them.*

Local Natural Areas were subsequently identified in the Shire's Local Planning Strategy (2013) and categorised as Conservation (reserved land), Protection, or Retention. The gazettal of Local Planning Scheme No. 4 (LPS4) in 2014 changed the purpose of many local reserves to Conservation, as well as putting in place protections and requirements for planning approval for clearing of Protection or Retention category LNA on private land.

The Local Biodiversity Strategy 2009 listed four goals:

1. *To aim to have 1065 hectares of LNA included in the Conservation Category and recognised by the Shire's Local Planning Strategy and LPS4; and to endeavour to increase the amount of LNA in the Conservation Category to up to approximately 1570 ha over time.*
2. *To have 5830 ha of LNA included in the Protection Category and recognised in the Shire's Local Planning Strategy and LPS4; and to endeavour to increase the amount of LNA in the Protection Category to up to approximately 5865 ha over time.*
3. *To have 510 ha of LNA included in the Retention Category and recognised in the Shire's Local Planning Strategy and LPS4; and to endeavour to increase the amount of LNA in the Retention Category to up to approximately 1190* ha over time.
4. *All Council's Local Reserves for Conservation in Local Planning Scheme No. 4 are actively managed for biodiversity conservation and half of all other Conservation Category LNAs and Protection Category (at least an estimated 2925 ha) are actively managed for conservation.*

A review of the Shire's LNA was undertaken by WALGA using their Environmental Planning Tool in 2020, using vegetation complex mapping maintained by the Department of Biodiversity, Conservation and Attractions and the 'Native Vegetation Extent' dataset produced by the Department of Primary Industries and Regional Development in 2020. The review of LNA mapped and recognised through the Local Planning Strategy and LPS4 found that:

1. 6,240 hectares of LNA was included in the Conservation Category;
2. 5573 hectares of LNA was included in the Protection Category; and
3. 292 hectares of LNA mapped and recognised as Retention Category in LPS4.

The large additional area included in the Conservation Category beyond the original target was partly due to rezoning of an area that was originally included in state managed lands and therefore not classified as LNA in 2009.

The WALGA review found that if the prioritisation process was repeated in 2020, less LNA would meet Priority 1 Conservation criteria compared to 2008 while more LNA would meet Priority 2 criteria.

The primary reason was identified as increased fragmentation of native vegetation in the Shire, resulting in less LNAs mapped as 'habitat' (LNAs larger than 10 ha separated by 8m from another patch of vegetation). This is a potential flaw within the original methodology, whereby the remaining native vegetation could classified as less critical to protect based on surrounding losses, rather than more.

After 2020 the Department of Primary Industries and Regional Development ceased production of the Native Vegetation Extent dataset, however it is anticipated that another state agency may continue to produce that or a similar dataset in the near future.

The WA Local Government Association has also ceased providing the Environmental Planning Tool and support services.

The summary of extent of vegetation complexes remaining in Appendix 1 is based on the 2020 dataset.

In May 2022 the State Government released the first Native Vegetation Policy for Western Australia. The policy includes a commitment for state agencies to identify and progress reforms to:

1. Consider and transparently account for the values of native vegetation in decision making that affects it, based on the best information available at the time.

2. Apply the mitigation hierarchy steps to any planned impacts on native vegetation at both strategic and project scale – avoid, minimise, then rehabilitate – before considering offsets.

3. Improve the spatial capture of their regulatory, land management, land planning and funding decisions that affect native vegetation, applying common data standards to facilitate data sharing.

4. Work together with other agencies and stakeholders to expand and apply the native vegetation knowledge base, improve mapping and monitoring of its status and values, and broaden the availability of spatial data.

A re-assessment of conservation priority should be undertaken in future once appropriate datasets again become available; however, the criteria will also need reconsideration given the very high threshold initially set to classify LNA as 'habitat' and the need to take into account local level protection of representative vegetation types.

At present, the conservation priorities identified in the Local Biodiversity Strategy 2009 and recognised in the Local Planning Strategy remain appropriate for strategic land use planning, and the update that is required is to the extent of LNA (to reflect areas cleared since 2009) as provided for in LPS4.

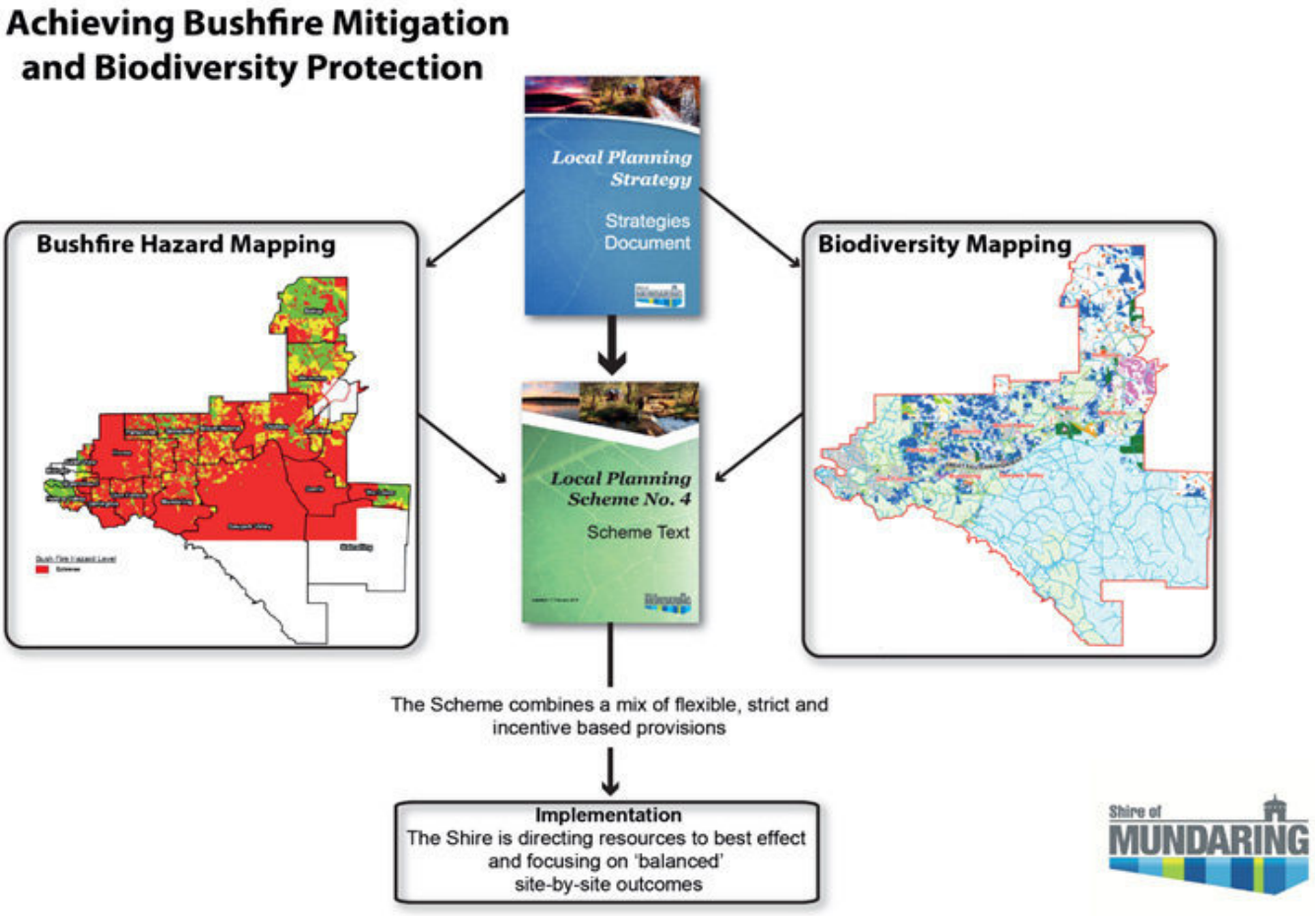
## Implementation through Local Planning Framework

The Shire's approach to balancing biodiversity protection with bushfire risk mitigation through its Local Planning Scheme has been recognised as best practice. Embedding protections for priority Local Natural Areas within the planning framework has helped to retain bushland and habitat.

As noted in the Local Biodiversity Strategy 2009, "Biodiversity strategies are not statutory documents, and need to be incorporated into the Local Planning Strategy and reflected in the Town Planning Scheme to have a bearing on Local and State Government decisions. This is critical as many of the decisions that impact on biodiversity and natural areas are linked to land use planning and development."

schemes within the State that embeds biodiversity mapping into a statutory layer, referred to as Local Natural Areas (LNA). The LPS4 provisions also afford protection to individual trees and patches of bushland too small to be recognised as LNAs. These trees or small areas of native vegetation are not as high a priority in the protection of biodiversity, but can still retain important habitat features and aesthetic and cultural values.

Apart from limited exceptions, the removal of local native vegetation requires planning approval from the Shire and the LPS4 provisions set out the criteria for assessing any such application. The protection of significant trees in Residential areas is more complicated and is generally more difficult to achieve.



It should be noted that one of the key exceptions from these controls relates to any vegetation required to be removed in order to comply with bushfire safety requirements under LPS4 and the Guidelines.

The Shire's role in administering planning controls to protect bushland and recognised environmental assets is generally consistent with the wider community's expectations, and generally enjoys a high level of support.

Some residents expect stronger controls preventing any further clearing, however this would frequently contradict bushfire risk requirements and existing development rights. Adding further controls on clearing within bushfire asset protection zone (i.e. a significant tree register), particularly in residential areas could also add a significant administrative burden to the Shire and affected residents for minimal gain, and would likely diminish the respect for current measures that are in place.

The Shire's approach has been recognised by the WAPC as leading the way in the State in relation to protection provisions, because it involved the inclusion of provisions within its local planning scheme, which seeks to balance bushfire safety and biodiversity protection within the local planning framework.

The LPS4 provisions regarding protecting vegetation are also consistent with the intent and direction of the Shire's endorsed Community Strategy Plan and Local Planning Strategy, which support a general presumption against the clearing of native vegetation wherever practicable.

Since the adoption of the Shire's Local Biodiversity Strategy in 2009 and Local Planning Scheme No. 4 in 2014, there have been significant reforms to the state planning framework.

These have shifted more decision making for subdivisions and larger scale developments from local to State Government, and elevated bushfire risk as a key planning consideration.

The Shire's Local Biodiversity Strategy 2009 stated, "for the purposes of this Strategy, it is estimated that existing subdivision potential and development rights could lead to approximately 315 ha of clearing."

A review of the planning applications completed since 2013 that impacted upon mapped LNA (287 applications) found a total of 39.7ha of vegetation has been permitted to be removed or modified as part of the Shire planning approval process. This figure is in addition to the vegetation lost as a result of subdivision and or modification of vegetation on private property.

Options for improving remote mapping including vegetation cover and health are required.

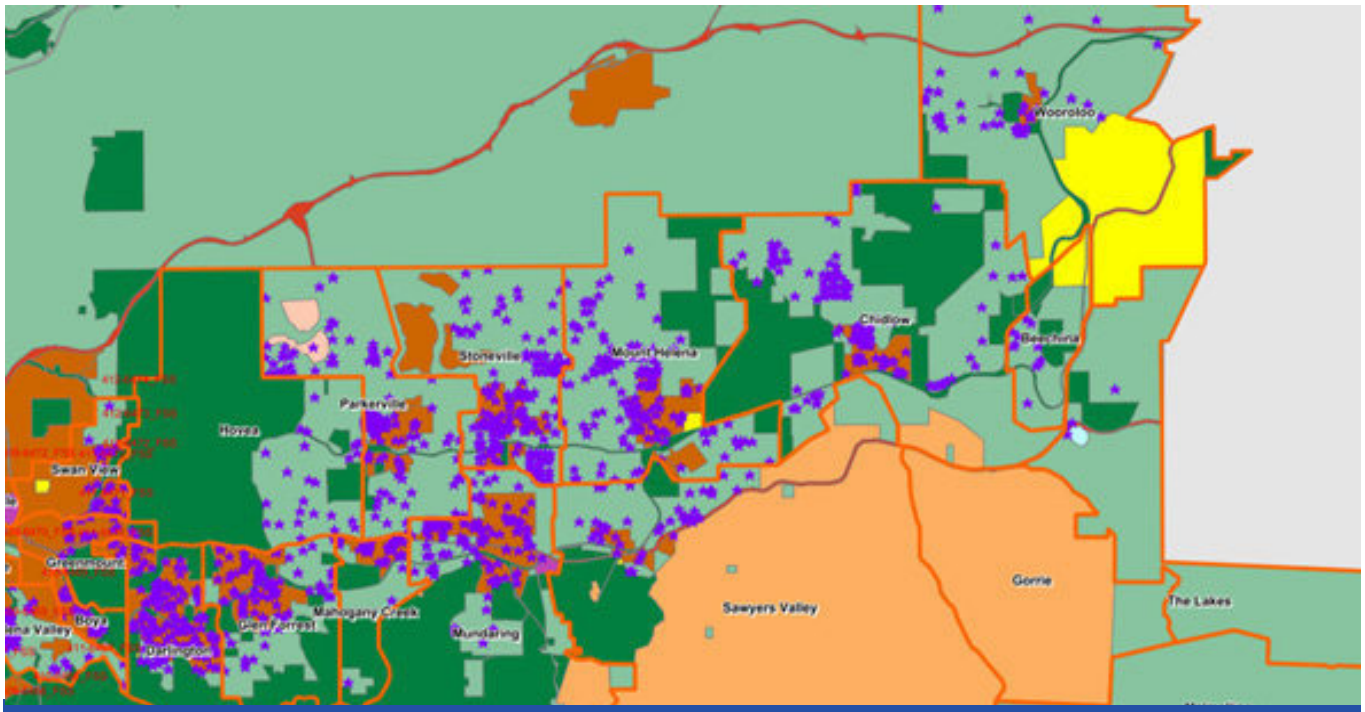
Within the local planning framework there is a strong presumption against clearing LNA, but this does not extend to prohibiting a landowner from constructing a dwelling and other structures where there is no appropriate cleared area on the site.

The mapped LNA essentially serves as a trigger for a planning assessment and for a more detailed environmental inspection. In these instances, the Shire's environmental, planning and fire team have been directly involved in early advice to landowners regarding the siting of dwellings to minimise the extent of clearing and balance bushfire and biodiversity considerations.

The mapped LNA essentially serves as a trigger for a planning assessment and for a more detailed environmental inspection. In these instances, the Shire's environmental, planning and fire team have been directly involved in early advice to landowners regarding the siting of dwellings to minimise the extent of clearing and balance bushfire and biodiversity considerations.

While habitat trees are often mapped on site as part of the planning process it is not comprehensive, and mapping effort is prioritised close to the proposed developed rather than across the whole property. The habitat trees layer that is used to record these on the Shire's GIS is marked as 'limited mapping' and while the number of trees recorded will continue to grow, the data is not an absolute record of all the significant vegetation in the shire.

The Shire requires Bushfire Management Plans to contain information that ensures key environmental features such as habitat trees are identified and protected.




**Fire Management Plans approved since 2013 (purple) also fulfil a role in identifying and protecting significant vegetation on a site specific basis**

The Environmental Officers are involved in reviewing Bushfire Management Plans for structure plans and subdivisions, and providing advice to Shire Planning Officers and the Western Australian Planning Commission (WAPC). The WAPC is the decision maker for structure plans and subdivisions, and will make decisions after receiving recommendations from a range of other agencies as well as the local government.

For smaller scale developments, the environmental features that were mapped during Environmental Asset Inspections or noted during site visits with bushfire planning consultants are recorded in the Bushfire Management Statement and on site plans.

Environmental protection provisions within the planning system are necessarily a balance between private property development rights and community aspirations. The incorporation of LNA and native vegetation protections within the Local Planning Strategy and LPS4 was the primary aim of the Local Biodiversity Strategy 2009 and this has been achieved. Consideration of the natural environment has been successfully integrated into local planning practice.

Local Planning Scheme No. 4 provides for LNA mapping to be updated based on landowner requests, or other investigations or assessments that the Shire conducts. Currently the mechanism, with LNA mapping as a trigger for requiring planning approval and on-site assessment of environmental values, is working effectively.

Operationally, the Shire's environmental advisory service (including the Environmental Asset Inspections service) has been directed towards planning applications to ensure early intervention and to shape development proposals and conditions of approval to minimise environmental impacts. This has left little time for the Shire's Environmental Officers to be proactive and provide environmental advice to other properties, which could make a significant difference to local biodiversity. A slight increase in Environmental Officer capacity to enable better conservation advice and service to more residents has been recommended.

Overall, the current provisions are considered to have operated effectively to protect vegetation and local natural areas through the local planning framework and no amendments to the Local Planning Scheme No. 4 are recommended at this stage. However, continued advocacy is required for State Government planning practices to better balance bushfire safety with environmental protection.

## Management of Conservation Reserves

The fourth goal of the Local Biodiversity Strategy 2009 was:

> 4. All Council's Local Reserves for Conservation in Local Planning Scheme No. 4 are actively managed for biodiversity conservation and half of all other Conservation Category LNAs and Protection Category (at least an estimated 2925 ha) are actively managed for conservation.

All Conservation reserves are assessed annually for bushfire hazard and many receive regular weed control treatment, but there is a lack of regular monitoring and mapping of vegetation condition.

The Landcare Team consists of two staff, who are often assisted with weeding, revegetation and other work on reserves by environmental volunteer Friends Groups (who may also belong to broader Catchment Groups crossing local government boundaries). There is support for Friends Groups to prepare grant applications, assisted by the Natural Areas Project Officer (part time).

The Fire Protection Team also consists of two staff, who assess and manage fuel loads across all land that the Shire is responsible for (not just nature reserves). Their primary objective is to reduce fuel loads and improve community safety, but as part of this work they also undertake significant weed control in nature reserves.

Mapping and recording of management issues and interventions, and sharing of information between Shire Services, has been limited by the technology available to staff. The rollout of a more flexible mapping (GIS) system in 2022 should allow for more data collection, sharing and analysis than has been possible in the past.

Most reserves do not have a management plan, and where management plans exists they are generally dated.  Dieback mapping and treatment has been undertaken intermittently, often based on external grants. Feral cats in nature reserves may be trapped and removed by the Shire's Community Safety Rangers, but there has been no coordinated program to trap foxes or other feral animals.

While all Conservation reserves are managed, it is difficult to say that they are all actively managed for biodiversity conservation in a way that adequately addresses all threats to their natural values. In addition, the ecological viability of the network of Conservation reserves long term depends on the management of surrounding land and maintenance of wildlife corridors. Support for private land conservation initiatives including wildlife corridors has been limited.

Protection Categories mapping could not be fully replicated due to changes to land use provisions in the Shire's Local Planning Scheme between 2008 and 2020.

# Appendix 2: Extent of Native Vegetation Complexes Remaining

The following information was produced by the WA Local Government Association as part of a review of LNA protection measures in 2020.

Vegetation complexes with less than 10% of pre-European extent retained and protected at bio-region scale (Swan Coastal Plain and Jarrah Forest bioregions) and represented in the Shire include:

- Forrestfield vegetation complex
- Guildford vegetation complex; and
- Swan vegetation complex.

Of these, only Swan vegetation complex has portions protected in the Shire (5% of the pre-European extent in the Shire) (see Table 2 in this appendice).

Of the 18 vegetation complexes represented in the Shire of Mundaring, there are three vegetation complexes which have significant representation in the State's conservation reserves system: Goonaping, Helena 2 and Swamp (all representative of vegetation complexes of the Jarrah Forest bio-region) (Table 1).

Of the vegetation complexes with less than 30% remaining at the bio-region level, the Southern River complex (Swan Coastal Plain IBRA) and Coolakin complex (Northern Jarrah Forest IBRA) are of high priority for conservation as less than 10% being protected in the respective bioregions. Over 60% of the pre-European extent of Coolakin vegetation complex is protected locally and 100% of its mapped extent remains in the Shire (Table 2).

The Southern River vegetation complex, of which 5 hectares remain in the Shire, has no local protection and therefore should be of high priority for future conservation in the Shire. Eight of the vegetation complexes occurring in the Shire are considered not adequately protected at the bioregion scale, with less than 15% of their pre-European extent on lands with formal protection (Table 1).

There are four vegetation complexes with no representation on lands providing formal protection in the Shire of Mundaring, including the already mentioned regionally significant vegetation complexes: Forrestfield, Guildford and Southern River. The fourth vegetation complex with no local protection is Yalanbee 6. While 100% of the pre-European mapping of Yalanbee 6 vegetation complex remains in the Shire, it is retained on privately owned land zoned Rural in the MRS and Public Purposes in LPS4.

[1] Retention and protection level thresholds of 10% and 30% are applied to the actual vegetation extent statistics with a buffer of about 5% to allow for the limitations of the native vegetation mapping dataset. It is considered that the mapping overestimatesthe actual native vegetation extent status due to limitations of aerial photography interpretations (inability to separate native and exotic vegetation and map vegetation condition).

[2] In the Perth Metropolitan Region, the minimal thresholds for representation of vegetation within protected lands is 10% of the pre-European extent for vegetation complexes on the Swan Coastal Plain and 15% of the pre-European extent for vegetation complexes in the Jarrah Forest.

## Table 1

**Shire of Mundaring vegetation complexes and their retention and protection status of vegetation complexes at the bioregion scale (Government of Western Australia 2019) Orange identifies vegetation complexes protected at less than 10% of their pre-European extent on the Swan Coastal Plain and less than 15% protected in Jarrah Forest bio-region. 5% buffer is added allow for mapping errors and limitations.**

| Vegetation Complex | Pre-European Extent (ha) | 2018 Extent (ha) | % Remaining | Current Extent Protected (IUCN I-IV) for Conservation (ha) | Current percentage remaining within lands Protected (IUCN I-IV) for Conservation (%) | Protected via Shire of Mundaring LPS Conservation reservation-2020 extent (ha) | Current percentage of regional extent protected with contribution via local protection in the Shire of Mundaring |
|---|---|---|---|---|---|---|---|
| **Swan Coastal Plain** | | | | | | | |
| Guildford Complex | 90,513.1 | 4,607.91 | 5.09 | 239.45 | 0.26 | 0 | 0.26 |
| Swan Complex | 15,194.1 | 2,062.03 | 13.57 | 56.54 | 0.37 | 0 | 0.37 |
| Forrestfield Complex | 22,812.9 | 2,803.36 | 12.29 | 313.01 | 1.37 | 0 | 1.37 |
| Southern River Complex | 58,781.5 | 10,832.18 | 18.43 | 691.69 | 1.18 | 0 | 1.18 |
| **Jarrah Forest** | | | | | | | |
| Cooke, Ce | 36,779.3 | 30,304.20 | 82.39 | 6,859.00 | 18.65 | 47.71 | 18.78 |
| Coolakin, Ck | 163,991.7 | 64,204.65 | 39.15 | 6,384.23 | 3.89 | 196.38 | 4.01 |
| Darling Scarp, DS1 | 3,277.96 | 825.96 | 25.20 | 418.03 | 12.75 | 0 | 12.75 |
| Darling Scarp, DS2 | 32,448.3 | 13,586.40 | 41.87 | 2,489.55 | 7.67 | 3.09 | 7.68 |
| Dwellingup, D2 | 86,128.3 | 71,055.96 | 82.50 | 16,628.15 | 19.31 | 104.11 | 19.43 |
| Dwellingup, D4 | 132,415.6 | 115,661.52 | 87.35 | 15,926.50 | 12.03 | 2,069.25 | **13.59** |
| Goonaping, G | 27,467.0 | 21,834.63 | 79.49 | 13,905.39 | 50.63 | 360.6 | 51.94 |
| Helena 2, He2 | 16,339.3 | 12,984.83 | 79.47 | 4,921.85 | 30.12 | 0 | 30.12 |
| Murray 2, My2 | 59,317.1 | 40,952.07 | 69.04 | 9,426.51 | 15.89 | 1,211.43 | **17.93** |
| Pindalup, Pn | 167,151 | 128,358.24 | 76.79 | 23,935.29 | 14.32 | 1,115.54 | 14.99 |
| Swamp, S | 53,658.2 | 40,612.97 | 75.69 | 11,687.19 | 21.78 | 73.29 | 21.92 |
| Yalanbee, Y5 | 126,609.8 | 83,829.11 | 66.21 | 7,694.97 | 6.08 | 653.94 | 6.59 |
| Yalanbee, Y6 | 197,849 | 92,080.88 | 46.54 | 22,731.08 | 11.49 | 0 | 11.49 |
| Yarragil 1, Yg1 | 80,202.95 | 64,927.06 | 80.95 | 7,912.21 | 9.87 | 74 | 9.96 |

* Excludes Crown Freehold Department Managed Lands that are managed under Section 8A of the CALM Act.

**Table 2: 2018 vegetation extent by vegetation complexes in the Shire of Mundaring (Government of Western Australia 2019 (columns with grey heading) and WALGA analysis)**

| Vegetation Complex | Pre-European Extent (ha)* | 2018 Extent (ha) | % Remaining in the Shire | Proportion of the Vegetation Complex Mapping extent within each LGA (%) | 2005 Extent (ha) | 2005-2018 vegetation extent comparison (ha) | Protected on DBCA managed lands (ha) (2020 extent) | Protected via LPS Conservation reservation-2020 extent (ha) | % or pre-European extent protected in the Shire (2008 status in %) |
|---|---|---|---|---|---|---|---|---|---|
| **Swan Coastal Plain** | | | | | | | | | |
| Southern River | 31.7 | 5.3 | 16.72 | 0.05 | 1.86 | 3.44 | 0 | 0 | 0% |
| Guildford Complex | 127.8 | 0.9 | 0.73 | 0.14 | 7.06 | -6.13 | 0 | 0 | 0% |
| Swan Complex | 252.2 | 39.2 | 15.56 | 1.66 | 57.7 | -18.47 | 8.52 | 0.26 | 4% |
| Forrestfield Complex | 987.4 | 66.7 | 6.76 | 4.33 | 50.55 | 16.15 | 1.28 | 0 | 0% |
| **Jarrah Forest** | | | | | | | | | |
| Cooke, Ce | 222.9 | 168.1 | 75.40 | 0.61 | 174.32 | -6.27 | 78.73 | 47.71 | 57% |
| Coolakin, Ck | 321.7 | 321.7 | 100.00 | 0.20 | 285.84 | 35.85 | 0 | 196.38 | 61% |
| Darling Scarp, DS2 | 1,249.8 | 779.6 | 62.38 | 3.85 | 699.52 | 80.07 | 360.07 | 3.09 | 29% |
| Dwellingup, D2 | 10,431.7 | 6,749.0 | 64.70 | 12.11 | 7,497.2 | -748.16 | 2,085.75 | 104.11 | 21% |
| Dwellingup, D4 | 12,081.6 | 9,437.1 | 78.11 | 9.12 | 9,596.8 | -159.66 | 819.62 | 2,069.25 | 24% |
| Goonaping, G | 460.3 | 412.2 | 89.54 | 1.68 | 420.04 | -7.86 | 0 | 360.6 | 78% |
| Helena 2, He2 | 974.5 | 862.2 | 88.47 | 5.96 | 903.01 | -40.82 | 328.04 | 0 | 34% |
| Murray 2, My2 | 19,064.3 | 14,181.6 | 74.39 | 32.14 | 14,739.4 | -557.79 | 3,456.34 | 1,211.43 | 24% |
| Pindalup, Pn | 8,676.1 | 5,311.9 | 61.22 | 5.19 | 5,303.26 | 8.67 | 272.41 | 1,115.54 | 16% |
| Swamp, S | 193.2 | 90.7 | 46.96 | 0.36 | 86.85 | 3.76 | 0 | 73.29 | 38% |
| Yalanbee, Y5 | 4,793.8 | 2,422.8 | 50.54 | 3.79 | 2,372.08 | 50.67 | 34.73 | 653.94 | 14% |
| Yalanbee, Y6 | 118.2 | 118.2 | 100.00 | 0.06 | 110.1 | 8.12 | 0 | 0 | 0 |
| Yarragil 1, Yg1 | 4,329.7 | 2,088.3 | 48.23 | 5.40 | 2,323.90 | -234.96 | 475.31 | 74 | 13% |
| Total | 64,316.7 | 43,055.6 | 67% | | 44,629.5 | -1,549.9 | 7,920.8 | 5,909.6 | 22% |

# Appendix 2: Extent of Native Vegetation Complexes Remaining

## Summary of findings

Highest priority vegetation complexes for formal protection in the Shire of Mundaring are:

- Forrestfield
- Guildford
- Southern River
- Swan
- Yalanbee 6.

To date, implementation of the Shire's 2009 Local Biodiversity Strategy contributed to the improved conservation status of the following vegetation complexes:

- Cooke
- Coolakin
- Dwellingup 2 & 4
- Goonaping
- Murray 2
- Pindalup
- Swamp
- Yalanbee 5
- Yarragil 1.

The greatest contribution to the regional protection status via protection of vegetation complexes by the Shire were achieved for Dwellingup 4 and Murray 2 vegetation complexes, increasing the regional protection level by more than 1% of the pre-European extent of these vegetation complexes (Table 1).

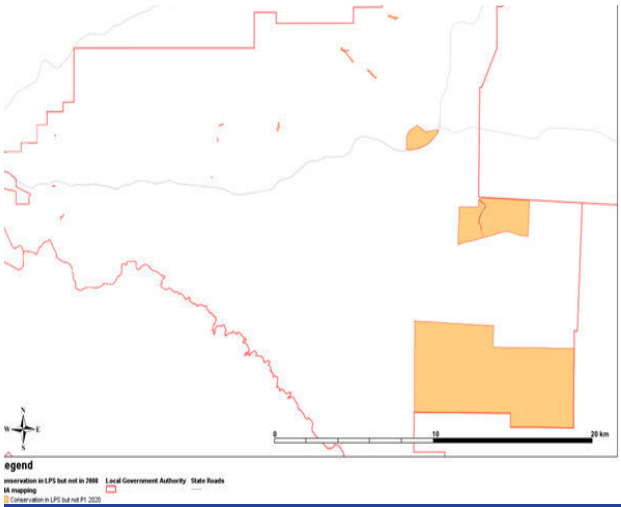


**Figure 1: Additional LNA (Conservation in 2020 not mapped as LNA in 2009 Local biodiversity Strategy**

However, of the 18 vegetation complexes mapped in the Shire of Mundaring, only three are adequately represented on lands providing long-term protection (Goonaping, Helena 2 and Swamp).

These findings point to gaps in how the Local Biodiversity Strategy Conservation Priorities criteria consider vegetation complexes.
The criteria does not consider local level of protection of representative vegetation types in the Shire and thus conservation priority of Yalanbee 6 vegetation complex with no formal protection in the Shire is dependent on the presence of other criteria such as threatened species. Yalanbee 6 is also not adequately protected at the regional level and in 2008 was not mapped as an LNA in the Local Biodiversity Strategy.

The significant increase in the overall area classified as LNA in 2020 is due to changes in land use classification in the Metropolitan Region Scheme (MRS) since 2008, and inclusion of lands reserved Parks and Recreation in the MRS but not managed by DBCA. One of the largest additions is over 9,000 hectares currently zoned Rural in the MRS that were in 2008 mapped as State Forest, Other DBCA managed lands and Water Lands (Figure 1).

When compared with the 2020 WALGA LNA, the proportion of LNAs meeting Priority 1 criteria decreased since 2008 and the area of LNAs meeting Conservation Priority 2 criteria increased.

The main contributing factor to this is the increased fragmentation of native vegetation in the Shire, resulting in less LNAs mapped as habitat (LNAs larger than 10 ha separated by 8m from another patch of vegetation).

## Appendix 3: Wildlife Corridor Network Maps

Regional Ecological Linkages were previously identified by the Perth Biodiversity Project, to connect regionally significant natural areas across the Perth Metropolitan Region.

Local wildlife corridors have been mapped to complement the Regional Ecological Linkages and together these will collectively be considered as the 'wildlife corridor network'. The local wildlife corridors are a composite of major watercourses (better vegetated higher order watercourses, mapped as part of the concurrently developed Watercourse Hierarchy Strategy) and other links between locally significant natural areas.

The major watercourses connect to many dams and water bodies, which are known to be important biodiversity refuges. Dams, other water bodies and major watercourses will also be significant refuges during future drought and heatwaves.

The additional corridors were identified using a least-cost path method identified by consultants, using origins and destinations based on Shire managed conservation reserves with at least 10ha of native vegetation and logical connections to national parks and other state lands. Access to a native vegetation dataset called 'Urban Monitor' was provided via a research collaboration agreement with the Department of Biodiversity, Conservation and Attractions (DBCA). DBCA staff also participated in reviews of draft mapping and suggestions for improvement.

The scoring for the least-cost path method was revised after a round of draft corridors were reviewed by members of the Shire's Environmental Advisory Committee.

A high score was added to buildings (using a 20m buffer) to reflect the impact of people, pets, vehicles and fences associated with building density. The revised scoring (see Table 1 on following page) was used to identify terrestrial corridors in addition to the major watercourses.

A width of 40m was used for local wildlife corridors as in many cases this is the maximum width of the riparian vegetation, multi use reserve, or distance between buildings.

The functional width of local wildlife corridors will obviously be wider where there is more remnant vegetation, and particularly where the corridor is shown passing through a local reserve it is the whole of the reserve which should be considered as effectively part of the wildlife corridor network.

Future revisions of the wildlife corridor mapping may use different source datasets for native vegetation and natural areas, particularly if State Government agencies improve the collection and sharing of remote data for this region.

It must be emphasised that the wildlife corridor mapping provides a mechanism for focussing attention and effort on areas that provide critical support for biodiversity, but cannot and do not include all wildlife movement pathways or important areas of habitat.

| Layer/Features | Cost |
|---|---|
| **Roads** | |
| Minor, Track | 70 |
| Freeway, State Highway, Main, Laneway, National Highway | 100 |
| **Streams** | |
| LiDAR derived streams. Order 1 and 2 removed, 3 to 9 included. | 2 |
| **Metropolitan Region Scheme** | |
| Parks and recreation | 5 |
| Parks and recreation - restricted public areas | 5 |
| State Forests | 5 |
| Waterways | 5 |
| Primary regional roads | 100 |
| Public purposes - prison | 100 |
| Railways | 100 |
| **Local Planning Scheme** | |
| Conservation | 5 |
| Recreation | 20 |
| Residential | 75 |
| Rural residential | 20 |
| Rural small holdings | 20 |
| Development | 50 |
| Public Purposes | 60 |
| General Agriculture | 30 |
| Local Centre | 100 |
| Special Use | 30 |
| Town Centre | 100 |
| Service commercial | 100 |
| Light Industry | 100 |
| No zone | 95 |
| Important Local Roads | 85 |
| Other local roads | 75 |
| **Urban Monitor** | |
| Native vegetation | 0.5 |
| **Building Footprints** | |
| Buffered to 20m | 100 |

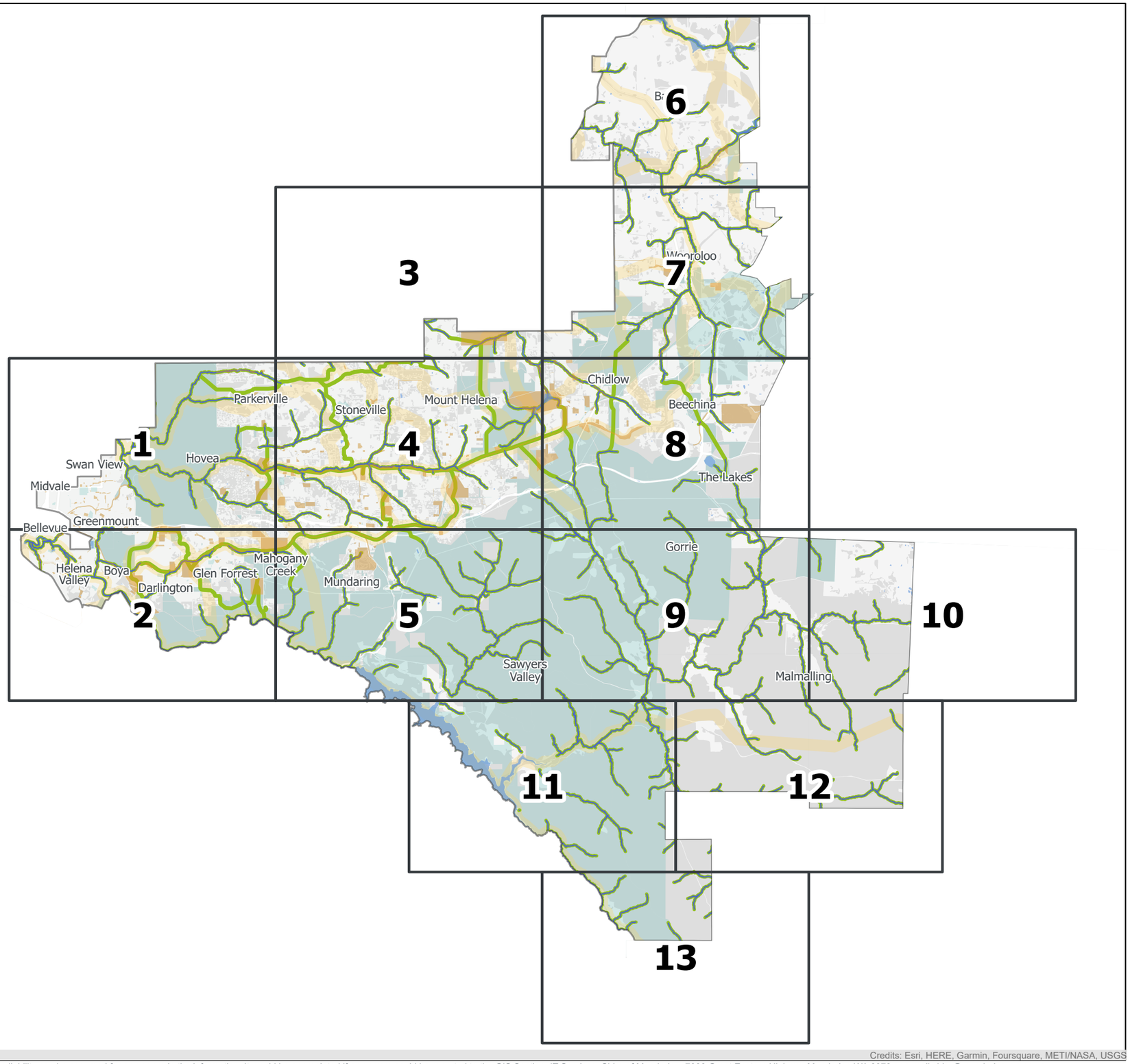
# Wildlife Corridors

- Remnant Native Vegetation
- Local Wildlife Corridors
- Regional Ecological Linkages
- State Managed Reserves
- Shire Managed Reserves
- Major Watercourses
- Mapped Water Bodies

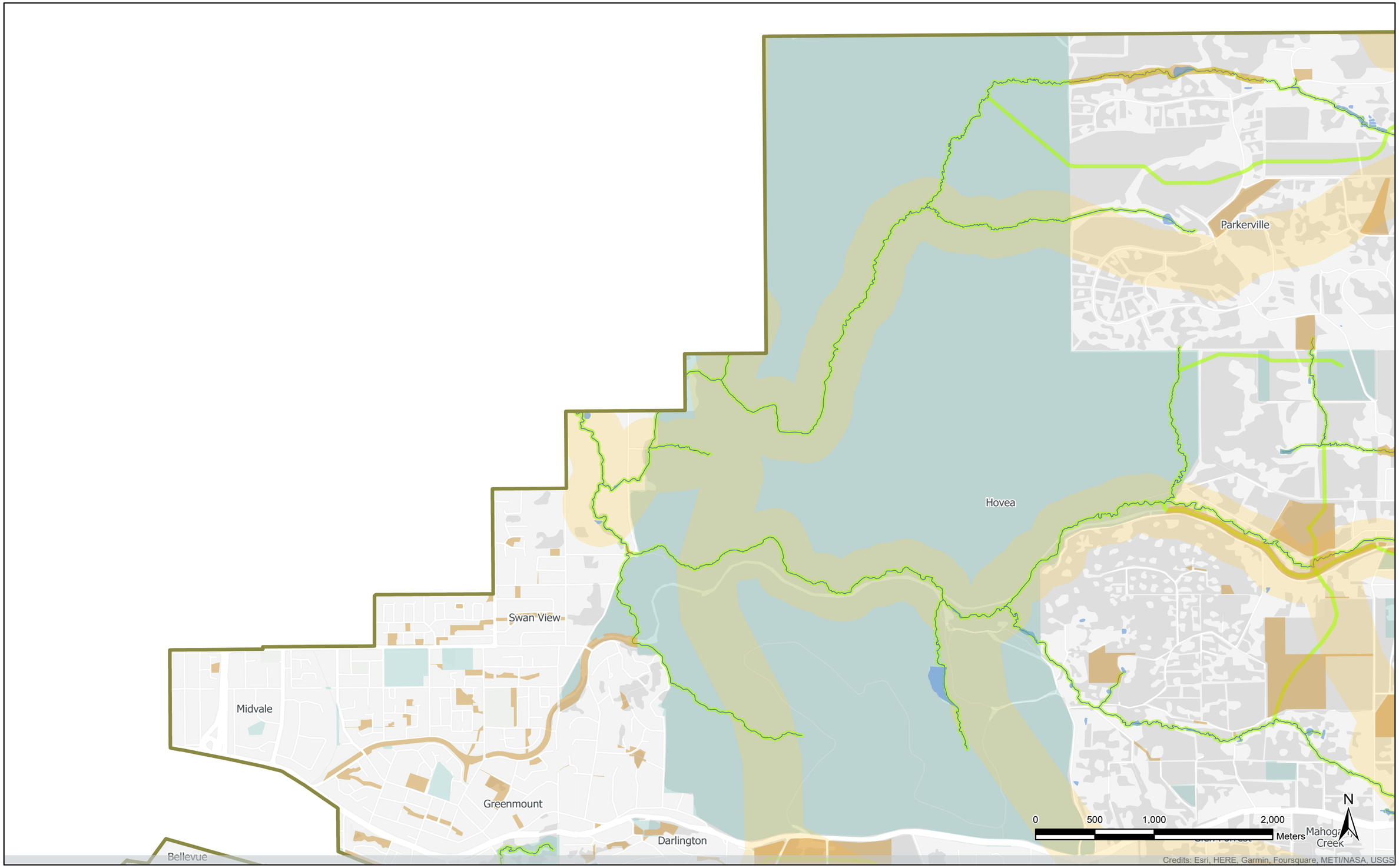
N

0 1.5 3 6

Kilometers




Credits: Esri, HERE, Garmin, Foursquare, METI/NASA, USGS

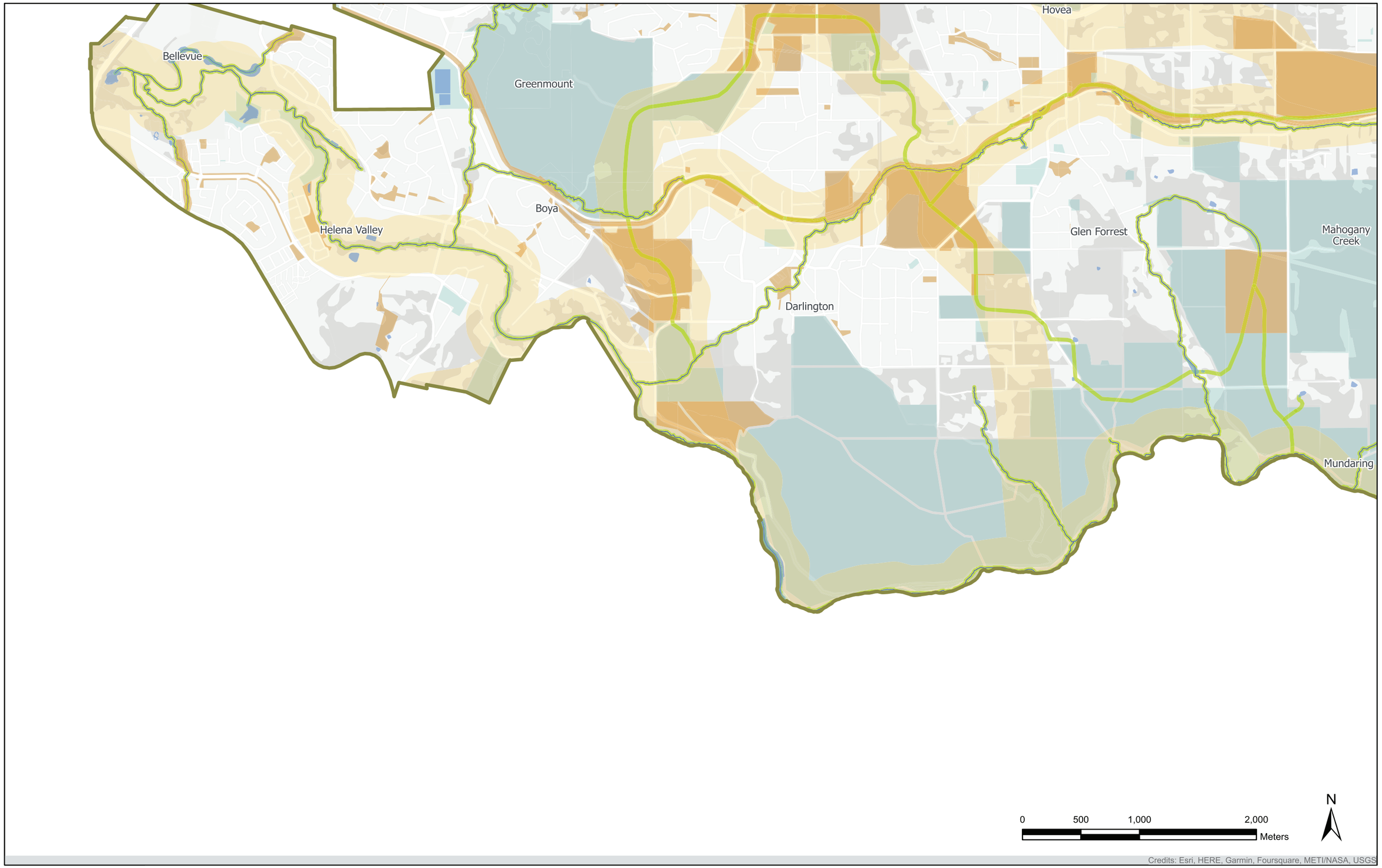



Shire of MUNDARING

# Wildlife Corridors

Map 1

3/10/2022




# Wildlife Corridors

Map 2

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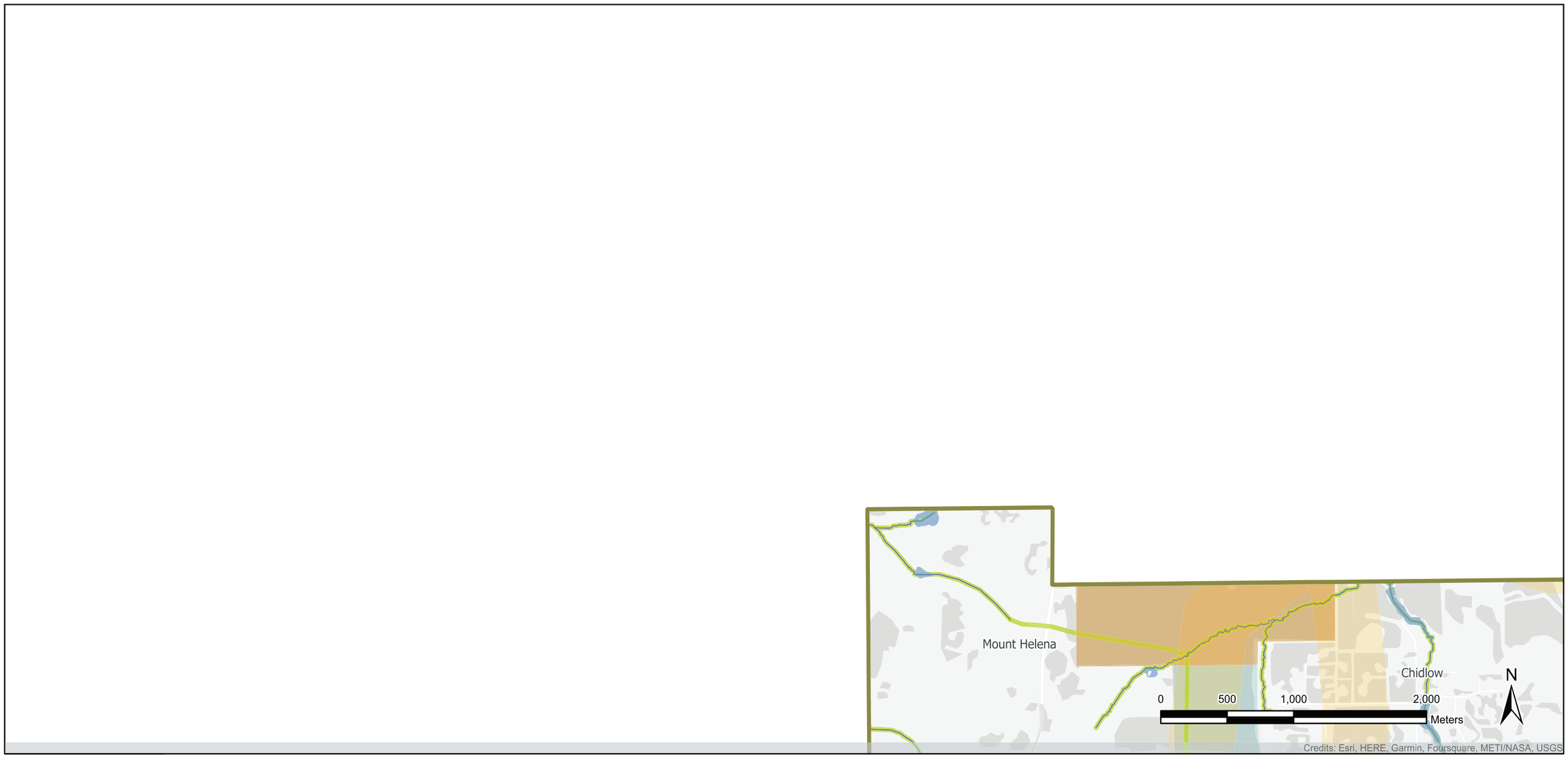
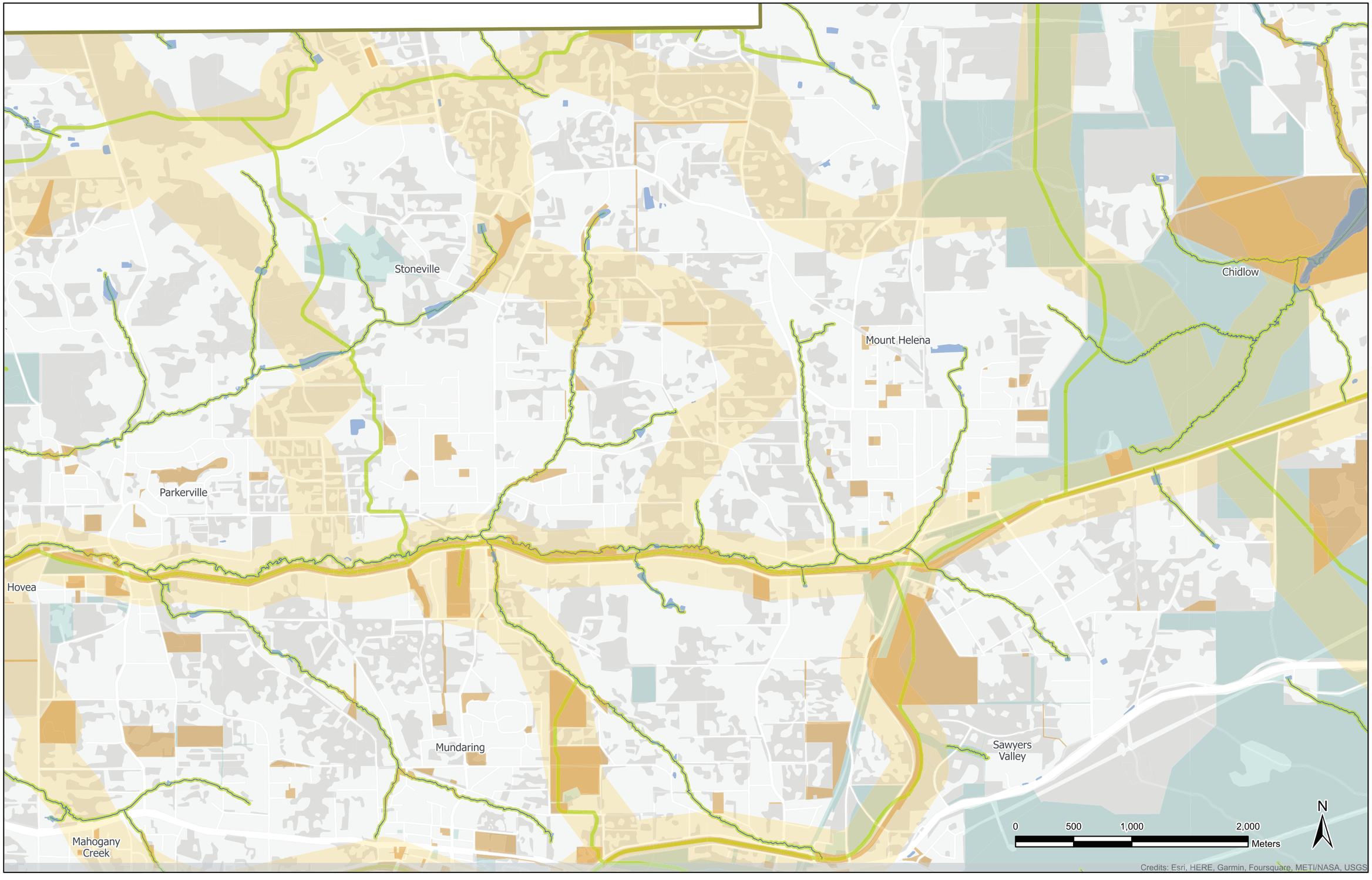



# Wildlife Corridors

Map 3

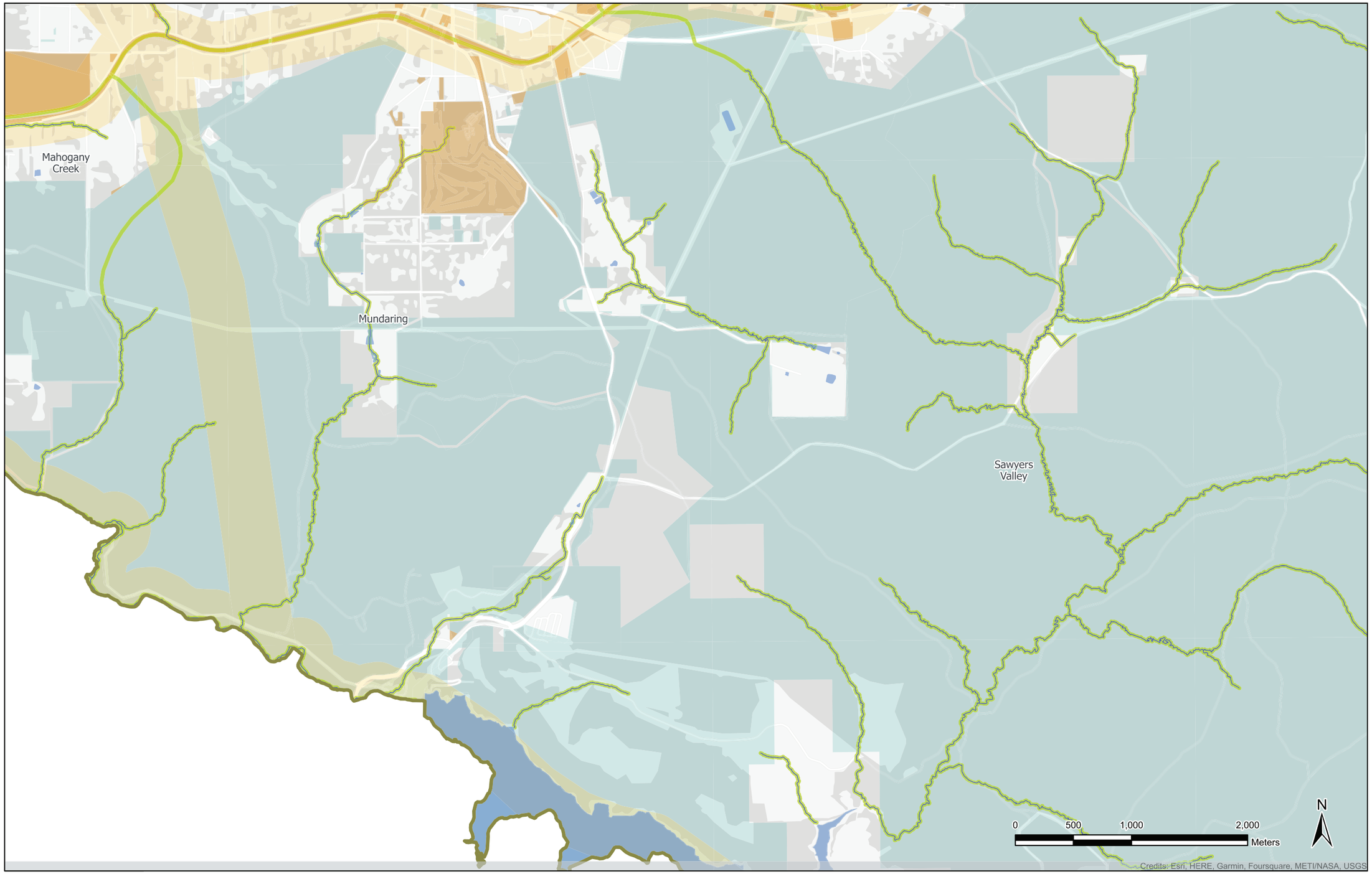
3/10/2022




# Wildlife Corridors

Map 4

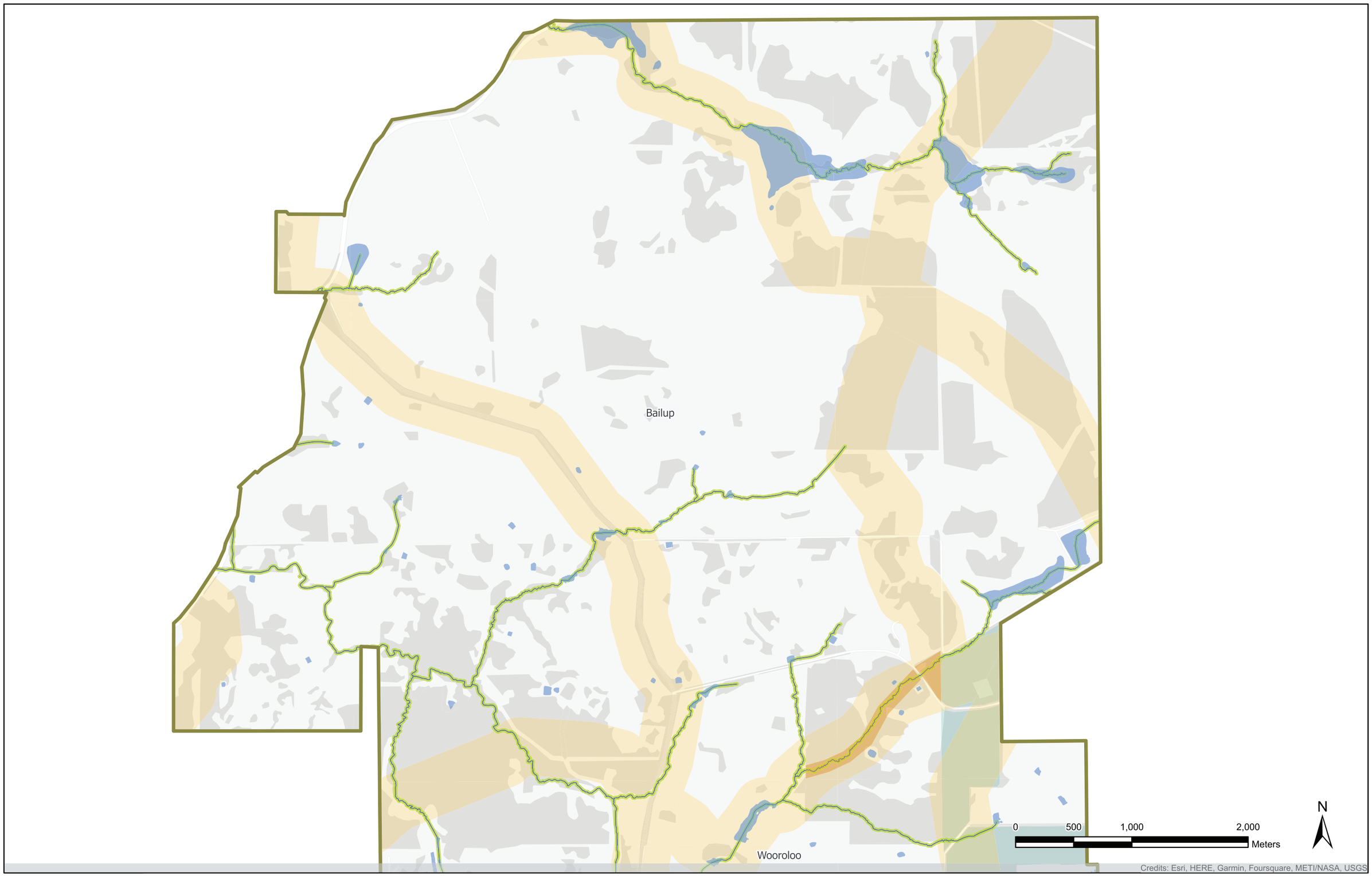
3/10/2022




# Wildlife Corridors

Map 5

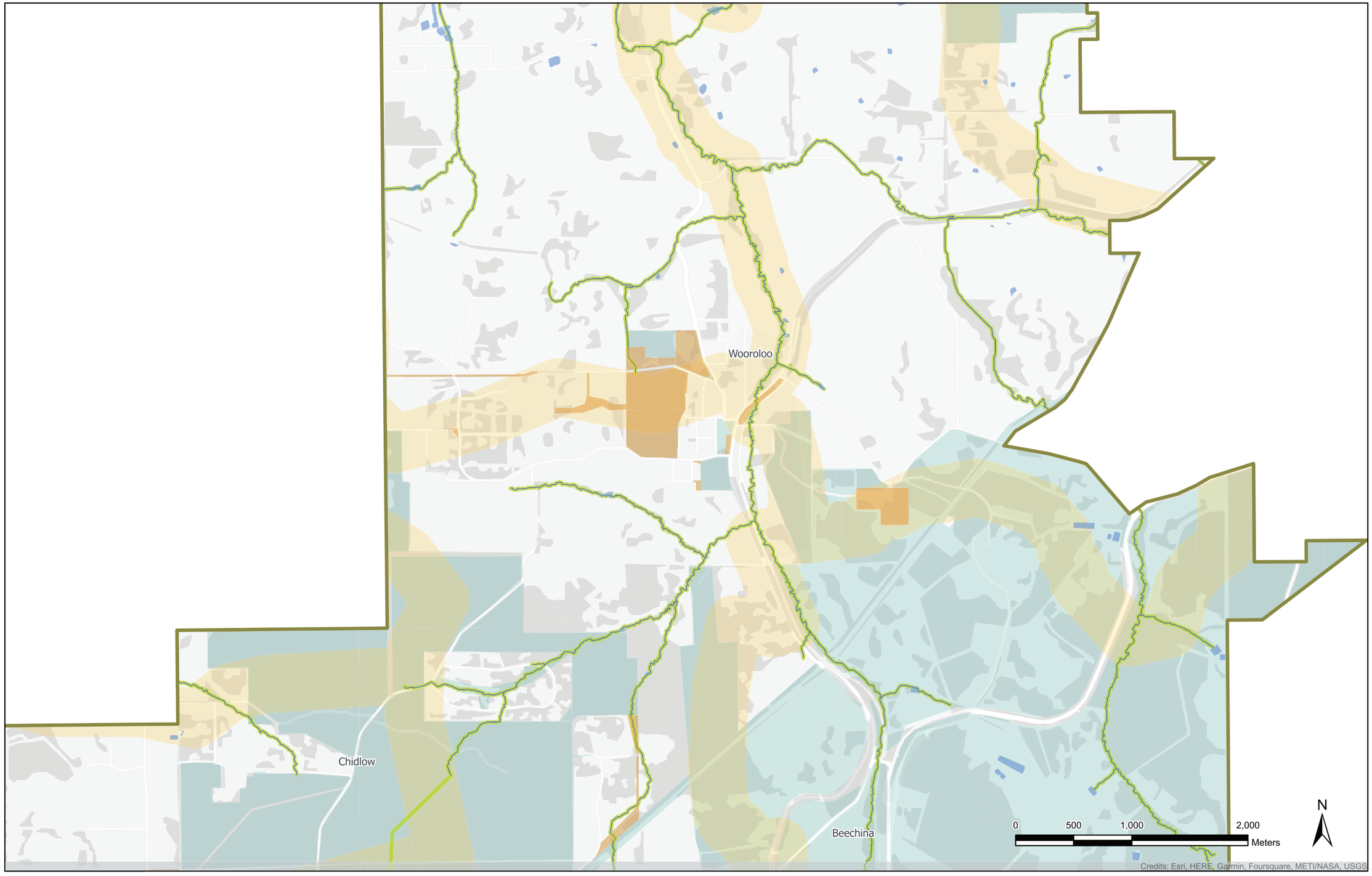
3/10/2022




# Wildlife Corridors

Map 6

3/10/2022

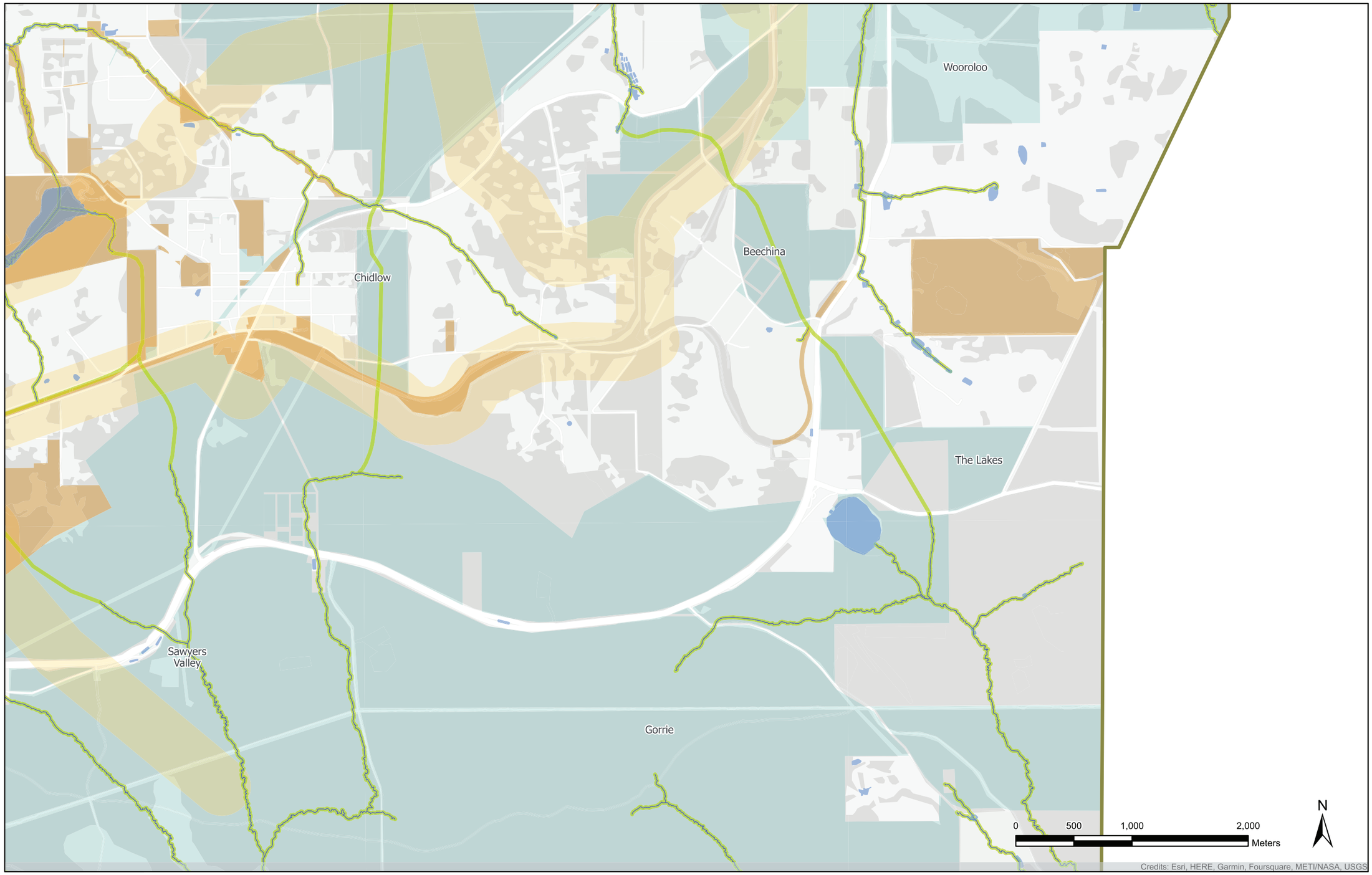



Shire of MUNDARING

# Wildlife Corridors

Map 7

3/10/2022

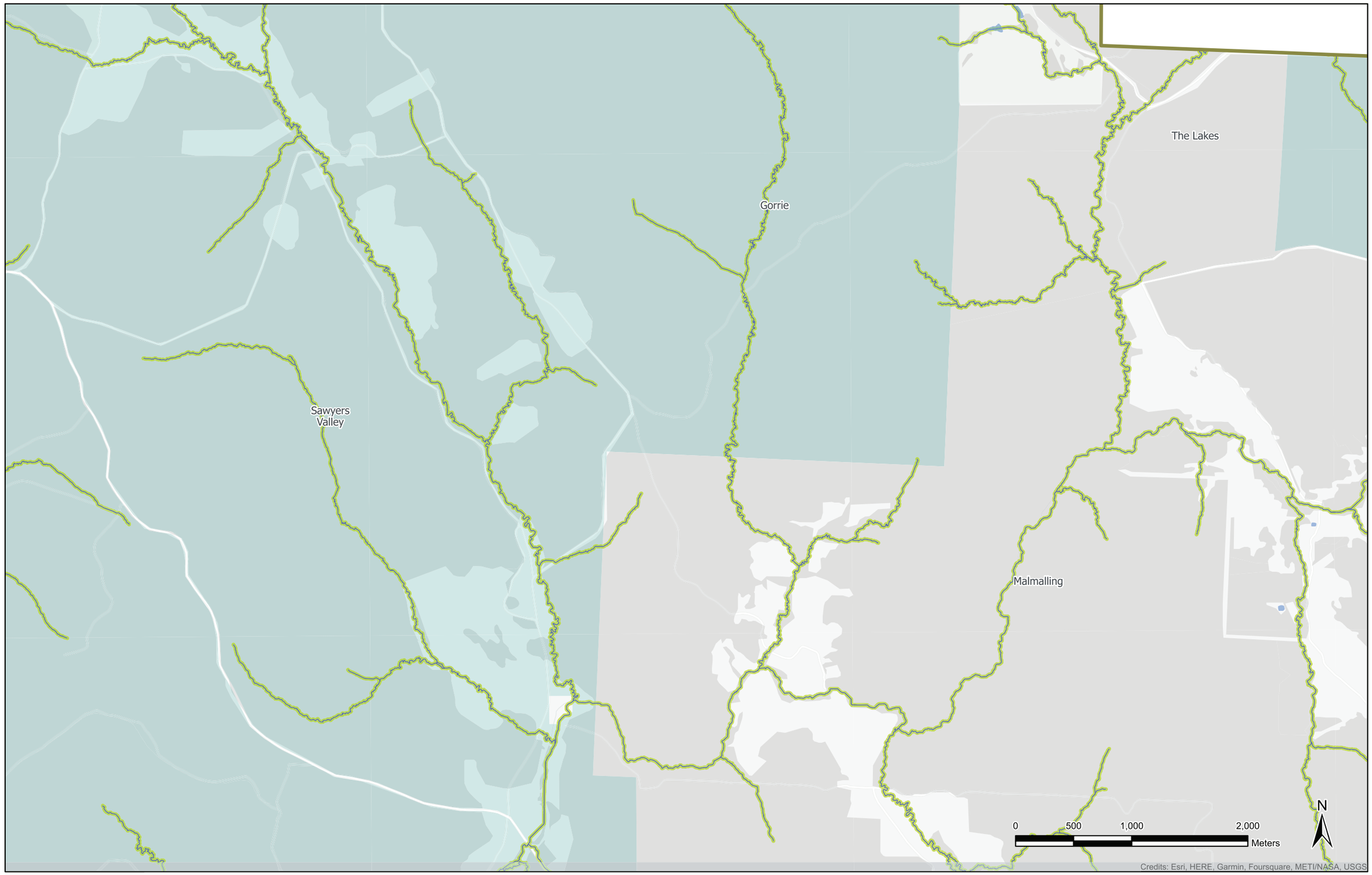



Shire of MUNDARING

# Wildlife Corridors

Map 8

3/10/2022

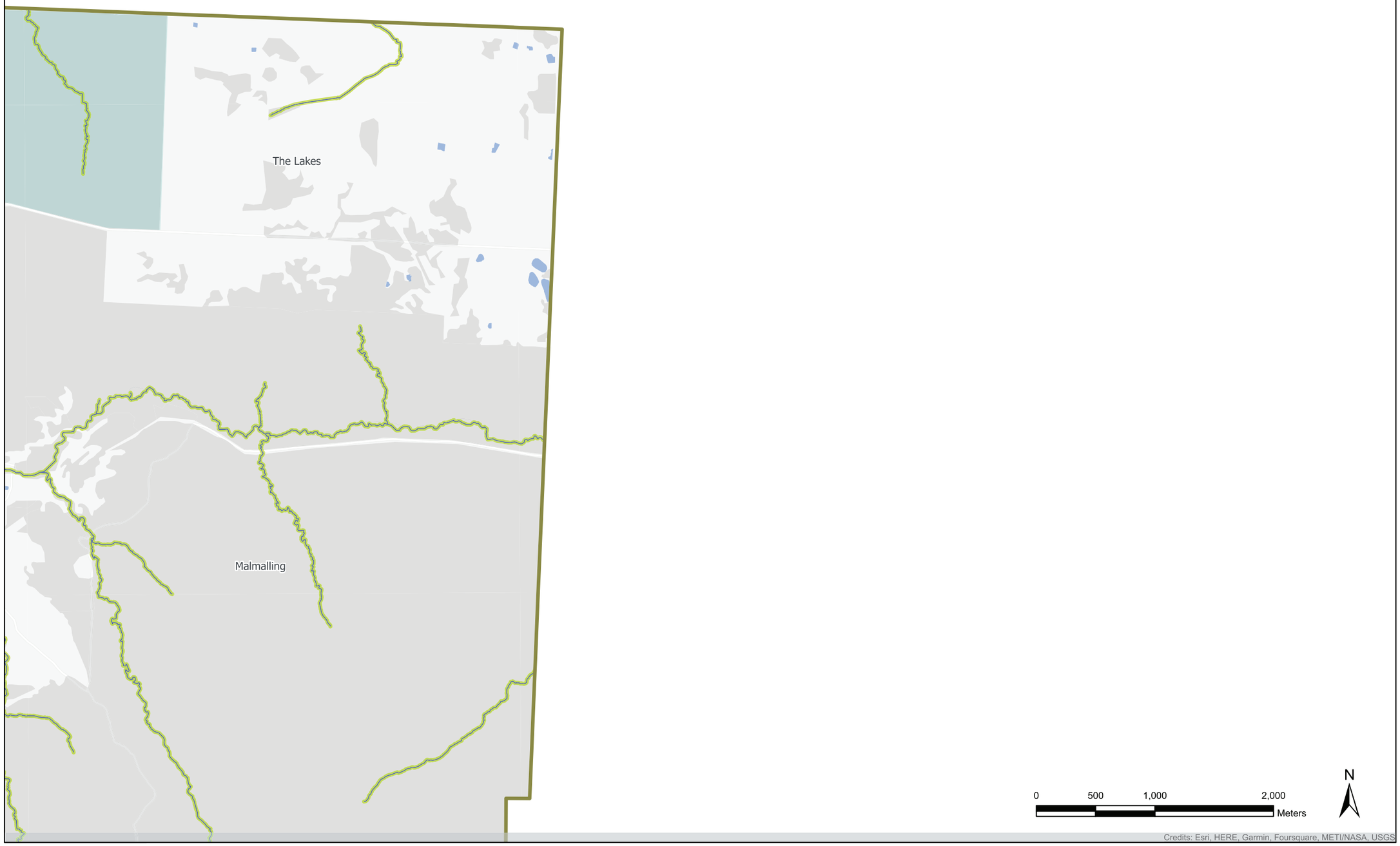



Shire of MUNDARING

# Wildlife Corridors

Map 9

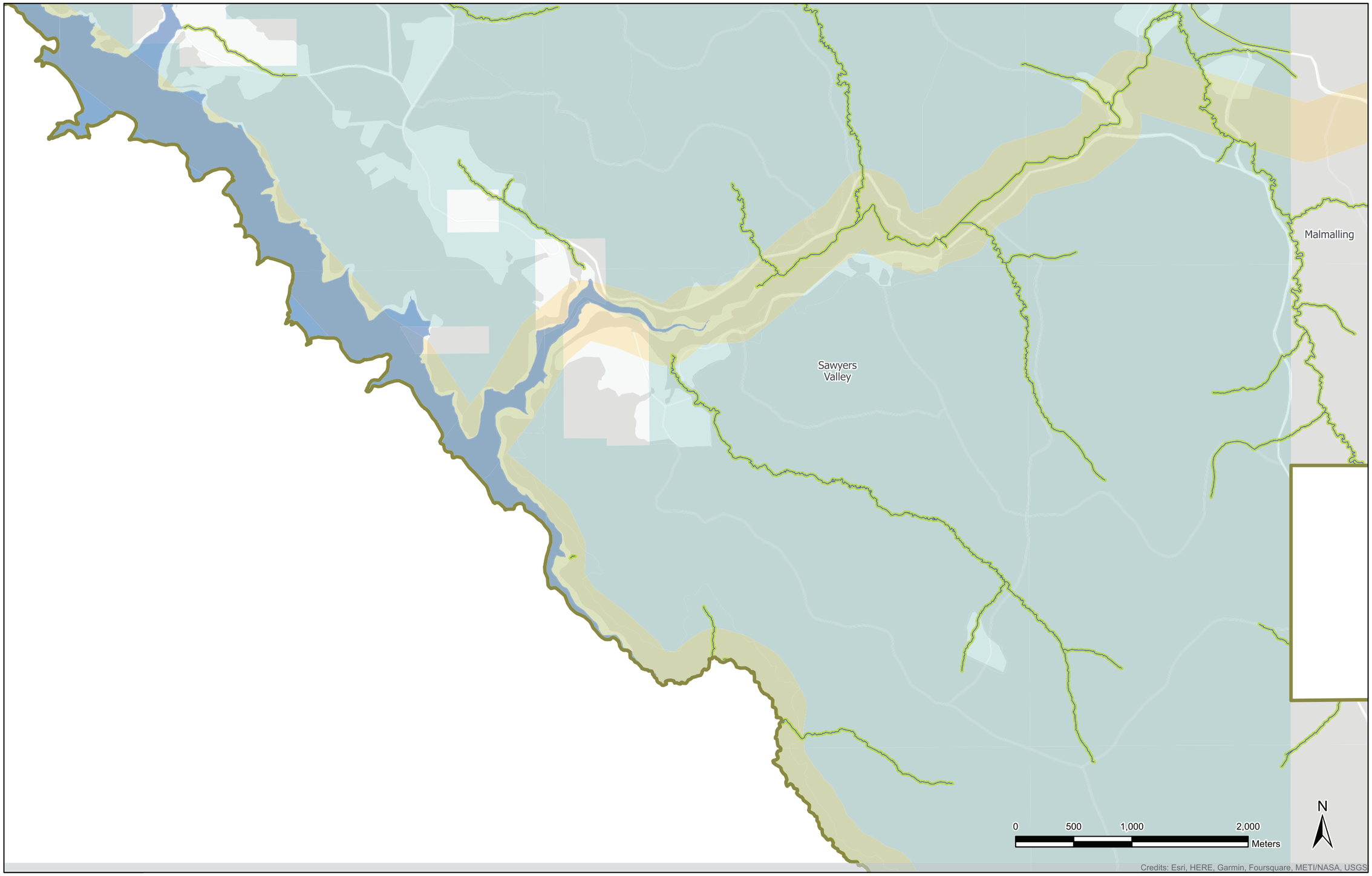
3/10/2022




# Wildlife Corridors

Map 10

3/10/2022

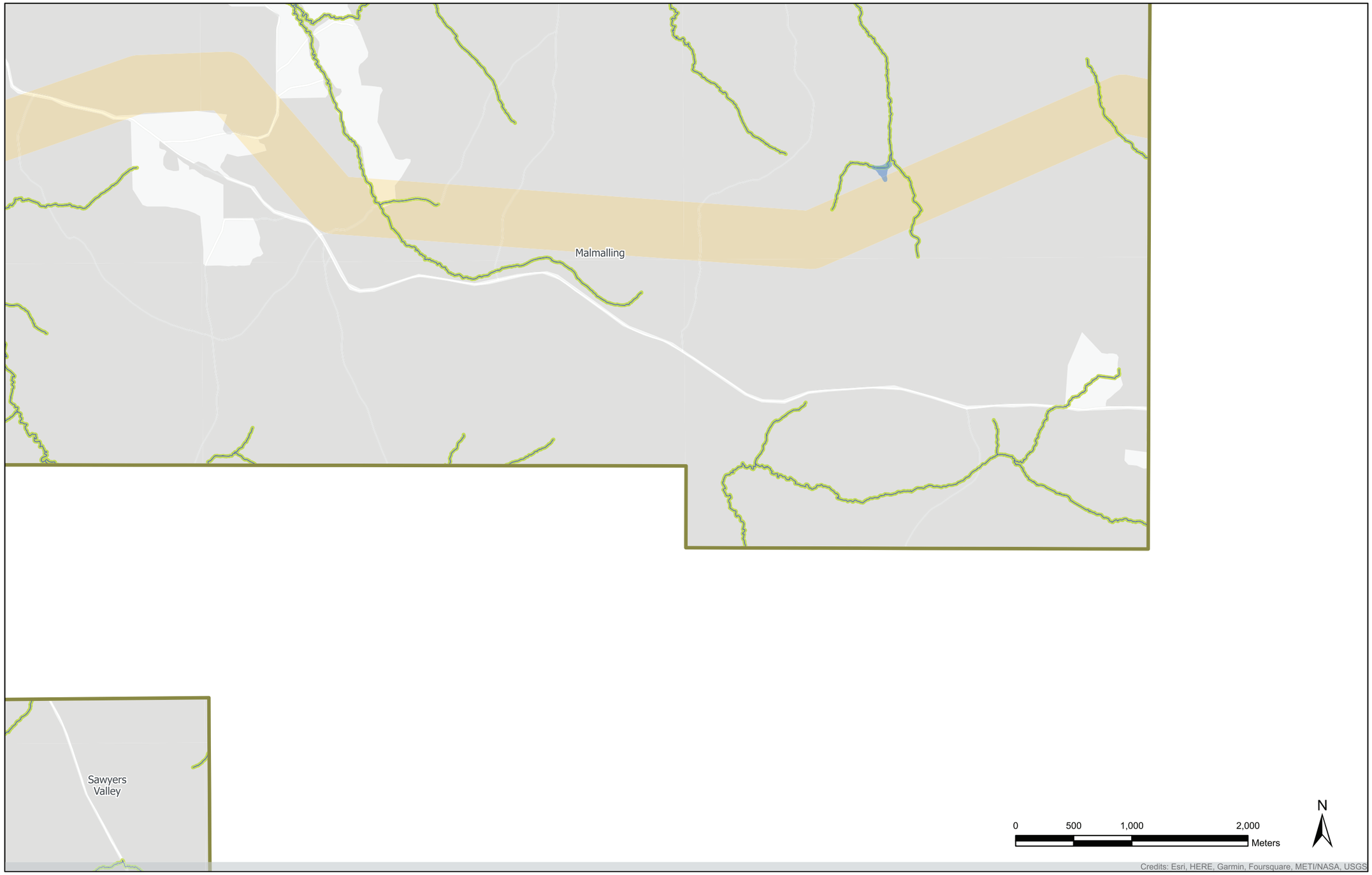



Shire of MUNDARING

# Wildlife Corridors

Map 11

3/10/2022




Shire of MUNDARING

# Wildlife Corridors

Map 12

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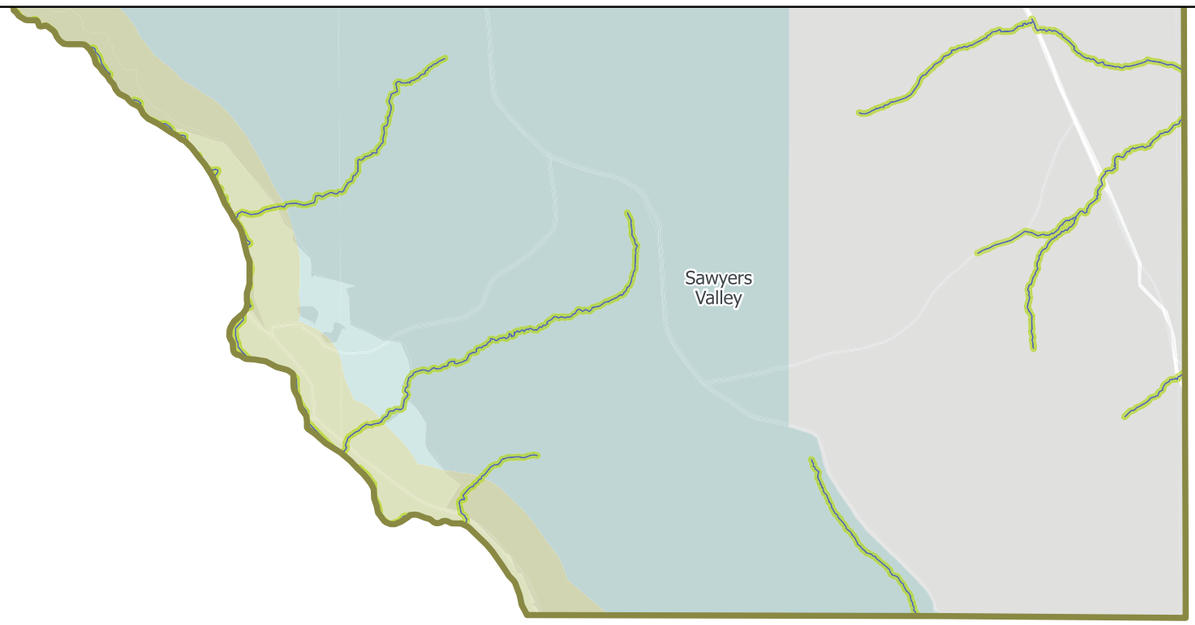


0 500 1,000 2,000
Meters

N



# Wildlife Corridors

Map 13

3/10/2022

Below is a list of specially protected fauna that may be found within the Shire of Mundaring. This species list was compiled using species listed under the WA *Biodiversity Conservation Act 2016* (BC Act) and the national *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), as obtained in 2023 for the Shire of Mundaring region.

Please note: It is very likely there are more species that would meet the criteria for protection under State or Commonwealth environmental legislation, but have not yet been identified or adequately studied. As the protected species listed under these Acts are reviewed their status may change. For the current species status and most recent lists, please refer to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) website for the EPBC Act List of Threatened Fauna and WA Department of Biodiversity, Conservation and Attraction (DBCA) website for the Biodiversity Conservation Act Threatened and Priority Fauna List.

| Scientific Name | Common Name | BC Act Status (WA) | EPBC Act Status |
|---|---|---|---|
| **Mammals** | | | |
| *Bettongia penicillata ogilbyi* | Woylie, Brush-tailed bettong | Critically endangered | Endangered |
| *Petrogale lateralis lateralis* | Black-flanked rock-wallaby, Black-footed rock-wallaby, Moororong | Endangered | Endangered |
| *Dasyurus geoffroii* | Chuditch, Western quoll | Vulnerable | Vulnerable |
| *Pseudocheirus occidentalis* | Western Ringtail possum, Ngwayir, Womp, Woder | - | Critically Endangered |
| *Phascogale calura* | Red-tailed phascogale, Kenngoor | Conservation Dependent | Vulnerable |
| *Isoodon fusciventer* | Quenda, Southwestern brown bandicoot | Priority 4 | - |
| *Falsistrellus mackenziei* | Western false pipistrelle, Western falsistrelle | Priority 5 | - |
| *Hydromys chrysogaster* | Water-rat, Rakali, Moyitj | Priority 6 | - |
| *Notamacropus eugenii derbianus* | Tammar wallaby | Priority 7 | - |
| *Notamacropus irma* | Western brush wallaby | Priority 8 | - |
| *Phascogale tapoatafa wambenger* | South-western brush-tailed phascogale, Wambenger | Conservation Dependent | - |

| Scientific Name | Common Name | BC Act Status (WA) | EPBC Act Status |
|---|---|---|---|
| **Reptiles** | | | |
| *Acanthophis antarcticus* | Southern death adder | Priority 3 | - |
| *Ctenotus delli* | Dell's skink, Darling Range southwest ctenotus | Priority 4 | - |
| **Invertebrates** | | | |
| *Westralunio carteri* | Carter's freshwater mussel | Vulnerable | Vulnerable |
| **Birds** | | | |
| *Botaurus poiciloptilus* | Australasian bittern | Endangered | Endangered |
| *Calidris ferruginea* | Curlew sandpiper | - | Critically Endangered |
| *Calyptorhynchus banksii naso* | Forest red-tailed black cockatoo | Vulnerable | Vulnerable |
| *Leipoa ocellata* | Malleefowl | Vulnerable | Vulnerable |
| *Numenius madagascariensis* | Eastern curlew, Far eastern curlew | - | Critically Endangered |
| *Rostratula australis* | Australian painted snipe | - | Endangered |
| *Calyptorhynchus baudinii* | Baudin's cockatoo | Endangered | Endangered |
| *Calyptorhynchus latirostris* | Carnaby's cockatoo | Endangered | Endangered |
| *Falco peregrinus* | Peregrine falcon | Specially Protected - OS | - |
| *Oxyura australis* | Blue-billed duck | Priority 4 | - |
| *Apus pacificus* | *Fork-tailed swift | Specially Protected - IA | Threatened |

| Scientific Name | Common Name | BC Act Status (WA) | EPBC Act Status |
|---|---|---|---|
| **Birds** | | | |
| *Arenaria interpres* | *Ruddy turnstone | Specially Protected - IA | - |
| *Plegadis falcinellus* | *Glossy ibis | Specially Protected - IA | - |
| *Thalasseus bergii* | *Crested tern | Specially Protected - IA | - |
| *Motacilla cinerea* | *Grey wagtail | - | Threatened |
| *Actitis hypoleucos* | *Common sandpiper | - | Threatened |
| *Calidris acuminata* | *Sharp-tailed sandpiper | - | Threatened |
| *Calidris melanotos* | *Pectoral sandpiper | - | Threatened |
| *Pandion haliaetus* | *Osprey | - | Threatened |
| *Tringa nebularia* | *Common greenshank | Specially Protected - IA | Threatened |

* Migratory bird species

**This summary of fire risk and fire ecology was prepared for the Shire of Mundaring by Bushfire Safety Consulting (2022).**

Fire is a key threatening process that can affect the Shire's reserves and other natural areas. The Shire of Mundaring is responsible for a large number of reserves relative to its population, and management decisions around fire mitigation is primarily guided by the staff and resources available to undertake the work.

When planning for bushfire risk mitigation, it is also important to consider conservation priorities, especially at a time when the community is increasingly focused on the risks posed by fire in a drying climate. Although naturally occurring fires and prescribed burning can be important and essential drivers of ecosystem structure and function, they can also can threaten biodiversity in some circumstances.

**As no single fire regime is optimal for all organisms at any scale, a sustainable fire management approach should ideally focus on ecological and protection goals in order to optimise outcomes.**

Increasingly, land managers across Australia are adopting a more nuanced approach to bushfire mitigation through seeking a greater understanding of the impacts of fire on biodiversity. Ecological bushfire management is an approach that identifies fire regimes appropriate for the maintenance of broad biodiversity values and protection of life and property.

Ecological bushfire management practices incorporate an evidence-based, adaptive management approach that is guided by prevailing resources, climate, biodiversity requirements and community expectations.

Ecological bushfire management has the dual purpose of reducing bushfire risk to life and surrounding assets, while maintaining or improving the ecological values of natural areas. It can provide best practice strategies and techniques related to bushfire risk and environmental management based on current knowledge and scientific research. This approach also considers long term responses of local native flora and fauna to fire, which is used to inform ongoing management decisions.

Ecological bushfire management principles can be applied in areas where biodiversity issues are considered a high priority within fire risk planning.

Further, they can also be applied in a manner consistent with the aims and objectives of local, State and National bushfire legislation, policy documents and guidelines.

## Fire and native plants

Fire can benefit plants adapted to fire in many ways, including by allowing a greater amount of light to reach leaves, reducing competition for water, and by creating relatively nutrient rich ash beds for seed germination. Some species can benefit more than others in this process.

However, fire can also cause deleterious effects to fire adapted species if time between fires is too short to allow for adequate recovery since last fire.

For example, species that regenerate from soil or cone stored seed need to mature and set seed before the subsequent fire or else there is a risk they will become locally extinct from the area (Burrows 2008).

Canopy species present at the site, Marri and Jarrah, can take up to 4 years to flower post fire due to the energy demands of resprouting. The fire response of the listed threatened species Acacia aphylla is generally unknown, although it is thought to regenerate from seed after fire (DEE 2008).

Little is known about the frequency of fire to which the northern Jarrah forest ecological community has adapted. A study examining fire scars on Balga (Xanthorrhoea presseii) in the Perth hills concluded that in the 150 years prior to European settlement, plants had been burnt on average every 50 years, increasing to once every 10 years on average post settlement (Lamont & Downes 1979).

Burrows, Ward & Robinson (1995) found evidence of fire injury on Jarrah to be about 81 years pre-European settlement, and every 17 years on average after colonisation.

They postulate that frequent low intensity burns predominately occurring during summer and autumn, lit by Aboriginal people managing the land prior to European colonisation, resulted in overall less high intensity fires resulting in much reduced fire injury on Jarrah.

In addition, Burrows (2008) states that in many south-west ecosystems, species are likely to be lost from plant communities when fire intervals exceed 35 to 40 years due to limits to the survival of seed stored in soil over time, however there has been little research into seed bank longevity or the vegetation composition of regenerating plant species in long unburnt forests post fire.

Fire and native fauna

Fire can benefit some animal species by resulting in an increase in regenerating food sources, such as new leaf growth and increased nectar availability from post-fire flowering of some plant species. Decreased plant cover can also increase hunting success for predators such as owls and eagles.

High intensity fires have been shown to increase the formation of tree hollows over time which benefits animals that require hollows for breeding (Inions et al. 1989). However, fire can also negatively affect some animal species as a result of a lack of mobility to escape the fire, habitat cover to protect from predators post-fire, and suitable food sources and habitat structure immediately after fire (Hussey & Wallace 2009).

Low intensity fires can potentially lead to a reduction in the number of fallen logs that can be used as habitat within the burnt area, without creating new ones to replace them (Inions et al. 1989). Reduced fire intervals can lead to the loss of animal species from an area, particularly where there are no unburnt patches within or nearby to assist recolonization or provide cover. For example, Honey Possum populations have been found to require approximately 25 to 30 years to recover from fire, with densities greater in native vegetation with time since last burn longer than this period (Bradshaw & Bradshaw 2017, Wilson et al. 2014, Everaardt 2003).

Populations of Quenda can also be reduced immediately post fire in areas where there are no close unburnt refugia, as they require dense cover from predation and leaf litter for food (Bryant et al. 2017, Haby et al. 2013).

This has also been observed after fire in populations of small birds (Davis et al. 2016). Too frequent fire that leads to the loss of shrub species can negatively affect the amount of food and habitat sources available for some species of animals, including the threatened cockatoo species (Hussey & Wallace 2009, Woinarski & Recher 1997).

While very little is known about the response to fire of invertebrates, some studies have reported a number of species that occur only in habitat features that are not present for some time after the passage of fire, such as the dead thatch of Balga skirts (Xanthorrhoea spp.) which are consumed by fire and take some time to re-establish post fire (Brennan et al. 2010). In addition, some invertebrate species have limited dispersal abilities and so are slower to recolonize post fire than others (Moir et al. 2005).

The inclusion of unburnt areas within bushland can assist in the conservation of many fauna species that utilize the area. The protection of habitat trees and ground logs during hazard reduction burns can assist in providing breeding sites and cover for fauna in the newly burnt areas. Maintaining habitat such as nearby unburnt vegetation cover, including the unburnt skirts of Xanthorrhoea preissii (Balga), can help protect Quenda and other native fauna that rely on cover, as can implementing feral animal control techniques immediately before and after a fire.

## Fire season

The season in which burning occurs is also important to the effect fire has on plant communities. It is widely thought that historically the vast majority of fires, both caused by lightening or lit by aboriginal people, occurred during late summer and autumn (Burrows 2008).

Fires at this time of year can be of a high intensity and result in the deaths of a large number of plant species.

However, fires of this intensity can crack seed cones and break the dormancy of some buried seeds, aiding in the reproduction of obligate seeders. In addition, the fires at this time of year would shortly be followed by winter rains, further assisting regeneration (Hussey & Wallace 2009).

The timing of rainfall is critical in the successful regeneration of plant species after fire. Regenerating plants after a fire in autumn have greater probability of success than after a spring fire as rainfall, optimal germination and growing conditions occur immediately after an autumn fire in the region. Post-fire germinating seedlings in climates with strong seasonal rainfall, such as that experienced in south-western Australia, are more likely to survive when fire occurs just prior to the onset of the wet season (Miller et al. 2019).

In contrast, fires that occur in the middle of winter are of a much lower intensity and leave many unburnt patches. Soil stored seed dormancy is not broken and fire sensitive plants, such as orchids, can be killed above ground. These plants are usually not affected by summer or autumn burns as they have a below ground dormancy period at this time. The heat of the fire lit in spring is usually not high enough to crack soil stored seed dormancy. Although surface seed germination is usually stimulated, that year's seed production is usually destroyed by the fire. Lack of rainfall over summer is thought to favour re-sprouting plants over obligate seeders after a spring burn due to reduced number of seedling survival (Spencer 2018).

## Optimal fire regime

While much still remains unknown about optimal fire regimes for the Jarrah forest, what seems certain is that no one fire regime benefits all organisms or ecosystems present (Burrows 2008, Spencer 2018). Based on this, the current consensus for determining appropriate fire regimes for the conservation of the northern Jarrah forest is to facilitate burns in mosaic patterns through the landscape with different fire frequency intervals.

Ideally these burns should be conducted in a variety of different conditions and of different intensities, with minimum time since last burn corresponding with the time required for all plants species to reach adequate post-fire reproductive capability (Hussey & Wallace 2009). Given that adequate reproductive capability is often unknown, minimum recommended time between burns has been given as twice as long as the period it takes for the slowest known growing seeders to flower (Spencer 2018).

It has been hypothesized based on the current available dataset on plant species responses to fire that a minimum of 6 to 8 years between fires in the northern Jarrah forest would enable the majority of plant species to regenerate (Burrows et al. 2008).

However, the juvenile period in plants of the south-west forest has been shown to be greatly increased in lower rainfall Jarrah forest locations such as at the reserve. In addition, the trend of decreasing rainfall demonstrates the need for conservative estimates of plant maturity when applying current datasets (Burrows et al. 2008).

Factoring in the number of species present for which no knowledge of maturity has been obtained, and the potential delaying effect of changing environmental conditions such as reduced rainfall, more conservative time frames are often recommended to maintain the ecological integrity of ecosystems when HR burning is required for fire management purposes.

There have been numerous cases in the south-west of reduced fire intervals negatively affecting the survival of species (Spencer 2018), and too frequent fire is a common threatening process for many of the south-west rare and threatened species and communities. This is particularly true for the ongoing survival of plant species that rely on soil or cone stored seed to germinate post-fire. In this case, fire intervals need to be greater than the amount of time it takes the plant to mature and produce an effective amount of seed in order to produce replacement plants should they be killed by fire (Burrows 2008).

While most common obligate seeder species in the Jarrah forest have relatively short time to first flowering times of between 3 to 5 years (Burrows et al. 2008), caution must be exercised in correlating flowering with successful seed production. For example, despite flowering only three to four years after a fire, a common plant species of the south-west, Parrotbush (Banksia sessilis), was found to set seed only eight years post fire (Hussey & Wallace 2009).

Maximum nectar production was not reached until 12 to 15 years post fire which has further ecological implications for nectar feeding birds and mammals.

Too frequent fire in fragmented landscapes is often the result of increased ignition sources from nearby urban development in combination with an increase in hazard reduction burning undertaken to reduce bushfire risk to adjacent development. An increased risk of artificial ignition through both unintentional means (car exhaust, discarded cigarette butt, sparks from machinery) and arson increases the risk that any planned hazard reduction burning undertaken will increase fire frequency and result in negative impacts on native vegetation communities present.

While too frequent fire can result in the loss of obligate seeder species from plant communities, very long inter-fire periods may also result in the loss of these species due to senescence. Woody shrub species are generally not as long lived as other plant species and need fire in order to promote regeneration via the germination of canopy or soil stored seed. Low intensity prescribed fire may assist in regeneration of these species if senescence and decline is observed.
Piles of fallen branches and dead plants that are placed away from trees, Balga and large living shrubs may create patches of hot fire that can assist in the regeneration of species that respond well to hot fire. Small areas of prescribed fire within a reserve can also increase the fine grain mosaic of different habitat ages through diversifying the time since last fire (Burrows 2008).

Of the data that has been collected to date, it seems likely that not all species regenerate in response to fire in the same way or at the same time scale, with different species benefitted through either more or less frequent fire.

In the Jarrah forest, Spencer (2018) recommends hazard reduction burning is conducted with minimum fire frequencies of 15 to 25 years, or three to four times the longest known juvenile period of obligate seeder plants that occur.

The longest known juvenile period for an obligate seeder recorded at the site is Hakea trifurcata, which has been recorded producing seed for the first time 48 months (4 years) following fire. This would suggest a minimum known fire interval of between 12 and 16 years is suitable for this species (Dec 2011).

Due to the known presence of some animal species that increase in abundance around this time since last fire is reached, most likely in response to the regeneration of habitat structural elements and/ or maximum nectar or seed production in vegetation post fire, retaining some areas of forests with longer fire intervals should be prioritized for conservation where possible.

The relative lack of research into invertebrates, fungi and other lesser known groups that are likely to contain species that require habitat only present in longer unburnt vegetation is also an important factor in conserving Jarrah forest within the landscape past the recommended minimum fire frequency periods. In addition, there is little research into the effects of fire frequencies at the recommended minimum interval on ecosystem resilience, particularly in the presence of human disturbance such as introduced diseases, plants and animals.

## A balanced approach

Overall, it seems likely that a diversity of fire frequencies, burn seasons and intensities throughout the landscape is required to maximise biodiversity and the health of forest ecosystems (Spencer 2018). With much still unknown about the effects of fire on ecological communities, monitoring and adaptive management is vitally important for preserving optimal biodiversity in ecological communities through the use or exclusion of fire (DEE 2017). Ongoing monitoring undertaken to observe and react to any decline in species that may occur from the frequency, seasonality or absence of fire in the future is highly recommended.

It is also important to monitor the effects of any fire management actions undertaken in high conservation areas in order to a develop site-specific understanding of the responses, as well as to apply a cautionary approach that aims to prevent loss or degradation of the high quality ecological communities.

There is still much to learn about the effects of fire on the flora and fauna found in the Shire. There may be opportunities to partner with state agencies and universities to participate in targeted research to help inform management decisions that aim to both conserve environmental values, while reducing the threat to lives and adjacent assets if a bushfire occurs.

This summary of fire ecology was prepared for the Shire of Mundaring by Bushfire Safety Consulting (2022). Relevant references from their report are below:

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## Phytophthora Dieback

*Phytophthora cinnamomi (P.cinnamomi)* is an introduced microscopic pathogen that is often referred to as a fungus. While it shares some characteristics of true fungi it is in fact a type of water mould and can survive in both soil and water. Phytophthora Dieback ('Dieback') refers to the disease that can occur when susceptible plants are exposed to *P.cinnamomi.* While some plant species are resistant to the pathogen, others are very susceptible, resulting in decline and death.

*P.cinnamomi* is present in all States and Territories of Australia where it causes disease in an extremely diverse range of native, ornamental, forestry and horticultural plants. It is believed that P.cinnamomi was introduced to Australia by early European settlers importing infested horticultural plants. Since the mid 1960's to early 1970's *P.cinnamomi* has been recognised as a serious pathogen in native ecosystems of Australia.

The pathogen can infect a range of native plants in Southwest WA, predominantly from the *Ericaceae, Fabaceae, Myrtaceae, Proteaceae,* and *Xanthorrhoeaceae* families. Although several Phytophthora species occur in Western Australia, *P.cinnamomi* is the most virulent and pathogenic. *P.cinnamomi* can also affect a range of horticultural crops and garden plants including apples, peaches, olives, avocados, camellias and roses. Other species of Phytophthora found in WA, such as Phytophthora multivora, are less virulent and significantly less widespread than P. *cinnamomi.*

## Dieback in Western Australia

Dieback is a significant environmental issue for natural areas between Geraldton in the Midwest and Esperance on the South Coast, and it is widespread in the Southwest region. The pathogen rarely occurs in areas receiving less than 400 mm annual rainfall.

The most recent Western Australian State of the Environment Report lists Dieback as a Priority 1 threat to biodiversity. A recent review of threats to species listed as threatened under the Federal Environment Protection and Biodiversity Conservation Act 1999 shows that *P. cinnamomi* is the second greatest invasive species threat in Australia after rabbits.

Dieback is a serious concern in WA for the following reasons:

- Over 1 million hectares of land in south west WA is affected, including many national parks, nature reserves and metropolitan bushland
- 40% of native plant species in the south west (over 2,200 species) are susceptible to the pathogen, including almost 50% of endangered and threatened flora
- Up to 20% of the State's Jarrah forest and up to 80% of the Stirling Range National Park is affected
- Changes in the composition and structure of floral communities resulting from the spread of Dieback have flow-on impacts throughout the ecosystem, including habitat alteration that can negatively affect indigenous fauna populations.
- Dieback can lead to significant soil erosion through the loss of susceptible vegetation as well as increased dominance of Dieback resistant plants such as grasses, rushes and sedges and weeds.

Local Government agencies are required to manage Dieback Phytophthora Dieback management under several regulatory mechanisms including the Environment Protection and Biodiversity Conservation Act 1999 (which lists Phytophthora Dieback as a key threatening process) and the Environmental Protection Act 1986.

## How Dieback is spread

Dieback is spread through the movement of water and soil within the landscape. Whilst it is possible for native and pest animals to spread the pathogen, by far the most significant vector of *P. cinnamomi* in the natural environment is human activity. Humans have the capacity to disturb and transport more soil thanany other vector, and all human activities carry some likelihood of spreading *P. cinnamomi.*

Major vectors of Dieback include wet soil adhering to vehicle tyres and earthmoving equipment. By far, most of the large areas of infestation that exist today in southern temperate Australia occurred as a result of human activity, often as a direct result of the introducing infested soil or road-building materials to vulnerable uninfested areas. Therefore, access restrictions and quarantine management procedures can be effective tools in reducing the spread of Dieback in natural areas.

Active spread by native and feral animals is difficult and prohibitively expensive to control. Active spread in subsurface water is difficult to control, however, under certain circumstances and to some degree surface drainage can be controlled.

Unfortunately, it is extremely difficult to completely eradicate *P. cinnamomi* from an infested site, and there is no evidence to suggest that the pathogen will disappear from a site once it has killed all of the most susceptible plant species. *P. cinnamomi* is thought to be able to survive long-periods of unfavourable conditions through the production of chlamydospores. However, there are still significant gaps in knowledge about the exact mechanisms of long-term pathogen survival.

## Dieback in the Shire

In 2019, the Shire of Mundaring commissioned Dieback consultants to undertake a comprehensive Dieback assessment of 33 priority Shire managed bushland reserves. The objective of the assessment was to confirm and map the extent of Dieback infestation within each reserve and identify Dieback free areas that can be protected from infestation in the long term.

The assessment confirmed the presence of Dieback in varying degrees in all of the reserves except for two (which were deemed to be uninterpretable due to a lack of Dieback indicator species).

Dieback was found to be widespread in the lower slopes, along drainage lines and water-gaining sites in many reserves. Infestations were also frequently mapped along access tracks, trails, firebreaks, old gravel pits and disturbed areas.

To date, a total of 15 reserves have been identified as having uninfested areas which are large enough to be ecologically viable and protectable from Dieback infestation in the medium to very long term (20 years to over 100 years). The assessment recommended a number of actions to prevent Dieback spreading to uninfested areas in priority reserves including:

- Treating the interface of infested and uninfested protectable areas with phosphite (a fungicide that slows the spread of *P.cinmamomi)*
- Review, update and implement management protocols for vehicle and machinery access to reserves
- Review and update Dieback signage in the reserves to delineate infested areas and uninfested areas and provide information for users to assist in preventing further spread
- Revegetate Dieback affected areas with Dieback resistant species or species that have a low susceptibility to *P. cinnamomi* infection. Revegetating areas that are infested or degraded will have a number of benefits including restoration of ecological function, reduced weed invasion, reduced soil erosion, improvement of visual amenity
- Continue to assist Friends groups to be more effective in undertaking conservation works in Dieback affected areas.
- Continue to monitor and map disease activity in priority reserves and treat where required

**References:**

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It is impossible to eradicate all weed species. Shire resources and community weed control efforts should be focussed on weeds that have worse impacts, including rapid spreading capability, or increasing bushfire risk. The impact and invasiveness of weeds occurring within the Shire of Mundaring has been assessed using:

- the national list of significant weeds (Weeds of National Significance, Weeds Australia, 2019)
- the Western Australian Organism List (WAOL) database, which lists declared pest species classified under the Biosecurity and Agriculture Management Act 2007 (WA) (DPIRD, 2019)
- the Swan Region impact and invasiveness rating of weeds (DBCA, 2016)
- knowledge and experience of staff working within Shire managed reserves.

| Common Name | Species Name |
|---|---|
| African Lovegrass | *Eragrostis curvula* |
| Arum Lily | *Zantedeschia aethiopica* |
| Bitou Bush | *Chrysanthemoides monilifera subsp. monilifera* |
| Black Flag | *Ferraria crispa* |
| Blackberry | *Rubus spp.* |
| Bridal Creeper | *Asparagus asparagoides* |
| Brazilian Pepper | *Schinus terebinthifolius* |
| Buckthorn | *Rhamnus alaternus* |
| Coast Teatree | *Leptospermum laevigatum* |
| Doublegee | *Rumex hypogaeus (Emex australis)* |
| Fig | *Ficus carica* |
| Flaxleaf Broom | *Genista linifolia* |
| Freesia | *Freesia alba x leichtlinii* |
| Fountain Grass | *Cenchrus setaceus* |
| Lantana | *Lantana camara* |
| Lavender | *Lavandula stoechas* |
| Madiera Vine | *Anredera cordifolia* |
| Narrowleaf Cottonbush | *Gomphocarpus fruticosus* |
| One-leaf Cape Tulip | *Moraea flaccida* |

| Common Name | Species Name |
|---|---|
| Paterson's Curse | *Echium plantagineum* |
| Perennial Veldt Grass | *Ehrharta calycina* |
| Prickly Pear | *Opuntia spp.* |
| Tagasaste | *Chamaecytisus palmensis* |
| Tambookie Grass | *Hyparrhenia hirta* |
| Watsonia | *Watsonia spp.* |
| Weedy Wattles<br><br>• Cootamundra<br>• Early Black Wattle<br>• Flinder's Range Wattle<br>• Golden Wattle<br>• Sydney Gold Wattle<br>• Queensland Silver Wattle | <br><br>• *Acacia baileyana*<br>• *Acacia decurrens*<br>• *Acacia iteaphylla*<br>• *Acacia pycnantha*<br>• *Acacia longifolia*<br>• *Acacia podalyriifolia* |
| Wild Gladiolus | *Gladiolus caryophyllaceus & Gladiolus undulatus* |

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